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# Massachusetts Recommended PreK - 12 Instructional Technology Standards



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October 2001

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# **The Commonwealth of Massachusetts Department of Education**

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October 2001

Dear Colleagues:

The primary purpose of this document is to define what PreK - 12 students should know and be able to do in order to use technologies for learning. To develop these standards, the Massachusetts Department of Education has drawn on the expertise of instructional technology specialists, library teachers, business teachers, and subject-area teachers.

In this age of rapidly changing information technology, students need to acquire technology skills in order to function effectively in their adult lives. This is especially true in Massachusetts where economic growth is based largely on high-tech industries. Most workplaces now provide employees with computers and basic applications (spreadsheet, word processing, database, presentation software, e-mail, and browser). Workers must have the skills to use these tools productively. When students leave high school, whether they enter the workforce or college, they will be expected to use computers and the Internet.

As Massachusetts educators concentrate on teaching the state curriculum frameworks, they also need to provide students with opportunities that build technology skills. When students leave high school they should know how to select the right technology tool to perform a task most efficiently. They should be able to access the Internet to locate information on a particular subject. They should be able to analyze that information for relevance and accuracy, and to synthesize and present it in a professional manner. These are life skills that will help them thrive in a world where new technologies continue to emerge and information grows ever more abundant.

In this document, the term "technology" refers to "instructional technology," or "educational technology." Where once we thought of instructional technology as simply "learning with computers," today it encompasses a broad range of hardware, software, and networking technologies. The software applications that students use most commonly in the classroom are those same basic tools routinely used in the workplace (word processing, spreadsheet, database, etc.). Networking technologies (such as Local Area Networks, Wide Area Networks, and high-speed Internet connections) provide students with access to a world of information. Portable equipment such as writing tools, graphing calculators, and handheld devices are among the expanding array of technology tools now used in many classrooms. Just as VCRs have been a standard piece of equipment in most schools for years, we are now likely to find camcorders, LCD projectors, scanners, and digital cameras among the hardware in many schools. We can expect this list to expand as new technologies emerge and become more affordable.

We will continue to work with schools and districts to prepare students for the world of work, higher education, and life-long skills using multiple technology tools. Thank you again for your ongoing support and for your commitment to achieving the goals of education reform.

Sincerely,

David P. Driscoll  
Commissioner of Education





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# Executive Summary

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The Massachusetts Recommended Instructional Technology Standards have been developed to support and advance Massachusetts's educational reform in learning and teaching. This document was created and has been revised by teachers, administrators, and other educators in prekindergarten through grade 12 school districts working with staff from the Department of Education. Its purpose is to provide guidelines to schools on what students should be able to do in order to use technologies for learning. School districts can use these recommended standards to make sure that their students are comfortable and proficient with multiple technology tools.

The Recommended PreK - 12 Instructional Technology Standards fall under three broad categories:

- Standard 1.** *Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.*
  
- Standard 2.** *Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.*
  
- Standard 3.** *Demonstrate ability to use technology for research, problem-solving, and communication. Students locate, evaluate, collect, and process information from a variety of electronic sources. Students use telecommunications and other media to interact or collaborate with peers, experts, and other audiences.*

Standard 1 includes proficiency in basic productivity tools such as word processing, spreadsheet, database, electronic research, e-mail, and applications for presentations and graphics. It also includes conceptual understandings of the nature and operation of technology systems. Standard 2 relates to the areas of social, ethical, and human issues. It encompasses positive attitudes toward the uses of technology and responsible use of information. Under Standard 3 students will learn to apply a wide range of technology tools to their learning of curriculum concepts.



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# Overview of Grade Spans

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Specific technology skills are grouped under three grade spans<sup>1</sup>:

- PreK - 4
- Grades 5 - 8
- Grades 9 - 12

## EXPLORATORY CONCEPTS AND SKILLS FOR GRADES PREK - 4

Although technology opens up exciting avenues to learning, computers should complement rather than replace successful methods that teachers use to help students develop basic skills and understanding. The mathematics framework, for example, stresses the importance of understanding basic arithmetical operations in elementary school.<sup>2</sup> The Massachusetts Department of Education encourages the use of a wide range of tools, both traditional and technological, to help students gain those understandings. However, in the PreK - 4 grade span the use of calculators should not supersede a firm grasp of basic mathematical skills.<sup>3</sup>

By the same token, as students learn the skills of electronic research, they should still know how to find a book in the library. As students become more fluent on the computer keyboard, they need to continue to develop legible handwriting.<sup>4</sup> Throughout their school years students will grow to regard technology as one of the many tools that can be used to help them solve problems and improve productivity. However, in the elementary grades, technology should not replace the manipulatives, pencil-and-paper, and other manual methods through which children acquire basic skills.

**Given this context, the instructional technology standards for the earliest grade span allow the teacher flexibility in deciding when students are ready to use technology. Instead of listing “performance indicators,” as in the two higher grade spans, the competencies listed for PreK - 4 are “exploratory concepts and skills.”** These are skills that will be introduced in the elementary grades and mastered in middle and high school.

By the end of fourth grade, all students should have had the opportunity to become familiar with the tools they will be expected to use with proficiency later on. Through this exposure they will have gained a positive view of computers as tools for learning. For example, electronic sources such as multimedia encyclopedias or teacher-previewed Web sites can be used to gather information for a report. Additionally, there are many developmentally appropriate applications for young children: interactive books, graphic organizers, and writing assistants, as well as mathematical and scientific tools. Such tools can enhance learning for all children, including those with disabilities; for example, multi-sensory software reinforces literacy skills by providing visual and auditory feedback to early readers. At the teacher’s discretion, these tools can be integrated appropriately in an effective lesson plan.

## PERFORMANCE INDICATORS FOR GRADES 5 – 8

By the completion of eighth grade, students should demonstrate basic to intermediate-level competencies in using applications such as word processing, database, spreadsheet, browser, presentation, and graphics software. They will be familiar enough with the purpose and function of these technologies to enable them to select the appropriate tool for a task. By eighth grade students will understand concepts of networking and they will be able to identify various components of a computer system. They will be expected to practice good file management skills and to operate peripheral equipment independently.

As soon as students begin using the Internet for research they should be taught effective search strategies. Rather than relying on one Web site for information they should use multiple sites and they should know how to validate those sites. Further, they should know when to look for information offline, rather than to rely solely on the Internet for sources. Finally, they should understand legal, ethical, and safety issues concerning the use of e-mail and the Internet.

By the end of eighth grade students will have had ample opportunity to apply technology tools for research, problem-solving, and communication across all curriculum areas. They will know how to communicate their learning with peers and other audiences through multimedia presentations, desktop-published reports, and other electronic media.

