

## **Technology in the Maryland Content Standards**

The Maryland State Content Standards, which include the Learning Outcomes, Core Learning Goals and Skills for Success, specify what students in kindergarten through 12<sup>th</sup> grade need to know and be able to do in four content areas: English/language arts, mathematics, science, and social studies. Included in these standards are expectations for how technology can and should be used to support student learning and instruction. Focusing on the standards listed below will help move Maryland closer to the vision of improving student learning through the meaningful integration of technology into classrooms and schools.

This document was designed to assist local school systems as they update their written curriculum to include technology and to help principals and teachers as they focus on instructional priorities. Please note that not all content standards are included in this document; there are many other areas where technology can be a valuable tool to support learning.

For a list of all the State Content Standards, visit the following web site:

[www.mdk12.org/mspp/standards/index.html](http://www.mdk12.org/mspp/standards/index.html)

### **Science: Skills & Processes**

#### **Grade 3**

- access and process information from readings, investigations, and/or oral communications
- collect and record data using developmentally appropriate instruments (e.g., calculators, computers and their accessories)
- compare data, identify possible trends, and form conclusions
- interpret and communicate findings (i.e., speaking, writing, and drawing) in a form suited to the purpose and audience, using developmentally appropriate methods including technology tools and telecommunications
- identify that individuals are free to reach different conclusions provided that supporting evidence is used
- use the knowledge of science and available scientific equipment to devise a plan to solve a practical problem
- describe that a model is different from a real object but can be used to learn something about the real thing

- demonstrate and explain that tools (i.e., non-metric, non-standard) are used to observe and measure when collecting information
- design, plan, and construct things with simple tools and a variety of materials

### **Grade 5**

- access and process information from readings, investigations, and/or oral communications
- use appropriate instruments (e.g. calculators, spreadsheets, databases, and graphing programs) to collect, organize, and display on charts, tables, graphs, or with drawings
- analyze data to identify trends and form conclusions
- interpret and communicate findings (i.e., speaking, writing, and drawing) in a form suited to the purpose and audience, using developmentally appropriate methods including technology tools and telecommunications
- recognize when reasoning can be distorted by inaccurate data and/or strong feelings
- use the knowledge of science and available scientific equipment to devise a plan to solve a local problem
- explain that observing the changes in models may simulate how real objects act when those same changes are applied
- demonstrate and explain that tools enable scientists and others to observe, estimate, measure, collect, and communicate scientific data and information (i.e., size, distance, motion)
- design, plan, and construct things in response to a particular need or problem (e.g., instruments, machines, structures, and systems)
- explain that technology extends the ability of people to change the world (e.g., to cut, shape, or put together materials, to move things from one place to another, and to reach farther with their hands, voices, senses, and minds)

### **Grade 8**

- access and process information from readings, investigations, and/or oral communications
- recognize/develop well-designed procedures that identify the independent and dependent variables, the need for control when testing a factor, the importance of multiple trials, the selection of appropriate materials/equipment, and the development of clear, logical directions within an investigation

- use appropriate instruments and metric units when making measurements and collecting data
- collect, organize, and display data in ways others can verify (i.e. numbers, statistics, tables, graphs, drawings, charts, diagrams) using appropriate instruments (e.g., calculators, spreadsheets, databases, and graphing programs)
- analyze and summarize data to identify trends and form a logical argument about a cause and effect relationship or a sequence of events
- interpret and communicate findings (i.e., speaking, writing, and drawing) in a form suited to the purpose and audience, using developmentally appropriate methods including technology tools and telecommunications
- critique scientific information and identify possible sources of bias
- analyze and extend patterns
- use the knowledge of science and available scientific equipment to devise a plan to solve a global problem
- explain that a model has advantages and disadvantages and may need to be changed for different purposes
- demonstrate and explain that tools are essential to scientific investigation for such purposes as to observe, estimate, measure, compute, collect, and communicate scientific data and information (i.e., size, distance, motion)
- design, plan, and construct things in response to a particular need or problem (e.g., instruments, machines, structures, and systems)
- explain that science and technology have strongly influenced life under different technological circumstances in the past and continue to do so today
- explain how people from different cultures and times have made important contributions to the advancement of science, mathematics, and technology in different cultures at different times

## **Grade 12**

- access and process information from readings, investigations, and/or oral communications. The student will read a technical selection and interpret it appropriately. The student will learn the use of new instruments and equipment by following instructions in a manual or from oral direction. The student will use create and/or interpret graphics (scale drawings, photographs, digital images, etc.)

