

McREL (Technology) *Topic	ISTE (NETS-S 2007)
<p><b>Standard 1. Knows the characteristics and uses of computer hardware and operating systems.</b></p> <p>Level Pre-K (Grades Pre-K)</p> <ol style="list-style-type: none"> <li>Knows names of basic computer hardware (e.g., mouse, keyboard, touch screen) <b>*Computer hardware</b></li> <li>Uses basic computer hardware (e.g., hunts for specific keys on keyboard, uses mouse) <b>*Computer hardware</b></li> </ol> <p>Level I (Grades K-2)</p> <ol style="list-style-type: none"> <li>Knows basic computer hardware (e.g., keyboard and mouse, printer and monitor, hard and floppy disk, case for the CPU [central processing unit]) <b>*Computer hardware</b></li> <li>Powers-up computer, monitor, and starts a computer program (e.g., checks that printer is switched on and on-line; reboots the computer when necessary) <b>*Computer operation</b></li> <li>Knows the alphanumeric keys and special keys (e.g., function keys, escape key, space bar, delete/backspace, return/enter) <b>*Typing</b></li> <li>Knows proper finger placement on the home row keys <b>*Typing</b></li> <li>Handles diskettes and other computer equipment with care <b>*Computer maintenance and trouble-shooting</b></li> </ol> <p>Level II (Grades 3-5)</p> <ol style="list-style-type: none"> <li>Knows the basic functions of hardware (e.g., keyboard and mouse provide input; printer and monitor provide output; hard and floppy disk provide storage; the cpu processes information) <b>*Computer hardware</b></li> <li>Uses proper fingering for all keys, beginning from the home row, maintaining proper posture while using the keyboard <b>*Typing</b></li> <li>Knows potential hazards to computer media (e.g., the damage caused to floppies by magnetic fields, dirt, and dust; caused to computers by excessive heat, smoke, and moisture) <b>*Computer maintenance and trouble-shooting *Computer networks/Internet</b></li> <li>Knows basic facts about networked computers (e.g., computers can connect to each other via modem and telephone line, or through local network systems, or internet and intranet) <b>*Computer networks/Internet</b></li> </ol> <p>Level III (Grades 6-8)</p> <ol style="list-style-type: none"> <li>Knows the differing capacities and trade-offs for computer storage media, such as</li> </ol>	<p><b>6. Technology Operations and Concepts</b></p> <p>Students demonstrate a sound understanding of technology concepts, systems, and operations.</p> <p>Students:</p> <ol style="list-style-type: none"> <li>understand and use technology systems.</li> <li>select and use applications effectively and productively.</li> <li>troubleshoot systems and applications.</li> <li>transfer current knowledge to learning of new technologies.</li> </ol>