## PERFORMANCE INDICATORS FOR GRADES 9 – 12

By the time they graduate, students should demonstrate more advanced levels of proficiency in their use of technology. Throughout high school, as students gain more experience with hardware and applications, they will learn to apply more sophisticated file management skills. They will learn, for example, how to convert data from one file format to another, link data between applications, and resolve error messages.

As needed, high school students will continue to develop and demonstrate the skills listed for the previous grade span. With more opportunity to apply technology in their course work, students will become more adept in using these tools. As the curriculum demands more complicated learning tasks, students will discover more advanced capabilities in applications such as database and spreadsheet. For example, they might use a spreadsheet for data analysis and use the data to create customized charts that are linked to a word-processed report.

During high school students also should have the opportunity to use more specialized technology tools that help them with problem solving. These might include simulation software, geographic information systems, computer-aided design, or any of a wide variety of content-specific tools. By completion of high school, students will have developed an appreciation for the capabilities of technology resources and an understanding of how these tools can be used for lifelong learning.

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# Instructional Technology Standards

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**Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

GRADE LEVEL	EXPLORATORY CONCEPTS AND SKILLS
<b>PREK - 4</b>	<ul style="list-style-type: none"><li data-bbox="516 596 1382 646">1.1 Develop basic skills for using hardware and applications (e.g., open/close a file, navigate using scroll bars, arrow keys, special keys, and mouse).</li><li data-bbox="516 676 1382 751">1.2 Use correct terminology for basic components of a computer system (e.g., monitor, keyboard, disk, printer, mouse), and develop understanding of their basic functions.</li><li data-bbox="516 781 1382 865">1.3 At district and teacher's discretion explore and develop keyboarding skills. (The district determines whether students will learn touch typing or simply become familiar with the keyboard functions.)</li><li data-bbox="516 894 1382 945">1.4 Explore basic formatting features of a word processing program (at teacher's discretion).</li><li data-bbox="516 974 1382 1003">1.5 Explore and understand the basic function and purpose of a database.</li><li data-bbox="516 1033 1382 1062">1.6 Explore and understand the basic function and purpose of a spreadsheet.</li><li data-bbox="516 1092 1382 1121">1.7 Collaborate with classmates to use teacher-selected Web sites.</li><li data-bbox="516 1150 1382 1201">1.8 Collaborate with classmates and teacher to send a class e-mail message (at discretion of district and teacher).</li><li data-bbox="516 1230 1382 1281">1.9 Collaborate with classmates and teacher to create a slide presentation with existing template.</li><li data-bbox="516 1310 1382 1360">1.10 Explore the use of drawing and painting applications for class projects (at teacher's discretion).</li></ul>

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# Instructional Technology Standards

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**Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

GRADE LEVEL	PERFORMANCE INDICATORS
GRADES 5 – 8	<p>By the end of 8<sup>th</sup> grade students should:</p> <p>(Continue to address earlier skills as needed.)</p> <ul style="list-style-type: none"><li>1.11 Identify components of a computer system, understand their functions, and use appropriate terminology in speaking about them (e.g., operating system, hard drive, memory, window).</li><li>1.12 Identify and use basic features of a computer operating system (e.g., format/initialize disks, access information on size and format of a file, create folders on local hard drive).</li><li>1.13 Save a file to the desktop, the hard drive, and external storage spaces (e.g., floppy disk, CD-ROM, virtual electronic space).</li><li>1.14 Select a printer and print a document with appropriate page setup and orientation.</li><li>1.15 Operate peripheral equipment (e.g., scanner, digital camera, camcorder).</li><li>1.16 Develop efficient keyboarding technique.<sup>5</sup></li><li>1.17 Identify and use editing and formatting features of a word processing program (e.g., centering, line spacing, margins, cut and paste, fonts, styles, spelling, page numbers).</li><li>1.18 Insert images (e.g., graphics, clip art, tables) from other files into word-processed document.</li><li>1.19 Describe structure and function of database and identify components (e.g., record, field).</li><li>1.20 Create an original database, defining field formats and adding new records.</li><li>1.21 Perform simple operations in a database (e.g., browse, sort, search, delete, add data).</li><li>1.22 Describe structure and function of spreadsheet (e.g., cells, rows, columns, formulas) and apply formatting features.</li><li>1.23 Create an original spreadsheet, entering simple formulas.</li><li>1.24 Produce simple charts from spreadsheet.</li></ul>

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# Instructional Technology Standards

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**Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

GRADE LEVEL	PERFORMANCE INDICATORS
<b>GRADES 5 – 8</b> <i>(continued)</i>	<p>1.25 Identify and use navigation features of browser (e.g., “go,” “back,” “forward”).</p> <p>1.26 Using a browser, “bookmark” a Web site for future reference.</p> <p>1.27 Identify basic elements of a Web site (e.g., URL, hyperlinks, site map, etc.).</p> <p>1.28 Copy an image from a Web site into a file on the desktop; write a correct citation caption in keeping with copyright law.</p> <p>1.29 Using e-mail, create and send a message. (Student use of e-mail is determined by district policy and may be a class-wide activity if students do not have individual accounts.)</p> <p>1.30 Open an e-mail attachment and save it to the desktop. (District discretion applies.)</p> <p>1.31 Use correct terminology in speaking about electronic communications (e.g., browser, search engine, online).</p> <p>1.32 Create a slide presentation using appropriate applications.</p> <p>1.33 Identify and use drawing and painting applications as appropriate for class projects.</p> <p>1.34 Identify appropriate applications for a classroom project.</p>

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# Instructional Technology Standards

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**Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

GRADE LEVEL	PERFORMANCE INDICATORS
<b>GRADES 9 – 12</b>	<p>By the end of 12<sup>th</sup> grade students should:</p> <p>(Continue to address earlier skills as needed.)</p> <p>1.35 Demonstrate file management skills (e.g., install new software, compress and expand files as needed, download files as appropriate).</p> <p>1.36 Run multiple applications simultaneously, alternating among them.</p> <p>1.37 Resolve commonly occurring error messages. Resolve simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems).</p> <p>1.38 Identify and use methods for transferring, downloading, and converting graphic, sound, and video files. Use different graphic file formats where appropriate (e.g., PICT, TIFF, JPEG).</p> <p>1.39 Save (also retrieve, load, and import) a word-processed document in different file formats (e.g., RTF, HTML).</p> <p>1.40 Use a variety of external peripherals (e.g., printers, Zip drives, scanner, digital camera) and understand how they connect to a computer.</p> <p>1.41 Perform efficient keyboarding technique.<sup>6</sup></p> <p>1.42 Import/export and link data between word-processed document and other applications.</p> <p>1.43 Duplicate database structure without data.</p> <p>1.44 Use features of a database program such as mailing labels and mail merges.</p> <p>1.45 Import/export and link data between database and other applications.</p> <p>1.46 Use advanced formatting features of a spreadsheet application (e.g., reposition columns and rows, add and name worksheets).</p> <p>1.47 Use formulas in a spreadsheet application.</p> <p>1.48 Import/export data between spreadsheet and other applications.</p>