- design experimental approaches, which answer scientific questions. The student will select appropriate instruments and materials to conduct an investigation
- use mathematical processes (measuring, calculating, etc) when conducting investigations, analyzing information, and/or displaying information. The student will use computers and/or graphing calculators to perform calculations for tables, graphs, or spreadsheets
- collect, organize, and display data in multiple ways that fit the context using appropriate instruments to effectively convey the information (e.g., calculators, spreadsheets, and databases and graphing programs). The student will develop and demonstrate skills in using lab and field equipment to perform investigative techniques. The student will organize data appropriately using techniques such as tables, graphs, and webs (for graphs: axes labeled with appropriate quantities, appropriate units on axes, axes labeled with appropriate intervals, independent and dependent variables on correct axes, appropriate title. The student will use computers and/or graphing calculators to produce tables, graphs, and spreadsheet calculations.
- analyze appropriate data to identify trends to form conclusions and apply what has been learned to evaluate the hypothesis. The student will analyze data to make predictions, decisions, or form conclusions. The student will check graphs to determine that they do not misrepresent results. The students will describe trends revealed by data.
- interpret and communicate findings through speaking, writing, and drawing in a form suited to the purpose and audience, using developmentally appropriate methods including technology tools and telecommunications. The student will use tables, charts, and graphs to display data in making arguments and claims in both oral and written presentations. The student will use computers and/or graphing calculators to produce the visual materials (tables, graphs, and spreadsheets) that will be used for communicating results.
- critique scientific information in order to detect bias and analyze the source of the bias
- analyze and extend patterns
- design, construct, and use models (e.g., math, computer, physical) to make predictions about actual events. The student will use models and computer simulations to extend his/her understanding of scientific concepts.
- demonstrate and explain how using existing tools extend knowledge and identify the limitations, which drive the need for new technologies (i.e., create improvements in observing, estimating, measuring, computing, collecting, and communicating scientific data and information). The student will explain how

development of scientific knowledge leads to the creation of new technology and how technological advances allow for additional scientific accomplishments.

- explain that when designing a device, process, or system (e.g., manufacturing, marketing, operating, maintaining, replacing, and disposing of) risk analysis and technology assessment determines how it will be employed
- explain that science and technology have strongly influenced the course of history and cite how human inventiveness has brought new risks as well as improvements to human existence. The student will identify and evaluate the impact of scientific ideas and/or advancements in technology on society.
- describe how various cultures from ancient times to the present have made contributions that led to current scientific ideas and technological invention

## **Science: Earth/Space Science**

### **Grade 3**

- describe the weather using observations, age appropriate tools (i.e., thermometers) and measurements

### **Grade 5**

- compare how agents of erosion (i.e., water waves, wind, water, and ice and the deposition of rocks and soil shape and reshape a planet’s surface (i.e., erosion of mountains, canyons, spits, sandbars, submarine canyons, glacial valleys)
- use age appropriate instruments and/or resources to quantify, collect, and record oceanic weather measurements and oceanic data (i.e., water temperatures, salinity, currents)

### **Grade 8**

- explain that some changes in a planet’s surface are due to slow processes (i.e., erosion, weathering) and some changes are due to rapid processes (i.e., landslides, tornadoes, hurricanes, volcanic eruptions, earthquakes, flooding, and tsunamis)
- analyze Earth (i.e. land and water) data collected from space-based instruments and relate it to weather patterns

### **Grade 12**

- explain how the formation, weathering, sedimentation, and reformation of rock constitutes a continuing “rock Cycle” in which the total amount of materials stay the same. The students will describe current efforts and technologies used to study the atmosphere, land, and oceans of Earth (remote sensing from space, undersea exploration, seismology, weather data collection).

- research the change in belief in the age of the earth (fossil record, rock layers, radioactive dating, Big Bang theory)
- identify and describe the properties, interactions, and the theories of formation of the universe and its components (i.e. galaxies, stars, planets, asteroids, comets, and meteors). The student will describe current efforts and technologies used to study the universe (optical telescopes, radio telescopes, spectroscopes, satellites, space probes, manned missions).
- analyze the major components of the atmosphere and hydrosphere and explain how the transfer of energy through them influences Earth’s weather and climate. The student will describe heat transfer systems affecting the atmosphere, land, and oceans (convection, conduction, radiation from space and from within Earth). The student will investigate meteorological phenomena (hurricanes, tornadoes, floods, thunderstorms, and blizzards). The student will research topics of current concern with regard to climate (greenhouse effect, global warming [or cooling], ocean currents).
- analyze the major components, thermal structure and chemical composition of the atmosphere. The student will describe changes in atmospheric conditions over time and explain possible causes including the greenhouse effect and ice age cycles.

