

Massachusetts Technology Literacy Standards and Expectations

April 2008

The Board of Elementary and Secondary Education voted to approve the updated *Massachusetts Technology Literacy Standards* standards on April 29, 2008, defining what K–12 students should know and be able to do in order to use technology for learning.

“In this revised document we have

- grouped specific technology skills under four grade spans;*
- focused on 21st century skills; and*
- devoted more attention to digital citizenship, ethics, society, and safety.*
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The goal of this document is to help students develop technology literacy skills to learn the content of the curriculum, as well as to be able to succeed and thrive in their adult lives. These skills will help them function effectively in a world where new technologies continue to emerge and information grows ever more abundant.

The teaching and learning of these skills should be integrated into the general curriculum, not taught in isolation. As students develop technology skills, they should apply these skills in their classroom, school, and life so that they will understand why these skills are important. An essential benefit of integrating the appropriate use of technology into the curriculum is that it can enhance the learning of the content without overburdening an already full curriculum.

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

Sincerely,

*Jeffrey Nellhaus
Acting Commissioner of Education”*

Following are excerpts from the original document summarizing key elements. The complete document can be located in District Documents.

Massachusetts Technology Literacy Standards Introduction

In announcing our participation in the Partnership for 21st Century Skills, a national network of states, Governor Deval Patrick said, "Throughout its history, the Commonwealth has been a leader in education. But our world is changing and so we, too, must change in order to ensure our place at the top for the next generation. The vision our administration has laid out will guarantee that Massachusetts students graduate with the tools to allow them to compete not just on the national stage, but with their peers across the globe."¹

The Partnership for 21st Century Skills states in its *Policymakers' Guide*, "To thrive in the world today, students need higher-end skills, such as the ability to communicate effectively beyond their peer groups, analyze complex information from multiple sources, write or present well-reasoned arguments about nuanced issues and develop solutions to interdisciplinary problems that have no one right answer. In this light, technology is a powerful springboard to higher-level learning."²

This publication is designed to help today's students take advantage of the power of technology. It provides a set of guidelines for schools, describing what students should know and be able to do in order to use technology effectively for learning. These guidelines represent realistic, attainable activities that link to the content standards of the *Massachusetts Curriculum Frameworks*.

The Massachusetts Technology Literacy Standards incorporate the Information and Communication Technology (ICT) Literacy skills developed by the Partnership for 21st Century Skills; the National Educational Technology Standards for Students (NETS*S) developed by the International Society for Technology in Education (ISTE); as well as ISTE's 2007 draft NETS Refresh.³

The Massachusetts Technology Literacy Standards fall into three broad categories:

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

This standard includes:

- proficiency in basic productivity tools such as word processing, spreadsheet, database, electronic research, e-mail, and applications for presentations and graphics;
- conceptual understandings of the nature and operation of technology systems; and
- learning and adapting to new and emerging technology tools.

Standard 2. Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.

This standard:

- relates to social, ethical, and human issues. It promotes positive attitudes toward the uses of technology, as well as responsible use of information. This standard also includes recognition of technology's impact on civic participation, the democratic process, and the environment;
- aims to ensure that students understand general rules for safe Internet practices, including how to protect their personal information on the Internet;
- is to help students develop an awareness of the personal image that they convey through the information they post on the Internet;
- aims to ensure that students understand federal and state laws regarding computer crimes; and
- supports students in exhibiting leadership for digital citizenship.

Standard 3. Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.

This standard:

- focuses on applying a wide range of technology tools to student learning and everyday life;
- aims to ensure that students will be able to use technology to process and analyze information;
- is to help students develop skills for effective technology-based communication;
- includes the use of technology to explore and create new ideas, identify trends, and forecast possibilities; and
- aims to provide students with an awareness of how technology is used in the real world

Overview of Grade Spans

Although technology opens up exciting avenues for learning, computers should complement, rather than replace successful methods that teachers use to help students develop basic skills and understanding. The Massachusetts Department of Elementary and Secondary Education encourages the use of a wide range of tools, both traditional and technological, to help students gain those understandings. For example, although students may become fluent in keyboarding on a computer, they need to continue developing legible handwriting. By the same token, even though students might become highly skilled in electronic research, they should know how to find a book in the library. Throughout their school years, students will grow to regard technology as one of the many tools they can use to help them solve problems and improve their productivity and their capacity to learn as they move through life.

In this publication, specific technology skills are listed for each grade span. Although these proficiency expectations are recommended by the Department, local school districts make their own decisions about their students' technology proficiency. Local decisions should be based on the accessibility and availability of technology, as well as the developmental readiness of a district's students.