<p>CD-ROMs, floppy disks, hard disks, and tape drives <b>*Computer hardware</b></p> <ol style="list-style-type: none"> <li>Types with some facility, demonstrating some memorization of keys <b>*Typing</b></li> <li>Connects via modem to other computer users via the internet, an on-line service, or bulletin board system <b>*Computer networks/Internet</b></li> <li>Knows basic characteristics and functions of an operating system <b>*Computer software</b></li> </ol> <p>Level IV (Grades 9-12)</p> <ol style="list-style-type: none"> <li>Knows of significant advances in computers and peripherals (e.g., data scanners, digital cameras) <b>*Advances in technology</b> <b>*Computer hardware</b></li> <li>Uses a variety of input devices (e.g., keyboard, scanner, voice/sound recorders, mouse, touch screen) <b>*Computer hardware</b></li> <li>Knows limitations and trade-offs of various types of hardware (e.g., laptops, notebooks, modems) <b>*Computer hardware</b></li> <li>Identifies malfunctions and problems in hardware (e.g., hard drive crash, monitor burn-out) <b>*Computer maintenance and trouble-shooting</b></li> <li>Knows features and uses of current and emerging technology related to computing (e.g., optical character recognition, sound processing, cable TV, cellular phones, ABS brakes) <b>*Advances in technology</b></li> </ol>	
<p><b>Standard 2. Knows the characteristics and uses of computer software programs</b></p> <p>Level Pre-K (Grades Pre-K)</p> <ol style="list-style-type: none"> <li>Understands that actions can control software programs <b>*Computer software</b></li> <li>Uses computers for a variety of purposes (e.g., playing games, listening and interacting with storybooks, working with numbers, drawing) <b>*Computer software</b></li> </ol> <p>Level I (Grades K-2)</p> <ol style="list-style-type: none"> <li>Types on a computer keyboard, using correct hand and body positions <b>*Typing</b></li> <li>Knows basic distinctions among computer software programs, such as word processors, special purpose programs, and games <b>*Computer software</b></li> <li>Uses menu options and commands <b>*Computer operation</b></li> </ol> <p>Level II (Grades 3-5)</p> <ol style="list-style-type: none"> <li>Uses a word processor to edit, copy, move, save, and print text with some formatting (e.g., centering lines, using tabs, forming paragraphs) <b>*Word processing/desktop publishing</b></li> <li>Makes back-up copies of stored data, such as text, programs, and databases</li> </ol>	<p><b>6. Technology Operations and Concepts</b></p> <p>Students demonstrate a sound understanding of technology concepts, systems, and operations.</p> <p>Students:</p> <ol style="list-style-type: none"> <li>understand and use technology systems.</li> <li>select and use applications effectively and productively.</li> <li>troubleshoot systems and applications.</li> <li>transfer current knowledge to learning of new technologies.</li> </ol>

**\*Computer maintenance and trouble-shooting**

3. Trouble-shoots simple problems in software (e.g., re-boots, uses help systems)

**\*Computer maintenance and trouble-shooting**

4. Knows the common features and uses of databases (e.g., databases contain records of similar data, which is sorted or organized for ease of use; databases are used in both print form, such as telephone books, and electronic form, such as computerized card catalogs) **\*Spreadsheets/databases**
5. Uses database software to add, edit, and delete records, and to find information through simple sort or search techniques **\*Spreadsheets/databases**
6. Knows how formats differ among software applications (e.g., word processing files, database files) and hardware platforms (e.g., Macintosh, Windows) **\*Computer hardware \*Computer software**

Level III (Grades 6-8)

1. Uses advanced features and utilities of word processors (e.g., uses clip art, a spell-checker, grammar checker, thesaurus, outliner) **\*Word processing/desktop publishing**
2. Knows the common features and uses of desktop publishing software (e.g., documents are created, designed, and formatted for publication; data, graphics, and scanned images can be imported into a document using desktop software) **\*Word processing/desktop publishing**
3. Knows the common features and uses of spreadsheets (e.g., data is entered in cells identified by row and column; formulas can be used to update solutions automatically; spreadsheets are used in print form, such as look-up tables, and electronic form, such as to track business profit and loss) **\*Spreadsheets/databases**
4. Uses a spreadsheet to update, add, and delete data, and to write and execute valid formulas on data **\*Spreadsheets/databases**
5. Uses boolean searches to execute complex searches on a data base **\*Spreadsheets/databases**

Level IV (Grades 9-12)

1. Understands the uses of listservs, usenet newsreaders, and bulletin board systems **\*Computer networks/Internet**
2. Knows how to import, export, and merge data stored in different formats (e.g., text, graphics) **\*Spreadsheets/databases \*Word processing/desktop publishing**
3. Knows how to import and export text, data, and graphics between software programs **\*Spreadsheets/databases \*Word processing/desktop publishing**
4. Identifies some advanced features of software products (e.g., galleries, templates, macros, mail merge) **\*Computer software**

