

**Massachusetts Technology Standards
Grades 9 through 12 – Technology Standards and Expectations**

Throughout high school, as students take courses to prepare themselves for college and the working world, they should acquire increasingly sophisticated technology skills. Depending on the pathways and courses they choose to take, high school students will become more adept with certain technology tools than others. Moreover, as the curriculum demands more complicated learning tasks, students will discover advanced capabilities in tools such as database and spreadsheet applications.

During high school, students also should have the opportunity to use more specialized technology tools that enhance their learning. These might include simulation software, geographic information systems, computer-aided design software, or any of a wide variety of content-specific tools. In addition, students should have the opportunity to learn how to write code in a commonly used programming language.

By the completion of high school, students should have developed an appreciation for the capabilities of technology resources, as well as an understanding of how these tools can be used for lifelong learning. In addition, students should be knowledgeable about the role technology plays in various fields of work, enabling them to better plan for their careers in the 21st century.

1. Basic Operations and Productivity Tools

1.1 Basic Operations

G9-12: 1. 11 Identify the platform, version, properties, function, and interoperability of computing devices.

G9-12: 1.12 Explain differences between formats that are open specification and proprietary, giving situations in which one is more appropriate than the other.

G9-12: 1.13 Install and uninstall software; compress and expand files (with district's permission).

G9-12: 1.14 Resolve commonly occurring error messages and simple hardware and software problems as they occur (e.g., frozen screen, disk error, printing problems).

G9-12: 1.15 Use online help and other support to learn about features of hardware and software, as well as to assess and resolve problems.

G9-12: 1.16 Demonstrate skills for evaluating appropriate hardware and software (e.g., features, versions, capacity) for a given task.

G9-12: 1.17 Demonstrate effective backup and recovery strategies.

G9-12: 1.18 Identify the capabilities and limitations of emerging technologies.

1.2 Word Processing/Desktop Publishing

G9-12: 1.21 Save, retrieve, load, and import a word processing document in different file formats (e.g., RTF, HTML).

G9-12: 1.22 Import, export, and link data between word processing documents and other applications.

G9-12: 1.23 Apply advanced formatting and page layout features when appropriate (e.g., columns, templates, and styles) to improve the appearance of documents and materials.

G9-12: 1.24 Use special features appropriately (e.g., footnotes, track changes, insert

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comments, search and replace, keyboard shortcuts).
G9-12: 1.25 Identify the use of word processing and desktop publishing skills in various careers.
1.3 Database
G9-12: 1.31 Describe the importance of designing the structure of a database to meet its intended goals.
G9-12: 1.32 Duplicate the structure of a database without data.
G9-12: 1.33 Use database features to create mailing labels, form letters, and perform mail merges.
G9-12: 1.34 Save database files in various formats.
G9-12: 1.35 Manipulate non-alphanumeric digital data (e.g., geospatial data from MassGIS ⁷ , images, audio) within a database.
G9-12: 1.36 Identify the use of database skills in various careers.
G9-12: 1.37 Define the term “metadata,” and explain how metadata describes the structure and workings of an organization's use of information.
1.4 Spreadsheet
G9-12: 1.41 Define and use functions of a spreadsheet application (e.g., sort, filter, find).
G9-12: 1.42 Enter formulas and functions; use the auto-fill feature in a spreadsheet application.
G9-12: 1.43 Explain and use advanced formatting features of a spreadsheet application (e.g., reposition columns and rows, add and name worksheets).
G9-12: 1.44 Use various number formats (e.g., scientific notation, percentages, exponents) as appropriate.
G9-12: 1.45 Differentiate between formulas with absolute and relative cell references.
G9-12: 1.46 Customize formatting of charts or graphs created in spreadsheet applications.
G9-12: 1.47 Use multiple sheets within a workbook, and create links among worksheets.
G9-12: 1.48 Import and export data between spreadsheets and other applications.
G9-12: 1.49 Create and use pivot tables.
G9-12: 1.410 Identify the use of spreadsheet skills in various careers.
1.5 Internet, Networking, and Online Communication
G9-12: 1.51 Explain how to select and use search engines and online directories. Explain the differences among search engines and how they rank results.
G9-12: 1.52 Explain the differences between searching and browsing a collection of data, identify when one technique is more appropriate than the other, and explain how the two can work together.
G9-12: 1.53 Explain and demonstrate effective search strategies for locating and retrieving electronic information (e.g., using syntax and Boolean logic operators).

⁷ For more information, see MassGIS's web page, GIS in Education at <http://www.mass.gov/mgis/gisedu.htm>.