Based on the developmental readiness of the students, this document groups the technology skills in four grade spans:

- Grades K–2
- Grades 3–5
- Grades 6–8
- Grades 9–12

Skills/Knowledge Acquisition

Students can acquire the skills/knowledge enumerated in this document in a variety of ways:

- everyday classroom activities (gaining technology skills while learning the content of the curriculum – see page 18 to page 22)
- specific course work (e.g., taking a Web design course)
- independent study (e.g., supporting a specific project)
- an after-school activity (e.g., publishing a school newsletter)
- peer tutoring (e.g., a high school student coaching a middle school student)
- work at home (Although concerns regarding access to technology by less affluent families are well founded, Department surveys indicate a much higher presence of computers in the homes of low income and limited English proficient families than many educators presume; such surveys at the classroom and school level can be instructive.)

The teaching of technology literacy skills should not be separate from the curriculum. Integrating the appropriate use of technology into the curriculum should enhance the learning of the content. The example on page 23 is a good demonstration of how a school district provides students the technology skills they need, not as a discrete subject, but as “flowing through the curriculum.”

In this document, we focus on educational/instructional technology rather than on computer science or engineering standards.

Massachusetts Technology Literacy Standards

Grades K through 2 – Technology Exploratory Skills and Expectations

In the early grades, technology should not replace the manipulatives, pencil-and-paper, and other manual methods through which children acquire basic skills. The *Mathematics Curriculum Framework*, for example, stresses the importance of understanding basic arithmetic operations in elementary school. Given this context, the technology literacy standards for the earliest grade span allow the teacher flexibility in deciding when students are ready to use technology. For this reason, the competencies listed for K–2 are described as exploratory concepts and skills. These are skills that will be introduced and, in some cases, developed in elementary grades and mastered in middle and high school.

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

Exploratory Skills and Expectations

Basic Operations

- K-2: 1.1 Demonstrate beginning steps in using available hardware and applications (e.g., turn on a computer, launch a program, use a pointing device such as a mouse).
- K-2: 1.2 Explain that icons (e.g., recycle bin/trash, folder) are symbols used to signify a command, file, or application.
- K-2: 1.3 Identify, locate, and use letters, numbers, and special keys (e.g., space bar, Shift, Delete) on the keyboard.
- K-2: 1.4 Recognize the functions of basic file menu commands (e.g., New, Open, Close, Save, Print).

Word Processing and Desktop Publishing

- K-2: 1.5 Use a word processing application to write, edit, print, and save simple assignments.
- K-2: 1.6 Insert and size a graphic in a word processing document.

Database and Spreadsheet (Tables/Charts and Graphs)

- K-2: 1.7 Explain that computers can store and organize information so that it can be searched.
- K-2: 1.8 Use a simple computer graphing application to display data.

Internet and Multimedia

- K-2: 1.9 Explain that the Internet links computers around the world, allowing people to access information and communicate.
- K-2: 1.10 Demonstrate the ability to use tools in painting and/or drawing programs.

Standard 2. Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.

Exploratory Skills and Expectations

Ethics

- K-2: 2.1 Follow classroom rules for the responsible use of computers, peripheral devices, and resources.
- K-2: 2.2 Explain the importance of giving credit to media creators when using their work in student projects.

Classroom/Society

- K-2: 2.3 Explain why there are rules for using technology at home and at school.
- K-2: 2.4 Identify the purpose of a media message (to inform, persuade, or entertain).
- K-2: 2.5 Describe how people use many types of technologies in their daily lives.

Health and Safety

- K-2: 2.6 Follow the school rules for safe and ethical Internet use. (Use of Internet in this grade span is determined by district policy.)
- K-2: 2.7 Demonstrate knowledge of ergonomics and electrical safety when using computers.
- K-2: 2.8 Explain that a password helps protect the privacy of information.

Standard 3. Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.

Exploratory Skills and Expectations

Research (Gathering and Using Information)

- K-2: 3.1 Use various age-appropriate technologies to locate, collect, and organize information.
- K-2: 3.2 Review teacher-selected Internet resources and explain why each resource is or is not useful.

Problem Solving

- K-2: 3.3 Use age-appropriate technologies (e.g., a simple graphing application) to gather and analyze data.

Communication & Collaboration

- K-2: 3.4 Use a variety of age-appropriate technologies (e.g., drawing program, presentation software) to communicate and exchange ideas.