<p>5. Uses desktop publishing software to create a variety of publications <b>*Word processing/desktop publishing</b></p>	
<p><b>Standard 3. Understands the relationships among science, technology, society, and the individual</b></p>	
<p>Level Pre-K (Grades Pre-K)</p> <p>1. Uses tools (e.g., hammer, fax, email, telephone) that help humans do work and solve problems <b>*Uses of technology</b></p>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b>  Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p> <ol style="list-style-type: none"> <li>identify and define authentic problems and significant questions for investigation.</li> <li>plan and manage activities to develop a solution or complete a project.</li> <li>collect and analyze data to identify solutions and/or make informed decisions.</li> <li>use multiple processes and diverse perspectives to explore alternative solutions.</li> </ol>
<p>Level I (Grades K-2)</p> <p>1. Knows ways that technology is used at home and at school (e.g., paging systems, telephones, VCRs) <b>*Technology in society</b></p>	<p><b>6. Technology Operations and Concepts</b> Students demonstrate a sound understanding of technology concepts, systems, and operations. Students:</p> <ol style="list-style-type: none"> <li>understand and use technology systems.</li> <li>select and use applications effectively and productively.</li> <li>troubleshoot systems and applications.</li> <li>transfer current knowledge to learning of new technologies.</li> </ol>
<p>2. Knows that new tools and ways of doing things affect all aspects of life, and may have positive or negative effects on other people <b>*Impact of Technology</b></p> <p>3. Understands that when an individual creates something on a computer, the created work is that person's property, and only that person has the right to change it <b>*Ethics, the law and technology</b></p> <p>4. Knows that man-made materials, products, and systems can affect the environment adversely, yet there are things that can be done to circumvent this process (e.g., disposing of waste properly, reusing old objects in new designs) <b>*Impact of Technology</b></p> <p>Level II (Grades 3-5)</p>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>advocate and practice safe, legal, and responsible use of information and technology.</li> <li>exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>demonstrate personal responsibility for lifelong</li> </ol>

<ol style="list-style-type: none"> <li>1. Knows that technologies often have costs as well as benefits and can have an enormous effect on people and other living things <b>*Impact of Technology</b></li> <li>2. Knows areas in which technology has improved human lives (e.g., transportation, communication, nutrition, sanitation, health care, entertainment) <b>*Impact of Technology</b> <b>*Uses of technology</b></li> <li>3. Knows that new inventions often lead to other new inventions and ways of doing things <b>*Invention And Innovation</b></li> <li>4. Knows that new inventions reflect people's needs and wants, and when these change, technology changes to reflect the new needs and wants <b>*Invention And Innovation</b></li> <li>5. Understands the concept of software piracy (i.e., illegally copying software), and that piracy is a violation of copyright laws <b>*Ethics, the law and technology</b></li> <li>6. Understands that technology may affect the environment both negatively and positively (e.g., a mass transit system may both reduce the number of cars in an area, but also cause harm to wildlife in the area) <b>*Impact of Technology</b></li> </ol>	<p>learning.</p> <p>d. exhibit leadership for digital citizenship.</p>
<p>Level III (Grades 6-8)</p> <ol style="list-style-type: none"> <li>1. Knows that scientific inquiry and technological design have similarities and differences (e.g., scientists propose explanations for questions about the natural world that are always tentative and evolving, and engineers propose solutions relating to human problems, needs, and aspirations; both science and technology depend on accurate scientific information and they cannot contravene scientific laws)</li> <li>2. Knows that science cannot answer all questions and technology cannot solve all human problems or meet all human needs</li> </ol>	
<ol style="list-style-type: none"> <li>3. Knows ways in which technology has influenced the course of history (e.g., revolutions in agriculture, manufacturing, sanitation, medicine, warfare, transportation, information processing, communication) <b>*Impact of Technology</b></li> </ol>	<p><b>5. Digital Citizenship</b></p> <p>Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>a. advocate and practice safe, legal, and responsible use of information and technology.</li> <li>b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>c. demonstrate personal responsibility for lifelong learning.</li> <li>d. exhibit leadership for digital citizenship.</li> </ol>
<ol style="list-style-type: none"> <li>4. Knows that technology and science have a reciprocal relationship (e.g., technology drives science, as it provides the means to access outer space and remote locations,</li> </ol>	