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G9-12: 1.54 Describe good practices for password protection and authentication.
G9-12: 1.55 Complete at least one online credit or non-credit course or tutorial; discuss the benefits and disadvantages of this method of learning.
G9-12: 1.56 Plan and implement a collaborative project using telecommunications tools with students in other classrooms and schools (e.g., email, discussion forums, groupware, interactive web sites, videoconferencing).
G9-12: 1.57 Demonstrate basic understanding of addressing schemes (i.e., IP addresses, DHCP, DNS).
G9-12: 1.58 Identify career options in network technologies.
G9-12: 1.59 Present data to multiple audiences using the most appropriate tools (e.g., spreadsheet, database, graphing, and concept-mapping tools).
G9-12: 1.510 Explain how various formatting options are used to convey information when formatting of charts or graphs created in spreadsheet applications.
1.6 Multimedia and Software Applications
G9-12: 1.61 Identify technology tools (e.g., authoring tools and other software resources) that can be used to create a multimedia product.
G9-12: 1.62 Compare differences between multimedia, hypertext, and static media; classify everyday items (e.g., DVDs, web sites, household appliances, books, posters) according to their use of multimedia, hypertext, and static presentations.
G9-12: 1.63 Demonstrate the ability to use a variety of applications to plan, create, and edit multimedia products (e.g., slide presentations, videos, animations, simulations, podcasts).
G9-12: 1.64 Identify career options in multimedia and software applications.
G9-12: 1.65 Link multiple pieces of information residing in different applications (e.g., linking a chart in a word-processing document to the spreadsheet where it was created, so that the chart is automatically updated when data are changed in the spreadsheet).
1.7 Web Authoring
G9-12: 1.71 Understand terminology necessary for web page authoring (e.g., HTTP, HTML, tags, links, browsers, plug-ins, web servers).
G9-12: 1.72 Distinguish between effective and ineffective designs in web sites.
G9-12: 1.73 Use text, images, design elements, and media effectively to create unified, well organized sites with effective navigation.
G9-12: 1.74 Use HTML or web-authoring tools to create and edit web pages (e.g., add/edit text, graphics, links, buttons).
G9-12: 1.75 Demonstrate an understanding of practices that contribute to a web site's accessibility to people with disabilities (e.g., tab order, keyboard equivalents, clear navigation mechanisms, alt tags describing images, captioning for multimedia).
G9-12: 1.76 Create and save web pages using appropriate file structure; upload and publish web pages.
G9-12: 1.77 Understand how to test and debug web files for quality assurance.
G9-12: 1.78 Identify career options in web design, development, and management.

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2. Ethics, Society, and Safety	
<i>2.1 Ethics</i>	
G9-12: 2.11	Demonstrate compliance with the school's Acceptable Use Policy.
G9-12: 2.12	Explain laws restricting the use of copyrighted materials.
G9-12: 2.13	Demonstrate the ability to evaluate the authenticity, accuracy, appropriateness, and bias of electronic resources, including web sites.
G9-12: 2.14	Identify examples of plagiarism, and discuss the possible consequences of plagiarizing the work of others.
G9-12: 2.15	Write correct in-text citations and reference lists for text and images gathered from electronic sources, as stated in the Massachusetts English Language Arts Framework.
G9-12: 2.16	Discuss and demonstrate issues related to acceptable and responsible use of technology (e.g. privacy, security, copyright).
G9-12: 2.17	Discuss misuse of technology for personal and commercial reasons (e.g., spam, viruses, personal identity and information theft); discuss related consequences and possible solutions.
G9-12: 2.18	Understand the appropriate and responsible use of communication tools such as chats, instant messaging, blogs, and wikis.
<i>2.2 Society</i>	
G9-12: 2.21	Design and implement a personal learning plan that includes the use of technology to support lifelong learning goals.
G9-12: 2.22	Analyze the effect of technological change on areas such as business, transportation, communications, industry, agriculture, and the arts, both locally and globally.
G9-12: 2.23	Explain the penalties for illegal practices such as software piracy, unauthorized file sharing/downloading, virus spreading, and hacking.
<i>2.3 Health and Safety</i>	
G9-12: 2.31	Evaluate school and work environments in terms of ergonomically sound practices.
G9-12: 2.32	Demonstrate ways that individuals can protect their technology systems from unethical or unscrupulous users.
G9-12: 2.33	Explain the use of appropriate protective technologies (e.g. firewalls and virus protection software).
G9-12: 2.34	Describe and use safe and appropriate practices when participating in online communities, such as discussion groups, blogs, and social networking sites.
G9-12: 2.35	Explain and use practices to protect one's personal safety online (e.g., not sharing personal information with strangers, being alert for online predators, and reporting suspicious activities to parents, teachers, or law enforcement personnel).

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3. Research, Problem-Solving, and Communications

3.1 Research

G9-12: 3.11 Compare, evaluate, and select appropriate online tools to locate information and conduct research using all appropriate electronic resources (e.g., web sites, online periodical databases, online catalogs, search engines, specialized directories, RSS feeds, and email alerts).

G9-12: 3.12 Formulate a research question or hypothesis, use appropriate technology resources to collect relevant information, analyze the findings, and report the results.

3.2 Problem Solving

G9-12: 3.21 Explain and 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).

3.3 Communication

G9-12: 3.31 Present information using a variety of media (e.g., reports, research papers, presentations, newsletters, web sites, podcasts, blogs).

G9-12: 3.32 Present ideas using a variety of formats that are appropriate for various audiences.

G9-12: 3.33 Use online communication tools such as bulletin boards, discussion forums, listservs, and web conferencing to collaborate with peers, community members, and field experts when appropriate.

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Gaining Technology Skills
While Learning the Content of the Curriculum

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, 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.

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. The scenarios, which were originally published by the Department of Education in its technology toolkit, were drawn from school districts that participated in Project MEET, from districts that received instructional technology grants from the Massachusetts Department of Education, and from award-winning teachers.

Each scenario features a lesson unit on a specific curriculum topic. Several criteria were used to select these lesson units. First the lesson needed to have a clear curriculum focus that aligned with the state's Curriculum Frameworks, and it had to integrate learning technology skills with learning the curriculum content. The lesson also had to address the fact that students have varying abilities, backgrounds, and interests. Finally, the lesson needed to have a way to evaluate how much students had learned.

All of these scenarios, plus fourteen more, are available on the Department's web site (<http://www.doe.mass.edu/edtech/toolkit/practices/index.htm>). The online version includes links to sample student work, classroom photographs, videos, multimedia presentations, and digital artwork.