Massachusetts Technology Literacy Standards

Grades 3 through 5 – Technology Standards and Expectations

By the end of fifth grade, all students should have the opportunity to become familiar with the tools they will be expected to use with proficiency. Through this exposure, they will have gained a positive view of technology as a tool for learning. For example, electronic sources such as multimedia encyclopedias and teacher- previewed Web sites can be used to gather information for a report. Additionally, there are many developmentally appropriate applications for 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, multimedia reading software reinforces literacy skills by providing visual and auditory feedback to early readers. These tools can be integrated appropriately in an effective lesson plan.

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

Basic Operations

- G3-5: 1.1 Demonstrate basic steps in using available hardware and applications (e.g., log into a computer, connect/disconnect peripherals, upload files from peripherals).
- G3-5: 1.2 Select a printer, use print preview, and print a document with the appropriate page setup and orientation.
- G3-5: 1.3 Use various operating system features (e.g., open more than one application/program, work with menus, use the taskbar/dock).
- G3-5: 1.4 Demonstrate intermediate⁴ keyboarding skills and proper⁵ keyboarding techniques.

Word Processing/Desktop Publishing

- G3-5: 1.5 Use menu/tool bar functions in a word processing program (i.e., font size/style, line spacing, margins) to format, edit, and print a document.
- G3-5: 1.6 Copy and paste text and images within a document, as well as from one document to another.
- G3-5: 1.7 Proofread and edit writing using appropriate resources (e.g., dictionary, spell-checker, grammar resources).

Database

- G3-5: 1.8 Define the term "database" and provide examples from everyday life (e.g., library catalogues, school records, telephone directories).
- G3-5: 1.9 Define terms related to databases, such as "record," "field," and "search."
- G3-5: 1.10 Do simple searches of existing databases (e.g., online library catalog, electronic encyclopedia).

Spreadsheet

- G3-5: 1.11 Demonstrate an understanding of the spreadsheet as a tool to record, organize, and graph information.
- G3-5: 1.12 Identify and explain terms and concepts related to spreadsheets (i.e., cell, column, row, values, labels, chart, graph).
- G3-5: 1.13 Enter/edit data in spreadsheets and perform calculations using simple formulas (+, -, *, /), observing the changes that occur.

Internet, Networking, and Online Communication

- G3-5: 1.14 Explain and use age-appropriate online tools and resources (e.g., tutorial, assessment, Web browser).
- G3-5: 1.15 Save, retrieve, and delete electronic files on a hard drive or school network.
- G3-5: 1.16 Explain terms related to the use of networks (e.g., username, password, network, file server).
- G3-5: 1.17 Identify and use terms related to the Internet (e.g., Web browser, URL, keyword, World Wide Web, search engine, links).
- G3-5: 1.18 Use age-appropriate Internet-based search engines to locate and extract information, selecting appropriate key words.

Multimedia and Presentation Tools

- G3-5: 1.19 Create, edit, and format text on a slide.
- G3-5: 1.20 Create a series of slides and organize them to present research or convey an idea.
- G3-5: 1.21 Copy and paste or import graphics; change their size and position on a slide.
- G3-5: 1.22 Use painting and drawing applications to create and edit work.

Standard 2. Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.

Ethics

- G3-5: 2.1 Explain and demonstrate compliance with school rules (Acceptable Use Policy) regarding responsible use of computers and networks.
- G3-5: 2.2 Explain responsible uses of technology and digital information; describe possible consequences of inappropriate use.
- G3-5: 2.3 Explain Fair Use Guidelines for the use of copyrighted materials (e.g., text, images, music, video) in student projects.

Society

- G3-5: 2.4 Identify ways in which technology is used in the workplace and in society.
- G3-5: 2.5 Work collaboratively online with other students under teacher supervision.
- G3-5: 2.6 Analyze media messages and determine if their purpose is to inform, persuade, or entertain.
- G3-5: 2.7 Explain that some Web sites and search engines may include sponsored commercial links.
- G3-5: 2.8 Explain how hardware and applications can enable people with disabilities to learn.

Health and Safety

- G3-5: 2.9 Recognize and describe the potential risks and dangers associated with various forms of online communications.
- G3-5: 2.10 Identify and explain the strategies used for the safe and efficient use of computers (e.g., passwords, virus protection software, spam filters, popup blockers).
- G3-5: 2.11 Demonstrate safe e-mail practices, recognition of the potentially public exposure of e-mail and appropriate e-mail etiquette (if the district allows student e-mail use).
- G3-5: 2.12 Identify cyber bullying and describe strategies to deal with such a situation.
- G3-5: 2.13 Recognize and demonstrate ergonomically sound and safe use of equipment.

Standard 3. Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.