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# Instructional Technology Standards

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**Standard 1. Demonstrate proficiency in the use of computers and applications as well as an understanding of concepts underlying hardware, software, and connectivity.**

GRADE LEVEL	PERFORMANCE INDICATORS
<b>GRADES 9 – 12</b> <i>(continued)</i>	<p>1.49 Customize formatting of charts or graphs created in spreadsheet.</p> <p>1.50 Define and use functions of a spreadsheet such as sort, filter, find.</p> <p>1.51 In a spreadsheet application, use various number formats (e.g., scientific notation, percentages, exponents) as appropriate.</p> <p>1.52 In a browser, organize bookmarks into folders for further reference.</p> <p>1.53 Know how to select and use search engines. Understand the differences between search engines.</p> <p>1.54 Explain effective search strategies to locate and retrieve electronic information (e.g., understand and use syntax and Boolean logic operators).</p> <p>1.55 Using e-mail, create an address book. (Use of e-mail is at district discretion and may be a class-wide activity if students do not have individual accounts.)</p> <p>1.56 Share files as attachments in an e-mail message (e.g., text, graphics, sound). (District discretion applies.)</p> <p>1.57 Create a multimedia presentation, desktop-published report, or Web page that incorporates data from other files.</p> <p>1.58 Create and manipulate illustrations using a drawing or painting program (e.g., adjust scale, size, shape).</p> <p>1.59 Identify capabilities of technology resources and understand how they can be used for lifelong learning.</p> <p>1.60 Select the appropriate technology tool for a task.</p>

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# Instructional Technology Standards

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## **Standard 2. Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.**

GRADE LEVEL	EXPLORATORY CONCEPTS AND SKILLS
<b>PREK - 4</b>	<ul style="list-style-type: none"><li data-bbox="467 562 1128 590">2.1 Follow classroom rules for responsible use of computers.</li><li data-bbox="467 615 1291 695">2.2 Develop understanding of the school's rules for safe and ethical Internet use. (Use of Internet in this gradespan is under close supervision and determined by district policy.)</li><li data-bbox="467 720 1266 779">2.3 Explore practices for evaluating Web sites (District policy determines Internet use.)<sup>7</sup></li><li data-bbox="467 804 1214 831">2.4 Develop understanding of how the computer is a tool for learning.</li><li data-bbox="467 856 1170 884">2.5 Explore issues of ergonomics and safety in using computers.</li></ul>

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# Instructional Technology Standards

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## **Standard 2. Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.**

<b>GRADE LEVEL</b>	<b>PERFORMANCE INDICATORS</b>
<b>GRADES 5 – 8</b>	<p>By the end of 8<sup>th</sup> grade students should:</p> <p>(Continue to address earlier skills as needed.)</p> <p>2.6 Explain and demonstrate understanding of classroom rules regarding responsible use of computers (responsible behavior around equipment, respect for other people’s work, and appropriate collaborative behavior).</p> <p>2.7 Explain and demonstrate ethical and legal behavior in copying files, applications, and media.</p> <p>2.8 Explain potential problem of computer viruses and exercise caution in opening e-mail attachments from unknown sources. (Use of e-mail is at district discretion.)</p> <p>2.9 Explain safe practices for sharing personal information via e-mail and the Internet. (Use of e-mail is at district discretion.)</p> <p>2.10 Explain proper e-mail etiquette. (Use of e-mail is at district discretion.)</p> <p>2.11 Describe and demonstrate knowledge of the school’s Acceptable Use Policy, and know the consequences of violating that policy.</p> <p>2.12 Validate a Web site for authenticity (e.g., find site sponsor, author, and date the site was last updated).<sup>8</sup></p> <p>2.13 Explain how media and technology can be misused to distort or exaggerate information.</p> <p>2.14 Write correct citations for text and images gathered from electronic sources. Understand that use of materials is limited by the fair use rule of copyright law.</p> <p>2.15 Develop an awareness of the issue of ergonomics (e.g., Repetitive Stress Injuries) and how to use equipment safely.</p>

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# Instructional Technology Standards

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## Standard 2. Demonstrate responsible use of technology and an understanding of ethics and safety issues in using electronic media.

GRADE LEVEL	PERFORMANCE INDICATORS
GRADES 9 – 12	<p>By the end of 12<sup>th</sup> grade students should:</p> <p>(Continue to address earlier skills as needed.)</p> <p>2.16 Identify ways in which technology is used in the workplace and in society.</p> <p>2.17 Demonstrate a clear understanding of the school's Acceptable Use Policy.</p> <p>2.18 Explain laws restricting use of copyrighted materials on the Internet.<sup>9</sup></p> <p>2.19 Explain how to evaluate electronic sources of information. (See Integrated Learning Scenario, <i>Validating a Web site.</i>)</p> <p>2.20 Cite electronic sources correctly.<sup>10</sup></p> <p>2.21 Understand issues of ergonomics and practice safe use of equipment.</p>

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# Instructional Technology Standards

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**Standard 3. Demonstrate ability to use technology for research, problem-solving, and communication. Students locate, evaluate, collect, and process information from a variety of electronic sources. Students use telecommunications and other media to interact or collaborate with peers, experts, and other audiences.**

GRADE LEVEL	EXPLORATORY CONCEPTS AND SKILLS
<b>PREK - 4</b>	<p>3.1 Explore and develop understanding of how to gather information from a variety of electronic sources, including teacher-selected Web sites, CD-ROM encyclopedias, and automated card catalog.<sup>11</sup></p> <p>3.2 Explore the use of application programs (e.g., word processing, database, spreadsheet) for organizing information into charts, tables, and diagrams.</p> <p>3.3 Explore the use of content-specific tools to enhance understanding of curriculum content (e.g., environmental probes, sensors, robotics, simulation software, and measuring devices).</p> <p>3.4 Collaborate with classmates and teacher in creating a multimedia presentation to communicate learning with others.</p> <p>3.5 Collaborate with classmates and teacher to exchange e-mail with another classroom (at discretion of district and teacher).</p>

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# Instructional Technology Standards