## **Science: Chemistry**

### **Grade 12**

- use observation of the properties of matter to predict its structure and changes to its structure. The student will select and use appropriate devices to measure directly or indirectly the length, mass, volume, or temperature of a substance (centigram balances, graduated cylinders & pipettes, metric rulers, thermometers & temperature probes). The student will gather and interpret data related to physical and chemical properties of matter such as density and percent composition (constructing data tables, graphing linear relationship, appropriate technology to analyze data).

## **Science: Physics**

### **Grade 12**

- use algebra and geometry to apply the concepts of energy, force (i.e., Newton’s Law, gravitation, friction), and momentum to explain the behavior of objects (i.e., linear and rotational motion, projectiles, collisions). The students will use analytical techniques appropriate to the study of physics (symbolically representing vector quantities, using signs to represent directions, selecting and using appropriate equipment for measuring and investigating, using appropriate units and applying dimensional analysis, manipulating equations).

- use energy transformations and physical effects to explain the interactions of waves and physical effects, (i.e., Doppler effect, and Interference patterns)

## **Science: Environmental Science:**

### **Grade 12**

- analyze and explain the movement of matter and energy through the biosphere (lithosphere, hydrosphere, atmosphere, and organisms) and the influence of this movement on weather patterns, climatic zones, and the distribution of life. The student will analyze how the transfer of energy between atmosphere, land masses and oceans results in areas of different temperatures and densities that produce weather patterns and establish climate zones around the earth.
- investigate and analyze environmental issues from local to global perspectives (e.g., world population, food production and distribution, pollution and epidemics, biodiversity) to develop an action project that protects, sustains, or enhances the natural environment

## **English Language Arts: Reading**

### **Grade 3**

- Comprehension and Interpretation of Informational Text
  - interpret information from diagrams, charts, and graphs
  - reorganize information from the text into different forms (charts, drawings, or graphic organizers)

### **Grade 5**

- Comprehension and Interpretation of Informational Text
  - reorganize information from the text into different forms (charts, drawings, or graphic organizers)

## **English Language Arts: Writing**

### **Grade 3**

- prepare writing for publication by purposefully using drawings, legible handwriting (cursive or manuscript), labeling and graphics (electronic or traditional)

### **Grade 5**

- self-edit writing using knowledge of standard English conventions of language (e.g., punctuation, sentence structure, usage, spelling) and appropriate print and non-print resources (e.g., dictionary, thesaurus, spell-check software)
- prepare writing for publication by purposefully using electronic resources and graphics (e.g., drawings, charts, illustrations) to enhance the final product

### **Grade 8**

- self-edit writing using knowledge of standard English conventions of language (e.g., punctuation, sentence structure, usage, spelling) and appropriate print and non-print resources (e.g., dictionary, thesaurus, spell-check software)
- prepare writing for publication using electronic resources (e.g., word processing, database, spreadsheet software) to adopt an appropriate format and principles of design (e.g., headings, margins, spacing, columns, page orientation) that enhance the final product

### **Grade 12**

- self-edit writing using knowledge of standard English conventions of language (e.g., punctuation, sentence structure, usage, spelling) and appropriate print and non-print resources (e.g., dictionary, thesaurus, spell-check software)
- prepare writing for publication by integrating illuminating graphics and format and appropriate traditional and electronic resources to enhance the final product and create an easily read product.

- design and use multi-page documents using publishing software and graphics programs

## **English Language Arts: Writing**

### **Research: Grade 3**

- understand and use the organizational features of research resources such as encyclopedias, computerized card catalogs, almanacs, and periodicals to locate relevant information

### **Research: Grade 8**

- use organizational features of electronic information and library and interlibrary computerized catalogs to research information for specific purposes

### **Research: Grade 12**

- use clear research questions and coherent research methodology to elicit and present evidence from primary and secondary sources using available library, electronic, and human resources

## **English Language Arts: Listening**

- apply listening skills appropriately in a variety of settings and for a variety of purposes including the use of print, non-print, and emerging technology and media.