Research

- G3-5: 3.1 Locate, download, and organize content from digital media collections for specific purposes, citing sources.
- G3-5: 3.2 Perform basic searches on databases (e.g., library card catalogue, encyclopedia) to locate information, using two or more key words and techniques to refine and limit such searches.
- G3-5: 3.3 Evaluate Internet resources in terms of their usefulness for research.
- G3-5: 3.4 Use content-specific technology tools (e.g., environmental probes, sensors, measuring devices, simulations) to gather and analyze data.
- G3-5: 3.5 Use online tools (e.g., e-mail, online discussion forums, blogs, and wikis) to gather and share information collaboratively with other students, if the district allows it.

Problem Solving

- G3-5: 3.6 With teacher direction, use appropriate technology tools (e.g., graphic organizer) to define problems and propose hypotheses.
- G3-5: 3.7 Use spreadsheets and other applications to make predictions, solve problems, and draw conclusions.

Communication

- G3-5: 3.8 Create projects that use text and various forms of graphics, audio, and video (with proper citations) to communicate ideas.
- G3-5: 3.9 Use teacher-developed guidelines to evaluate multimedia presentations for organization, content, design, presentation, and appropriate use of citations.
- G3-5: 3.10 Communicate with other students and other classes using appropriate technology, including e-mail if the district allows it.

Massachusetts Technology Literacy Standards

Grades 6 through 8 – Technology Standards and Expectations

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

Students should understand the legal, ethical, and safety issues concerning the use of e-mail, the Internet, and other online tools. Students should understand how to protect their personal identification and information on the Internet and be knowledgeable about general rules for safe Internet practices. In addition, students should develop an awareness of how they present themselves on the Internet.

By the end of eighth grade, students should have had ample opportunity to become fluent in the use of technology tools for research, problem solving, and communication across all curriculum areas. They should know how to communicate their learning with peers and other audiences through multimedia presentations, desktop-published reports, and other electronic media. They should have learned effective strategies for locating and validating information on the Internet. Moreover, students should understand why it is important to use multiple Web sites for their research, rather than relying on a single site for information.

In summary, when students enter the ninth grade, they should be able to use technology to learn and enhance their understanding of academic subjects and the world around them. Technology should be incorporated into their everyday learning activities, both inside and outside the classroom.

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

Basic Operations

- G6-8: 1.1 Use features of a computer operating system (e.g., determine available space on local storage devices and remote storage resources, access the size and format of files, identify the version of an application).
- G6-8: 1.2 Identify successful troubleshooting strategies for minor hardware and software issues/problems (e.g., "frozen screen").
- G6-8: 1.3 Independently operate peripheral equipment (e.g., scanner, digital camera, camcorder), if available.
- G6-8: 1.4 Identify and use a variety of storage media (e.g., CDs, DVDs, flash drives, school servers, and online storage spaces), and provide a rationale for using a certain medium for a specific purpose.
- G6-8: 1.5 Demonstrate keyboarding skills between 25-30 wpm with fewer than 5 errors. (For students with disabilities, demonstrate alternate input techniques as appropriate.)

Word Processing/Desktop Publishing

- G6-8: 1.6 Demonstrate use of intermediate features in word processing applications (e.g., tabs, indents, headers and footers, end notes, bullet and numbering, tables).
- G6-8: 1.7 Create, save, open, and import a word processing document in different file formats (e.g., RTF, HTML).

Database

- G6-8: 1.8 Describe the structure and function of a database, using related terms appropriately.
- G6-8: 1.9 Create a simple database, defining field formats and adding new records.
- G6-8: 1.10 Perform simple operations in a database (i.e., browse, sort, filter, search on selected criteria, delete data, enter data).
- G6-8: 1.11 Plan and develop database reports to organize and display information.

Spreadsheet

- G6-8: 1.12 Describe the use of spreadsheets to calculate, graph, organize, and present data in a variety of real-world settings.
- G6-8: 1.13 Create an original spreadsheet, using formulas.
- G6-8: 1.14 Use various number formats (e.g., scientific notation, percentages, exponents) as appropriate.
- G6-8: 1.15 Produce simple charts and graphs from a spreadsheet.
- G6-8: 1.16 Distinguish among different types of charts and graphs, and choose the most appropriate type to represent given data.
- G6-8: 1.17 Apply advanced formatting features to customize tables, charts, and graphs.