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**Standard 3. Demonstrate ability to use technology for research, problem-solving, and communication. Students locate, evaluate, collect, and process information from a variety of electronic sources. Students use telecommunications and other media to interact or collaborate with peers, experts, and other audiences.**

GRADE LEVEL	PERFORMANCE INDICATORS
GRADES 5 – 8	<p>By the end of 8<sup>th</sup> grade students should:</p> <p>(Continue to address earlier skills as needed.)</p> <p>3.6 In keeping with the research process outlined in Standard 24 of the <i>English Language Arts Curriculum Framework</i>, identify electronic sources of information (e.g., Internet, CD-ROM, online periodical databases, and online catalogs).</p> <p>3.7 Use search engines effectively to find relevant, unbiased, and current information on a subject. (Standard 2 performance indicators apply—i.e., evaluate Web sites and write correct citations for sources.)</p> <p>3.8 Organize information that is collected using a variety of tools (e.g., spreadsheet, database, saved files).</p> <p>3.9 Communicate results of research and learning with others using the most appropriate tools (e.g., desktop-published or word-processed report, multimedia presentation).<sup>12</sup></p> <p>3.10 Manipulate data using charting tools and graphic organizers (e.g., concept mapping, flow charting, and outlining software) to connect ideas and organize information.</p> <p>3.11 Under teacher's guidance, and at discretion of district, use e-mail to communicate with others (e.g., students in other classrooms, experts in a subject, teachers).</p>

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# Instructional Technology Standards

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**Standard 3. Demonstrate ability to use technology for research, problem-solving, and communication. Students locate, evaluate, collect, and process information from a variety of electronic sources. Students use telecommunications and other media to interact or collaborate with peers, experts, and other audiences.**

GRADE LEVEL	PERFORMANCE INDICATORS
<b>GRADES 9 – 12</b>	<p>By the end of 12<sup>th</sup> grade students should:</p> <p>(Continue to address earlier skills as needed.)</p> <p>3.12 In conducting research use all appropriate electronic sources (e.g., Web sites, online periodical databases, online catalogs).</p> <p>3.13 Integrate (with correct citations) electronic research results into a research project.</p> <p>3.14 Routinely evaluate Web sites for authenticity when using them.</p> <p>3.15 Present information, ideas, and results of work using any of a variety of communications technologies (e.g., multimedia presentations, Web pages, videotapes, desktop-published documents).</p> <p>3.16 Collect, organize, analyze, and graphically present data using the most appropriate tools (e.g., spreadsheet, database, graphing, and concept-mapping tools).</p> <p>3.17 Import graphics, photos, and other media into report or presentation, citing sources appropriately.</p> <p>3.18 Create multiple links among various pieces of information residing in different applications (e.g., a chart imported from a spreadsheet into a word-processed report can be linked to update automatically when the data is changed in the spreadsheet).</p> <p>3.19 Demonstrate how specialized technology tools can be used for problem-solving, decision-making, and creativity (e.g., simulation software, environmental probes, computer-aided design, geographic information systems, dynamic geometric software, graphing calculators, art and music composition software).</p> <p>3.20 Demonstrate the function of electronic conferencing tools such as Internet bulletin boards, listserv, electronic classrooms, and interactive video.</p> <p>3.21 At discretion of district, exchange e-mail independently.</p>



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## Gaining Technology Skills while Learning the Content of the Curriculum

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Anyone who has taken a training course in the use of spreadsheet, for example, knows how quickly we forget the skills unless we can apply them in our work. Whether technology instruction takes place in the classroom or in the computer lab, it is important that students be able to apply their newly acquired skills to subject matter learning. For example, a student who has gathered data for a science project and needs to organize the data in a database will see a reason for learning about the features and function of a database. This is context-sensitive learning in which technology skills instruction is centered on the curriculum.

Initial technology skills instruction needs to be provided by someone who is proficient in that technology tool. Although some teachers are skilled enough with technology to teach their students to use the tools within the context of the curriculum content, not all subject-area teachers can be expected to do this. A staff person with technology expertise (such as an instructional technology specialist, library teacher, or another classroom teacher acting as a mentor) can co-teach alongside the teacher in either the classroom or the computer lab.

As technology tools become an integral part of the learning environment, and as students gain the knowledge and skills to use them appropriately, new opportunities for learning open up. Dynamic geometric software, for example, can help students visualize and understand complex mathematics concepts. Simulation software applications enable students to investigate models of real-world problems such as climate change and population growth. Basic tools such as spreadsheet and database applications can be applied across the curriculum to analyze and solve problems.

The following scenarios show how technology can be applied in the classroom so that students acquire these skills while addressing the standards of the curriculum frameworks.

# Integrated Learning Scenario

## Technology-Enriched Insect Studies\*

Grades 1 and 2

<b>LEARNING STANDARDS TO BE ASSESSED</b>	<p><b>SCIENCE AND TECHNOLOGY/ENGINEERING: LIFE SCIENCES</b></p> <p><b>Characteristics of Living Things</b>[HJ1]</p> <ul style="list-style-type: none"> <li>▪ <b>3</b> — Recognize that plants and animals have life cycles, and that life cycles vary for different living things.</li> </ul> <p><b>Living Things and Their Environment</b></p> <ul style="list-style-type: none"> <li>▪ [HJ2]7 — Recognize changes in appearance that animals and plants go through as the seasons change.</li> <li>▪ <b>8</b> — Identify the ways in which an organism’s habitat provides for its basic needs.</li> </ul>
<b>TECHNOLOGY EXPLORATORY CONCEPTS AND SKILLS</b>	<ul style="list-style-type: none"> <li>▪ <b>1.1, 1.2, 1.3, 1.10:</b> [HJ3]Develop basic skills for opening and closing a file, using mouse, keyboard, and correct terminology for parts of computer; explore the use of electronic drawing tools.</li> <li>▪ <b>2.4</b>[HJ4]: Develop understanding of how the computer is a tool for learning.</li> <li>▪ <b>3.1</b>[HJ5]: Explore and develop understanding of how to gather information from Web sites and CD-ROMs.</li> </ul>
<b>INTRODUCTION</b>	<p>Students observe insects in various classroom habitats. They raise <i>monarch</i> butterflies from caterpillar to adult stage in a specially constructed classroom structure through which they can observe the discrete stages of the butterfly life cycle. They also establish an ant farm and a colony of crickets in a multi-chambered classroom habitat. During field trips to a nature trail they examine insects in the wild.</p> <p>In the classroom students view multimedia CD-ROMs on the subject of insects,<sup>13</sup> as well as video clips of their classroom insects that were digitally recorded by the teacher and downloaded on the computer. The content of these multimedia resources reinforces the concept of change and metamorphosis that students have observed in their classroom insects. Students are shown how to insert the CD into the CD-ROM drive so that they can use these tools independently. They also learn how to open a folder on the desktop that contains the videoclips of their own insects. Students select clips by reading the label and clicking on the icon. They learn the terminology for these features (file, folder, desktop, CD, and CD-ROM drive) as well as basic actions such as pointing and clicking with a mouse.</p>