<p>collect and treat samples, collect, measure, store, and compute data, and communicate information; science drives technology, as it provides principles for better instrumentation and techniques, and the means to address questions that demand more sophisticated instruments)</p>	
<p>5. Knows ways in which technology and society influence one another (e.g., new products and processes for society are developed through technology; technological changes are often accompanied by social, political, and economic changes; technology is influenced by social needs, attitudes, values, and limitations, and cultural backgrounds and beliefs)  <b>*Impact of Technology</b></p> <p>6. Knows examples of copyright violations and computer fraud (e.g., computer hacking, computer piracy, intentional virus setting, invasion of privacy) and possible penalties (e.g., large fines, jail sentences) <b>*Ethics, the law and technology</b></p> <p>7. Knows ways technology is used to protect the environment and prevent damage caused by nature (e.g., new building technologies protect cities from earthquakes, bacteria are used in cleaning water)  <b>*Impact of Technology *Uses of technology</b></p>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>advocate and practice safe, legal, and responsible use of information and technology.</li> <li>exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>demonstrate personal responsibility for lifelong learning.</li> <li>exhibit leadership for digital citizenship.</li> </ol>
<p>Level IV (Grades 9-12)</p> <p>1. Knows that science and technology are pursued for different purposes (e.g., scientific inquiry is driven by the desire to understand the natural world and seeks to answer questions that may or may not directly influence humans; technology is driven by the need to meet human needs and solve human problems)</p>	
<p>2. Knows ways in which social and economic forces influence which technologies will be developed and used (e.g., cultural and personal values, consumer acceptance, patent laws, availability of risk capital, the federal budget, local and national regulations, media attention, economic competition, tax incentives) <b>*Technological design and development</b></p> <p>3. Knows that alternatives, risks, costs, and benefits must be considered when deciding on proposals to introduce new technologies or to curtail existing ones (e.g., Are there alternative ways to achieve the same ends? Who benefits and who suffers? What are the financial and social costs and who bears them? How serious are the risks and who is in jeopardy? What resources will be needed and where will they come from?)  <b>*Impact of Technology *Technological design and development</b></p>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>advocate and practice safe, legal, and responsible use of information and technology.</li> <li>exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>demonstrate personal responsibility for lifelong learning.</li> <li>exhibit leadership for digital citizenship.</li> </ol>
<p>4. Knows that technological knowledge is often not made public because of patents and</p>	

<p>the financial potential of the idea or invention; scientific knowledge is made public through presentations at professional meetings and publications in scientific journals</p>	
<p>5. Knows examples of advanced and emerging technologies (e.g., virtual environment, personal digital assistants, voice recognition software) and how they could impact society <b>*Impact of Technology</b> <b>*Technological design and development</b></p> <p>6. Observes common courtesies and acceptable use policies while telecomputing <b>*Ethics, the law and technology</b></p>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>advocate and practice safe, legal, and responsible use of information and technology.</li> <li>exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>demonstrate personal responsibility for lifelong learning.</li> <li>exhibit leadership for digital citizenship.</li> </ol>
<p>7. Knows that mathematics, creativity, logic, and originality are all needed to improve technology <b>*Technological design and development</b></p> <p>8. Knows the role of technology in a variety of careers <b>*Technology in society</b></p> <p>9. Knows that the rate of technological development and diffusion is increasing rapidly, even though individual technologies may be developed at a slow pace due to technical difficulties or consumer resistance <b>*Technological design and development</b></p>	
<p>10. Knows that technology can benefit the environment by providing scientific information, providing new solutions to older problems, and reducing the negative consequences of existing technology (e.g., monitoring a habitat or measuring greenhouse gases, improving renewable energy sources, and creating scrubbers to improve coal-burning facilities) <b>*Impact of Technology</b></p>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>advocate and practice safe, legal, and responsible use of information and technology.</li> <li>exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>demonstrate personal responsibility for lifelong learning.</li> <li>exhibit leadership for digital citizenship.</li> </ol>
<p><b>Standard 4. Understands the nature of technological design</b></p> <p>Level Pre-K (Grades Pre-K)</p>	