## **English Language Arts: Speaking**

### **Oral Presentations: Grade 5**

- select audio or visual aids and technology (e.g., props, computer graphics, lighting) to support presentations

### **Oral Presentations: Grade 8**

- create visual aids, using technology when appropriate, to support presentations

### **Oral Presentations: Grade 12**

- incorporate props, visual aids, and technology to enhance presentations

## **Mathematics: Algebra, Patterns, and Functions**

### **Grade 5**

- represent relationships using graphs and tables

### **Grade 8**

- represent and interpret quantitative relationships in a table or graph
- graph ordered pairs in the four quadrants of a coordinate plane
  - graph linear equations on a coordinate plane
- solve inequalities and graph the solutions on a number line

### **Grade 12**

- represent patterns, and/or functional relationships in a table, as a graph, and/or by mathematical expression
- demonstrate understanding of the concept of a function and identify its characteristics
  - identify, graph, and transform linear functions including the absolute value function
  - describe the graph of a non-linear function and discuss its appearance in terms of the basic concepts of maxima and minima (highs and low), roots (zero), limits (boundaries), rate of change, and continuity
  - describe how the graphical model of a non-linear function represents a given problem and will estimate the solution
- graph to solve systems of linear equations and linear inequalities

## **Mathematics: Geometry**

### **Grade 3**

- construct or draw geometric figures using tools and technology
  - sketch squares, rectangles, triangles and circles

### **Grade 5**

- construct or draw geometric figures using tools and technology
  - draw, label, describe, and identify: points, lines, line segments, and rays
  - draw circles, squares, triangles, and rectangles given their dimensions

### **Grade 8**

- construct or draw geometric figures using tools and technology
  - use a compass and straightedge to construct angles, rectangles, circles and other geometric figures
  - draw and analyze geometric figures on a coordinate plane

## **Grade 12**

- analyze the properties of geometric figures and/or will construct and/or draw geometric figures using technology and tools
  - determine parallel, perpendicular, intersecting and skew lines and apply properties of parallelism and perpendicularity to problem situations
  - describe line/segment/plane relationships including parallel, perpendicular, intersecting, bisecting, midpoint, median, altitude
  - describe point relationships (collinear and coplanar)
  - describe angles and angle relationships including vertical, adjacent, complimentary, supplementary, interior, exterior
  - describe geometric solids including cones, cylinders, spheres, prisms, and pyramids
  - describe circle/sphere relationships including tangent, radius, diameter, chord, secant, central angle, inscribed angle, angles formed by secants and tangents and circumscribed and inscribed polygons
  
- construct and/or draw geometric figures using tools and technology
  - validate properties of geometric figures using appropriate tools and technology
  - construct a line segment congruent to a given line; and an angle congruent to a given angle
  - construct the bisector of a line segment and the bisector of an angle
  - construct a perpendicular to a given line from a point on the line and a point not on the line
  - identify and/or verify properties of geometric figures using the coordinate plane and concepts from algebra
  - use transformations to move figures, create designs and/or demonstrate geometric properties.

## **Mathematics: Statistics**

### **Grade 3**

- interpret, compare and make predictions based on tables, pictographs, and bar graphs

### **Grade 5**

- analyze and interpret stem and leaf plots, circle graphs, line plots, and line graphs

### **Grade 8**

- analyze and interpret frequency tables, box and whisker plots, and scatter plots
- make predictions about a set of linear data given the line of best fit
- fit a line to a set of linear data and make predictions about the data

### **Grade 12**

- make informed decisions and predictions based upon the results of simulations and data from research
  - describe data, make predictions, and draw inferences
- interpret data and/or make predictions by finding and using a line of best fit and by using a given curve of best fit
  - determine the equation of a line that best fits a set of linear data

## **Mathematics: Probability**

### **Grade 8**

- conduct and predict the probability of an event based on the outcomes of an actual event or a simulation

### **Grade 12**

- design and conduct an experiment or simulation to compare the experimental probability with the theoretical probability as the number of trials increases
- calculate theoretical probability or use simulations or statistical inferences from data to estimate the probability of an event
  - define event and sample spaces and apply these concepts to determine the probability of an event
  - use counting techniques to solve probability problems