	<p>The teacher opens the browser and selects sites<sup>14</sup> that she has previewed and bookmarked prior to the lesson. These are age-appropriate sites that contain information and activities on insects. Because the sites contain more information than the teacher wishes to use, she brings up the relevant page rather than allowing the children to navigate the site themselves. To introduce students to the conceptual structure of the Internet she explains that there are many computers throughout the world, just as there are telephones all over the world. Like telephones, these computers are connected, so that people in different parts of the world can share information. If the class will be visiting a Web site in another part of the world, she shows them on the globe where that Web site originates. She also explains that, just as they would not make a long-distance telephone call to another part of the world on their own, they should not go onto the Internet alone. At this age they need to have an adult with them.</p>
<p><b>OPTIONAL EXTENSION</b></p>	<p>After the students have learned the core standards for Living Things and their Environment, the teacher may decide to introduce them to the idea that butterflies migrate to a warmer location as the season gets colder. <i>Journey North</i><sup>15</sup> is a real-time monarch migration study on the Web. Through this interactive program, thousands of students throughout the U.S. and Mexico track the spring and fall migration of monarch butterflies between the eastern U.S. and the mountains west of Mexico City. It is important that the teacher preview the site and use only those activities that are developmentally appropriate for the class.</p>
<p><b>PRACTICE/ ASSESSMENT</b></p>	<p>Students write about their activities and observations. They also express their ideas and learning through art, creating insect sculptures out of clay, and making pictures of their classroom insects with an electronic paint program.<sup>16</sup> They type the names of the insect body parts in the appropriate places of their drawings. These original computer drawings are incorporated into guidebooks that every student creates to demonstrate what has been learned about the insects studied. In addition to their electronic drawings, the students' insect books might contain images downloaded from the Web, or digital photos of the classroom insects. Although it is the teacher who downloads and prints the images, the students learn the general concept of downloading images from the Web to a computer and then printing that file from the computer.</p> <p>Having used multimedia sources, children gain an understanding that the computer is a tool for gathering information. Through the use of other tools, such as the electronic paint program, students learn that the computer can also be a tool for producing creative works.</p>
<p><b>CULMINATING PERFORMANCE AND EVALUATION</b></p>	<p>Students share what they have learned with peers, teachers, and parents through oral presentations, as well as a display of their artwork and writing. Other students in the school visit the first/second grade classrooms to see the insect art projects on display.</p>

*\*Technology-Enriched Insect Studies* is based on a lesson designed and implemented in the classroom by Victoria Munroe and Carol Holzberg at the Swift River School in New Salem, Massachusetts.

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# Integrated Learning Scenario

## The Harlem Renaissance\*

### Grade 7

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<b>LEARNING STANDARDS TO BE ASSESSED</b>	<p><b>ENGLISH/LANGUAGE ARTS</b></p> <p><b>Language Strand</b></p> <ul style="list-style-type: none"> <li>▪ <b>1.3</b> — Apply understanding of agreed-upon rules and individual roles in order to make decisions.</li> </ul> <p><b>Reading and Literature Strand</b></p> <ul style="list-style-type: none"> <li>▪ <b>9.5</b> — Relate a literary work to artifacts, artistic creations, or historical sites of the period of its setting.</li> </ul> <p><b>Composition Strand:[HJ6]</b></p> <ul style="list-style-type: none"> <li>▪ <b>24.3</b> — Apply steps for obtaining information from a variety of sources, organizing information, documenting sources, and presenting research in group projects.</li> </ul> <p><b>Media Strand:</b></p> <ul style="list-style-type: none"> <li>▪ <b>27.3</b> — Create a media production using effective images, text, music, sound effects, or graphics.</li> </ul>
<b>TECHNOLOGY PERFORMANCE INDICATORS</b>	<ul style="list-style-type: none"> <li>▪ <b>1.25, 1.27, 1.28, 1.32:</b> [HJ7]Identify and use features of a browser, identify basic elements of a Web site, copy an image from a Web site to the desktop, create a slide presentation.</li> <li>▪ <b>2.2, 2.6, 2.7, 2.12, 2.14</b>[HJ8]: Demonstrate ethical and legal behavior in copying files, understand school policy regarding Internet use, validate Web sites, write correct citations for materials used from electronic sources.</li> <li>▪ <b>3.6, 3.9</b>[HJ9]: Identify electronic sources of information and choose appropriate sources, communicate results of research and learning with others using the most appropriate tools.</li> </ul>
<b>INTRODUCTION</b>	<p>Students in an English Language Arts class are about to read <i>Let the Circle Be Unbroken</i>, a book by Mildred Taylor set in Mississippi in the 1930s. Characters in the book include family members from New York as well as the South. The teacher wants to give students background information regarding the disparate experiences of the book’s characters that bring tension and drama to the story. She knows that more knowledge about New York’s culture during that time period will enrich her students’ understanding of the story.</p> <p>She introduces the Harlem Renaissance, a period from the 1920s into the 1940s when Black artists, singers, musicians, and writers flourished. She shows the students pictures and plays music that demonstrate the energy and influence of African American artistry and life in Harlem at that time.</p>

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After her brief overview, the teacher introduces the multimedia project they will do in small groups as they read the book. The teacher explains that the focus of this research project will be the lives and work of some of the famous people associated with the Harlem Renaissance. Students will use Internet resources, as well as print, audio, and visual materials from the library/media center. They will then use presentation software<sup>17</sup> to teach their classmates what they have learned. The classroom teacher has planned the project with the instructional technology specialist to ensure that expectations are viable and that the students gain the necessary technology skills for this project.

The teacher divides the class into six groups of about four students each, and gives each group a packet that includes a calendar of due dates, an outline of group and individual expectations, and the list of scoring criteria that will be used for assessment of presentations. Finally, she assigns one of the following artists to each group: Duke Ellington, Langston Hughes, Aaron Douglas, Zora Neale Hurston, Bessie Smith, and Lois Mailou Jones.

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**PRACTICE/  
ASSESSMENT**

Each group's project is required to include an overview of the artist's life, artistic accomplishments, philosophy, and influence on other artists, musicians, or writers both at the time of the Harlem Renaissance and later.