Internet, Networking, and Online Communication

- G6-8: 1.18 Use Web browsing to access information (e.g., enter a URL, access links, create bookmarks/favorites, print Web pages).
- G6-8: 1.19 Identify probable types and locations of Web sites by examining their domain names, and explain that misleading domain names are sometimes created in order to deceive people (e.g., .edu, .com, .org, .gov, .au).
- G6-8: 1.20 Explain and correctly use terms related to networks (e.g., LANs, WANs, servers, and routers) and Internet connectivity (e.g., DSL, T1, T3).
- G6-8: 1.21 Explain and correctly use terms related to online learning (e.g., IP address, post, thread, Intranet, discussion forum, drop box, account, password).
- G6-8: 1.22 Explain that some Web sites require the use of plug-ins and specific browser versions to access content.
- G6-8: 1.23 Use e-mail functions and features (e.g., replying, forwarding, attachments, subject lines, signature, and address book.) The use of e-mail is at the school district's discretion and may be a class-wide activity if students do not have individual accounts.

Multimedia

- G6-8: 1.24 Create a multimedia presentation using various media as appropriate (e.g., audio, video, animations, etc.).
- G6-8: 1.25 Use a variety of technology tools (e.g., dictionary, thesaurus, grammar-checker, calculator) to maximize the accuracy of work.

Standard 2. Demonstrate the responsible use of technology and an understanding of ethics and safety issues in using electronic media at home, in school, and in society.

Ethics

- G6-8: 2.1 Explain ethical issues related to privacy, plagiarism, spam, viruses, hacking, and file sharing.
- G6-8: 2.2 Explain how copyright law protects the ownership of intellectual property, and explain possible consequences of violating the law.
- G6-8: 2.3 Explain fair use guidelines for using copyrighted materials (e.g., images, music, video, text) in school projects.
- G6-8: 2.4 Describe appropriate and responsible use of communication tools (e.g., chats, instant messaging, blogs, and wikis).

Society

- G6-8: 2.5 Identify and discuss the technology proficiencies needed in the workplace, as well as ways to prepare to meet these demands.
- G6-8: 2.6 Identify and describe the effect technological changes have had on society.
- G6-8: 2.7 Explain how technology can support communication and collaboration, personal and professional productivity, and lifelong learning.
- G6-8: 2.8 Analyze and explain how media and technology can be used to distort, exaggerate, and misrepresent information.
- G6-8: 2.9 Give examples of hardware and applications that enable people with disabilities to use technology.

Health and Safety

- G6-8: 2.10 Explain the potential risks associated with the use of networked digital information (e.g., Internet, mobile phones, wireless, LANs).
- G6-8: 2.11 Provide examples of safe and unsafe practices for sharing personal information via e-mail and the Internet.
- G6-8: 2.12 Explain why computers, networks, and information need to be protected from viruses, intrusion, and vandalism.
- G6-8: 2.13 Explain terms associated with the safe, effective, and efficient use of telecommunications/Internet (e.g., password, firewalls, spam, security, Acceptable Use Policy).
- G6-8: 2.14 Describe how cyber bullying can be blocked.

Standard 3. Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.

Research

- G6-8: 3.1 Explain and demonstrate effective searching and browsing strategies when working on projects.
- G6-8: 3.2 Collect, organize, and analyze digital information from a variety of sources, with attribution.
- G6-8: 3.3 Use a variety of computing devices (e.g., probeware, handheld computers, digital cameras, scanners) to collect, analyze, and present information for curriculum assignments.

Problem Solving

- G6-8: 3.4 Independently use appropriate technology tools (e.g., graphic organizer) to define problems and propose hypotheses.
- G6-8: 3.5 Use and modify databases and spreadsheets to analyze data and propose solutions.
- G6-8: 3.6 Develop and use guidelines to evaluate the content, organization, design, use of citations, and presentation of technologically enhanced projects.

Communication

- G6-8: 3.7 Plan, design, and develop a multimedia product to present research findings and creative ideas effectively, citing sources.
- G6-8: 3.8 Identify differences between various media and explain issues associated with repurposing information from one medium to another (e.g., from print to the Web).
- G6-8: 3.9 Use a variety of telecommunication tools (e.g., e-mail, discussion groups, Web pages, blogs, Web conferences) to collaborate and communicate with peers, experts, and other audiences (at district's discretion).

Gaining Technology Skills While Learning the Content of the Curriculum

Anyone who has taken a training course in the use of a spreadsheet, for example, knows how quickly we forget the skills unless we can apply them in our work on a regular basis. 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 the use of 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, other teachers may not be prepared to do this.

A possible solution is for a staff person with technology expertise (such as an instructional technology specialist, library teacher, or another classroom teacher acting as a mentor) to provide mentoring or to co-teach alongside the teacher.

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 applets, for example, can help students visualize and understand complex mathematics concepts. Simulation software enables 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. Even basic word processing software can encourage students to organize their thoughts and revise their work.