## **Social Studies: Social Studies Skills**

### **Grade 3**

- find, interpret, and apply information from primary and secondary sources including pictures, graphics, maps, atlases, artifacts, and timelines
- describe how their community has changed over time and how people have contributed to its change, drawing from maps, photographs, newspapers and other sources

### **Grade 5**

- find, interpret, and organize primary and secondary sources of information including pictures, graphics, maps, atlases, artifacts, timelines, political cartoons, videotapes, journals, and government documents

### **Grade 8**

- find, interpret, evaluate, and organize primary and secondary sources of information including pictures, graphics, maps, atlases, artifacts, timelines, political cartoons, videotapes, journals, and government documents
- pose and answer questions about geographic distributions and patterns shown on maps, graphs, charts, models, and databases to explain historical migration of people, expansion and disintegration of empires, and growth of economic systems

### **Grade 12**

- assess the credibility of primary and secondary sources, assessing the accuracy and adequacy of the author's details to support claims and noting instances of bias, propaganda and stereotyping, and draw sound conclusions
- use case studies and geographic information from a variety of sources such as data bases, field interviews, media services, and questionnaires to identify contemporary geographic problems and issues and consider the advantages and disadvantages of various solutions
- use clear research questions and coherent research methodology to elicit and present evidence from primary and secondary sources using available library, electronic and human resources
- identify community resources that preserve historical information and know how to access this knowledge (e.g., libraries, museums, historical societies, courthouse, world wide web, family records, elders)
- synthesize information from multiple sources, evaluating each source in terms of the author's viewpoint or bias and use of evidence, identifying complexities and

discrepancies in the information, and making distinctions between sound generalizations and misleading over simplifications

- explain different points of view in historical accounts of controversial events and determine the context in which the statements were made (e.g., the questions asked, the sources used, the author's perspective)

## **Social Studies: United States History**

### **Grade 12**

- explain the effects of technological developments on the nation's economic strength, daily life, and the world economy such as the computer revolution, changes in communication, and advances in medicine

## **Social Studies: Geography**

### **Grade 3**

- identify the characteristics and purposes of maps, globes, and other geographic tools
- construct and interpret maps to locate and describe places using relative distance, map elements including a title, simple grid systems, cardinal directions, compass rose, border, and legend/key, author and date

### **Grade 5**

- explain the purposes of and the differences among maps, globes, aerial photographs, and satellite images
- construct and interpret graphs, charts, databases, and thematic maps using map elements including a title, symbols, cardinal and intermediate directions, compass rose, border, longitude and latitude, legends/key and scale
- identify ways and reasons why people adapt to and modify the natural environment with technology, and analyze consequences of the modifications

### **Grade 8**

- use appropriate maps and other graphic representations to analyze geographic problems
- construct and interpret graphs, charts, databases, and thematic maps using map elements including a title, symbols, cardinal and intermediate directions, compass rose, border, longitude and latitude, legends/key and scale

- explain how people's ideas about and relationship to the environment have changed over time particularly in response to how new technologies affect access to and use of resources

### **Grade 12**

- use a variety of geographic tools to collect, synthesize, interpret, analyze, and evaluate information to answer geographic questions in the context of other social sciences
- construct and interpret thematic maps, graphs, charts, and databases to answer geographic questions and infer geographic relationships explain the possible global effects of human modification of the natural environment including how technology has expanded human capacity to modify and adapt to the physical environment
- use case studies and geographic information from a variety of sources such as data bases, field interviews, media services, and questionnaires to identify contemporary geographic problems and issues and consider the advantages and disadvantages of various solutions
- explain the possible global effects of human modification of the natural environment including how technology has expanded human capacity to modify and adapt to the physical environment

## **Social Studies: Economics**

### **Grade 3**

- identify improvements in technology (factories, machinery, transportation, communication) over time

### **Grade 5**

- explain how changes in technology (factories, machinery, transportation, communication, new technology) impact Maryland's economy

### **Grade 8**

- analyze the impact of technological change (factories, machinery, transportation, communication, new technology) and resource use in promoting economic growth

## **Social Studies: Political Systems**

### **Grade 5**

- identify various sources of information that are available to citizens to make political decisions

### **Grade 8**

- analyze the influence of the media on political life in the United States including recognizing bias in reporting, analyzing, and editorializing

**Grade 12**

- evaluate the ways in which the government policy is shaped and set, including the influence of political parties, interest groups, lobbyists, the media, and public opinion