Students know that they will be assessed on their individual involvement in the project as well as the group presentation. Each student must

- complete an appropriate amount of the group's planned research (to be defined and assessed by group members);
- design and create at least one "slide" of the presentation (including a plan on paper that is checked by the teacher before being presented);
- speak knowledgeably to the class about at least their own slide, giving more information than is contained on the slide;
- help answer class members' questions as part of the presentation; and
- assist group members with planning, research, technology, and editing as needed.

Students designate individual roles within their groups and plan their work based on the class schedule. The teacher circulates among the groups, observing individual and group dynamics and assisting as needed. Then students collaborate to write their initial research questions and visit the library/media center.

The library teacher works with the instructional technology specialist and classroom teacher to coordinate Internet use and to guide students in selecting and using other library resources. The teachers provide an overview of the library rules and school policy for using search engines, evaluating Web sites, and writing citations. They also ensure that students understand copyright laws concerning the information they download and use in their presentations.

Initially students use class periods for research. Once they have demonstrated competency in using the Internet, they are allowed to use the library computers during study halls and after school. Three class periods a week are spent focusing on reading and discussing *Let the Circle Be Unbroken*. Individual students reflect regularly in their journals about how their study of the Harlem Renaissance helps them understand the novel.

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	<p>When students are ready to begin work on their presentations, the instructional technology specialist gives an overview of the presentation software. During project periods, students finish their research, create their “slides” on computer, and practice their presentations. The teachers help students download and import media files into their presentations and check that they are citing the sources they use. Students check off requirements for the project as they finish them, meet in groups with the teacher, and assist each other, both on the computer and at their desks.</p>
<p><b>CULMINATING PERFORMANCE AND EVALUATION</b></p>	<p>Students present their group projects to the class. The presentations are projected on screen, each student speaks about his or her “slide,” and the group members answer questions from the audience. Using the scoring guide, the teacher evaluates each group project. Each presentation must include:</p> <ol style="list-style-type: none"> <li>1. a meaningful title and an introduction to the person and his/her work;</li> <li>2. an important quotation from the person with an explanation of its meaning and importance; and</li> <li>3. a related image or melody imported from the World Wide Web, recording, or print source.</li> </ol> <p>In addition, the teacher assesses each student’s weekly journal writing.</p>

*\*The Harlem Renaissance* is based on a project created and implemented by Janet Furey, English Language Arts teacher at Weston Middle School, Weston, Massachusetts.

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# Integrated Learning Scenario

## Validating a Web Site\*

### Grade 9

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**LEARNING  
STANDARDS TO  
BE ASSESSED****ENGLISH/LANGUAGE ARTS****Composition Strand**

- **24** — Students will gather information from a variety of sources, analyze and evaluate the quality of the information they obtain, and use it to answer their own questions.
- **24.5** — Formulate open-ended research questions and apply steps for obtaining and evaluating information from a variety of sources, organizing information, documenting sources in a consistent standard format, and presenting research.

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**TECHNOLOGY  
PERFORMANCE  
INDICATORS**

- **2.19:** Evaluate electronic sources of information.

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**INTRODUCTION**

At the start of a research project, an English teacher brings her class into the library for an introduction to electronic research on the Internet. Once it is clear that students understand how to use the different search tools (Internet directories, search engines, and meta-search engines), she focuses the lesson on evaluating information for quality. To illustrate how students can be misled by sources on the Internet, the library teacher tells the class about a student who, after visiting a number of Web sites, firmly believed that the 1969 moon landing was faked by NASA. Another student, after reading information on a Web site written by a Holocaust revisionist, was convinced that the concentration camps were really an effort by the Nazis to eradicate typhus-carrying head lice.<sup>18</sup>

The teachers lead the class in a discussion of how these students could have critically evaluated these Web sites for authenticity, reliability, validity, and bias.

Using an LCD projector<sup>19</sup> connected to her computer, the library teacher conducts an Internet search as the class watches. The teacher tells the students that it is possible to determine the origins of a site even before going to the site. She asks students to look closely at the URLs, or Web site addresses, that appear in the list of search results. She points to one URL that has the domain name of “edu” and asks the class if this means the site is sponsored by an educational institution. When the students tell her that they think it denotes sponsorship, she points out that “edu” simply indicates that the site is using the server of an educational institution. She then shows the class that a tilde (“~”) in the same URL shows that the site was created by an individual who has been given space on the university’s server. She shows the class another URL that contains the word “users,” indicating another personal home page.

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The teacher clicks on the URL of the personal home page with the "...edu/~..." in the address. She asks the class to look for more information that might tell them something about the author's credentials. Finding only the author's name, the class discusses ways in which they might discover more about the author. The teacher shows the class how to run a search for the author's name in a meta-search engine,<sup>20</sup> which, in this case, results in numerous entries. The teacher asks the class to examine the URLs of the listings to see if there is anything interesting, aside from the fact that many people have referred to this person in their writing. The teacher reminds the class that, because the school uses a filter, this list may be incomplete. Having previewed the sites before class, the teacher goes to one that presents an objective overview of the site author's credentials and the controversy incited by his views.

Returning to the Web site being evaluated, the teacher now asks the students to determine if there are links to other recognized sites. From the home page, they see that there are a number of working links. The teacher shows the students how they can determine if these links are to external Web sites or if they are internal links to other pages on the same site.<sup>21</sup> The same name appears after the "~" in the URL of most of these linked pages. The class discusses why this pattern of all internal links on a Web site should raise doubts of the credibility of information presented.

The teacher explains that we can also learn a great deal by looking at the pattern of links pointing to a Web site from the outside. The author of a Web site has no control over who links to his site from the outside, and it is possible that the author does not know who is linking to his site. However, a search engine with a link command can be used to find easily all the links pointing into a Web site. The teacher demonstrates how to do this by copying the URL from the source site and pasting it after the word "link:" in the "search for" box of the search engine.

Now that the students have been shown how to check the credibility of sources, they are ready to evaluate Web sites themselves.

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**PRACTICE/  
ASSESSMENT**

The teacher asks students to write down the steps they would take to evaluate a Web site. (The teacher uses this to assess individual learning.) This is followed by a class discussion in which a set of criteria is developed and written on the board for all to see. The teacher leads the class discussion using the following set of guidelines:<sup>22</sup>

- What is the source of this information? In general, it is possible to determine the type of organization by the domain (or suffix in the URL):
    - ❖ Educational institutions: .edu
    - ❖ Government: .gov
    - ❖ Military: .mil
    - ❖ Professional organization: .org
    - ❖ Commercial sites: .com
    - ❖ Internet providers: .net
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- Who sponsors the site? Who writes the material that appears on it?
    - ❖ Does an individual or an organization sponsor the site?
    - ❖ Is the author or organization a recognized authority?
    - ❖ Had you heard of the organization or author before you found the site on the Internet?
    - ❖ Are the author's credentials mentioned on the site?
    - ❖ Does the author/publisher provide an e-mail address?
  
  - When was the site created?
    - ❖ Has the site been updated recently?
    - ❖ Does the site need to be current?
    - ❖ Do the links work? Do they lead to other useful material?
  
  - How reliable is the information posted on the site?
    - ❖ Does the site give links to other recognized sites?
    - ❖ Is the information factual?
    - ❖ Is the text well written?
    - ❖ Does the page cite a bibliography or references to confirm accuracy? Is there author bias?
    - ❖ Are the topics included explored in depth?
    - ❖ Are the articles or other posted materials dated?

After dividing the class into groups of about four students, the teacher then gives each group a URL for a Web site that the teacher has previewed and evaluated in advance. Each student team is then asked to evaluate their Web site using the criteria developed in class.

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**CULMINATING  
PERFORMANCE  
AND  
EVALUATION**

Each team gives a presentation to the class, summarizing its evaluation of the site researched and showing the link maps. The team members explain what these connections reveal about the site.

The class evaluates the presentations based on the team's thoroughness in following the criteria for evaluating a Web site.

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\**Validating a Web site* is based primarily on an article by Alan November in *Technology and Learning*, March 2001, (Vol. 21, Number 8). More information can be found on the Web site: [www.anovember.com](http://www.anovember.com).



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# Appendix 1

## How the Massachusetts Standards Compare to the National Educational Technology Standards (NETS)

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As a general frame of reference for developing these standards, we used the *Technology Foundation Standards for Students*, developed by the *National Educational Technology Standards (NETS) Project*. NETS is an initiative of the International Society for Technology in Education (ISTE) in collaboration with the U.S. Department of Education.<sup>23</sup>

The goal of the NETS Project is to develop national standards for educational technology. The document, *Technology Foundation Standards for Students*, originally published in 1998, describes in detail what students should understand about technology and what they should be able to do with it. The NETS Technology Foundation Standards for Students are:

- Standard 1. basic operations and concepts;
- Standard 2. social, ethical, and human issues;
- Standard 3. technology productivity tools;
- Standard 4. technology communications tools;
- Standard 5. technology research tools; and
- Standard 6. technology problem-solving and decision-making tools.

In order to simplify this document, the Massachusetts Department of Education has collapsed the six NETS standards into three standards. The NETS standards are incorporated into the three standards of *PreK - 12 Instructional Technology Recommended Standards* as follows:<sup>24</sup>

RECOMMENDED PREK - 12 INSTRUCTIONAL TECHNOLOGY STANDARDS	CORRESPONDING NETS FOUNDATION STANDARDS
Standard 1	Standard 1, 3
Standard 2	Standard 2
Standard 3	Standards 3, 4, 5, and 6

There are areas in which the technology standards overlap with some of the learning standards in the curriculum frameworks. For example, the Media strand of the English Language Arts Framework contains standards on creating media presentations using computer technology.

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## Appendix 2

### District Technology Planning: Providing the Right Conditions for Student Technology Literacy

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To create a school environment in which students develop technology skills, districts must provide adequate and sustained access to high-speed computers and the Internet. Teachers themselves must become skilled users of technology, with ongoing curriculum integration support.

These conditions are stated as priorities of the National Educational Technology Plan.<sup>25</sup> Since 1995, Massachusetts districts have been asked to maintain local technology plans and to report on their progress. Results have shown that some districts provide very good access to high-speed, multimedia computers while others are lagging behind.<sup>26</sup>

With the guidance of a group of district technology specialists from across the state, the Massachusetts Department of Education outlined a set of six benchmark standards to guide districts in establishing goals for their local technology plans. In May 2000, the document *Local Technology Plan Benchmark Standards for the Year 2003* was released.<sup>27</sup> The six benchmark standards are as follows:

#### **BENCHMARK STANDARD 1**

##### **COMMITMENT TO A CLEAR VISION AND MISSION STATEMENT**

- A. The district has a realistic and clearly stated set of goals. It is committed to achieving its vision by the target year 2003.
- B. The district has a technology team.
- C. The district has a budget for its local technology plan. The district's operational budget includes a line item for technology.
- D. The district leverages the use of state, federal, and private resources.

#### **BENCHMARK STANDARD 2**

##### **ACCESS**

By the year 2003, every district will have achieved at least a 5:1 student-to-computer ratio of modern, fully functioning, Internet-enabled computers and devices.

#### **BENCHMARK STANDARD 3**

##### **INFRASTRUCTURE FOR CONNECTIVITY**

The district ensures that every classroom and every administrative office has at least one computer with a high-speed connection to the Internet by the year 2003. A building's electrical service must be sufficient to support the computers and networks installed.

**BENCHMARK STANDARD 4**  
**TECHNICAL SUPPORT, TECHNOLOGY CURRICULUM INTEGRATION,**  
**AND PROFESSIONAL DEVELOPMENT**

- A. **TECH SUPPORT:** The district ensures that every administrator, teacher, and student receives high-quality user and system support so that by the year 2003 there will be at least one FTE (full-time equivalent) person to support 100-200 computers. Technical support can be provided by dedicated staff or equivalent services.
- B. **CURRICULUM INTEGRATION:** The district provides at least 0.5 FTE staff person to support every 30-60 users (staff only) in their efforts to achieve technology competency and to integrate technology into the curriculum.
- C. **TECHNOLOGY PROFESSIONAL DEVELOPMENT:** By the year 2003, at least 85% of district staff will have participated in technology training sponsored by the districts.
- D. **ACCEPTABLE USE POLICY:** The district has an Acceptable Use Policy regarding Internet use.

**BENCHMARK STANDARD 5**  
**ACCURATE DATA REPORTING**

The district maintains accurate data that meet state IMS (Information Management System) standards.

**BENCHMARK STANDARD 6**  
**ACCESS TO THE INTERNET OUTSIDE THE SCHOOL DAY**

- A. The district works with community groups to ensure that by 2003, students and staff will have sufficient access to the Internet, which will enable them to work outside the school day. The school must maintain a catalog of places in the community (“points of access”) where students and staff can gain access to the Internet after school hours.
- B. The district maintains an up-to-date Web site, and every educator has an Internet account with the capability of sending e-mail and accessing the World Wide Web.

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# Notes

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<sup>1</sup> The grade spans defined here are intended to align with the curriculum frameworks rather than the organization of grade levels in schools.

<sup>2</sup> Guiding Principle III in the Mathematics Curriculum Framework describes how technology is an essential tool in math education, and "...if properly used, [can] contribute to a rich learning environment for developing and applying mathematical concepts." The framework also stresses that "elementary students should learn how to perform thoroughly the basic arithmetic operations independent of the use of a calculator."

<sup>3</sup> According to the Third International Mathematics and Science Study (TIMSS), "U.S. fourth graders use calculators and computers in mathematics class more frequently than do students in most other TIMSS countries. Use of calculators in U.S. fourth-grade mathematics classes is about twice the international average.... In six of the seven nations that outscore the U.S. in mathematics, teachers of 85% or more of the students report that students never (or hardly ever) use calculators in class." (Twenty-six countries participated in the TIMSS study.) National Center for Education Statistics, *Pursuing Excellence: A Study of U.S. Fourth-Grade Mathematics and Science Achievement in International Context*, chapter 2 "Contexts of Learning," accessed June 15, 2000, <http://nces.ed.gov/timss/report/97255-2a.html>.

<sup>4</sup> Standard 22.3 of the English Language Arts Curriculum Framework states that children in grades 3 to 4 should "write legibly in cursive, leaving space between letters in a word and between words in a sentence."

<sup>5</sup> Because districts vary in their policies on keyboarding, the Department of Education is leaving it to the districts to define "efficient keyboarding technique" for their students. There are helpful resources available. For example, the Techforce Initiative's *IT Pathway Pipeline Model* suggests 20 words per minute for Grade 8. The Techforce Initiative was a two-year, National School-to-Work Office-funded project aimed to highlight and expand Information Technology employer participation in School to Career programs.

<sup>6</sup> The *IT Pathway Pipeline Model* recommends a speed of 35 words per minute including numbers and symbols at Grade 10.

<sup>7</sup> The Composition Strand of the English Language Arts Curriculum Framework states the benefits of using electronic sources for research and points out that "the greatest challenge these electronic media present may be the sheer volume of data they offer." It stresses the importance of learning criteria for evaluating online information for quality.

<sup>8</sup> Useful Web sites on evaluating Web sites:

- <http://www.library.ucla.edu/libraries/college/help/critical/index.htm>
- <http://ericir.syr.edu/ithome/digests/edoir9802.html>

Also see Integrated Learning Scenario, *Validating a Web site*, in this document.

<sup>9</sup> Useful Web sites:

- Stanford University Library: Copyright and Fair Use: Fair Use and Multimedia  
<http://fairuse.stanford.edu/multimed/>
- U.S. Copyright Office Home Page  
<http://www.loc.gov/copyright/>
- Patent, Copyright, and Trademark Law—Nolo.com Legal Encyclopedia  
[http://www.nolo.com/encyclopedia/pct\\_ency.html#Subtopic115](http://www.nolo.com/encyclopedia/pct_ency.html#Subtopic115)
- The New Plagiarism: Seven Antidotes to Prevent Highway Robbery in an Electronic Age  
<http://www.fno.org/may98/cov98may.html>

<sup>10</sup> Correct citation for a Web page:

Author. Title of item. [online] Available: [http://\(URL\)](http://(URL)), date of document or the date you accessed it.

<sup>11</sup> Standard 24 of the Massachusetts English Language Arts Curriculum Framework (November 2000) outlines the research process. The skills of evaluating electronic information sources and citing them correctly, listed under Instructional Technology Standard 2, apply to all electronic research skills.

<sup>12</sup> Media Production is covered in Standard 27 of the Massachusetts English Language Arts Curriculum Framework (November 2000).

<sup>13</sup> Examples of insect multimedia CD-ROMs designed for this age group are ICE's *Jr. Nature Guides Insects*, DK Multimedia's *Encyclopedia of Nature*, and Sunburst Technology's *Learn about Insects*.

<sup>14</sup> Examples are *Yuckiest Site on the Internet*, <http://www.yucky.com> and *Entomology for Beginners* <http://www1.bos.n1/homes/bijlmakers/entomology/begin.htm>. Entomology links for science educators can be accessed at <http://home1.gte.net/jwagner/entomolo.htm>.

<sup>15</sup> *Journey North* is a science education program produced by Annenberg/CPB. It can be found on the Web at: <http://www.learner.org/jnorth/spring2000/species/monarch/index.html>.

<sup>16</sup> Broderbund's *KidPix Studio* is an appropriate drawing application for this age group. *Microsoft Office*, versions 1998 and more recent, includes drawing and painting tools for both Mac and PC.

<sup>17</sup> Microsoft's *PowerPoint* was used in this project. *HyperStudio* is another presentation tool commonly used in the classroom.

<sup>18</sup> See Alan November's article in *Technology and Learning*, March 2001 (Vol. 21, Number 8).

<sup>19</sup> A less costly option is to have a computer-to-television converter, which connects the computer to a large-screen television monitor.

<sup>20</sup> A meta-search engine queries several search engines simultaneously. Similar results can be obtained from entering a query in any of the major search engines (Lycos, Excite, AltaVista, etc.).

<sup>21</sup> They are able to do this without actually clicking on a link. Simply positioning the cursor over a link will reveal the URL of the linked Web address in the status bar at the bottom of the browser window.

<sup>22</sup> This process is outlined in the *Massachusetts Guide to Choosing and Using Curricular Materials on Genocide and Human Rights Issues*, under the section, *The Internet as a Tool for Researching Genocide and Human Rights Issues*. <http://www.doe.mass.edu/mailings/1999/hr699.html#Internet>

<sup>23</sup> More information on the NETS project is available at the ISTE Web site, <http://www.iste.org>.

<sup>24</sup> Both Standards 1 and 3 contain elements of the NETS Foundation Standard 3.

<sup>25</sup> U.S. Department of Education, *Revising the 1996 National Educational Technology Plan*, <http://www.air.org/forum/goals.htm> (accessed Aug. 2000).

<sup>26</sup> Statewide statistics derived from online data collection are reported in *EdTech Updated 2000*. <http://www.doe.mass.edu/edtech/>

<sup>27</sup> The complete document can be viewed in pdf format on the Department's Web site at <http://www.doe.mass.edu/edtech/broad/sixstandards.pdf>.

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# Acknowledgments

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Many of the performance indicators in this document are adapted from *the National Educational Technology Standards for Students* (NETS), a project of the International Society for Technology in Education (ISTE) and the U.S. Department of Education.

This document was prepared by the following Massachusetts Department of Education staff:

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The Department of Education wishes to thank the many educators who provided thoughtful ideas and feedback throughout the revision process.



# Massachusetts Department of Education

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This document was prepared by the Massachusetts Department of Education.  
Dr. David P. Driscoll, Commissioner of Education

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