<ol style="list-style-type: none"> <li>1. Knows that materials and equipment can be combined in different ways to make something new (e.g., building a tent using a sheet around a table, using molding clay to make pretend food)</li> <li>2. Knows ways to communicate design ideas (e.g., pictures, models)</li> <li>3. Knows that some things are natural and others are human made</li> </ol> <p>Level I (Grades K-2)</p> <ol style="list-style-type: none"> <li>1. Knows that both objects and systems occur in nature (e.g., stars and the solar system), but people can also design and make objects and systems (e.g., telephones and communication systems) to solve a problem and to improve the quality of life <b>*Uses of technology</b></li> <li>2. Knows that tools have specific functions, such as to observe, measure, make things, and do things better or more easily; selecting the right tool makes the task easier <b>*Uses of technology</b></li> <li>3. Knows that people are always inventing new ways to solve problems and accomplish work (e.g., a computer is a machine that helps people work and play) <b>*Invention And Innovation</b></li> <li>4. Knows that planning is an important part of the design process</li> <li>5. Knows that new objects can be created out of physical materials (e.g., paper, cloth)</li> <li>6. Knows that because there may be multiple solutions to a design problem, each appropriate to different situations, many creative ideas can be useful</li> </ol> <p>Level II (Grades 3-5)</p> <ol style="list-style-type: none"> <li>1. Categorizes items into groups of natural objects and designed objects</li> <li>2. Knows that group collaboration is useful as the combination of multiple creative minds can yield more possible design solutions</li> <li>3. Knows that the design process is a series of methodical steps for turning ideas into useful products and systems</li> </ol>	
<ol style="list-style-type: none"> <li>4. Identifies a simple problem that can be solved using technology <b>*Technological design and development *Uses of technology</b></li> <li>5. Knows constraints that must be considered when designing a solution to a problem (e.g., cost, materials, time, space, safety, scientific laws, engineering principles, construction techniques, appearance, environmental impact, what will happen if the solution fails)</li> <li>6. Uses appropriate tools, techniques, and quantitative measurements to implement proposed solutions</li> </ol>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b></p> <p>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p> <ol style="list-style-type: none"> <li>a. identify and define authentic problems and significant questions for investigation.</li> <li>b. plan and manage activities to develop a solution or complete a project.</li> <li>c. collect and analyze data to identify solutions and/or</li> </ol>

	<p>make informed decisions.</p> <p>d. use multiple processes and diverse perspectives to explore alternative solutions.</p>
<p>7. Evaluates a product or design (e.g., considers how well the product or design met the challenge to solve a problem; considers the ability of the product or design to meet constraints), and makes modifications based on results</p> <p>8. Knows that people have invented and used tools throughout history to solve problems and improve ways of doing things  <b>*Invention And Innovation *Uses of technology</b></p> <p>9. Knows that different technologies can often be combined (e.g., an escalator uses both pulleys and an electric motor)  <b>*Technological design and development *Uses of technology</b></p> <p>Level III (Grades 6-8)</p> <p>1. Knows that the design process is a slow, methodical process of test and refinement</p> <p>2. Knows that the design process relies on different strategies: creative brainstorming to establish many design solutions, evaluating the feasibility of various solutions in order to choose a design, and troubleshooting the selected design</p>	
<p>3. Identifies appropriate problems which can be solved using technological design (e.g., identifies a specific need, considers its various aspects, considers criteria for a suitable product) <b>*Technological design and development *Uses of technology</b></p> <p>4. Designs a solution or product, taking into account needs and constraints (e.g., cost, time, trade-offs, properties of materials, safety, aesthetics) <b>*Technological design and development</b></p> <p>5. Implements a proposed design (e.g., organizes materials and other resources, plans one's work, makes use of group collaboration when appropriate, chooses suitable tools and techniques, works with appropriate measurement methods to ensure accuracy)</p>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b></p> <p>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p> <p>a. identify and define authentic problems and significant questions for investigation.</p> <p>b. plan and manage activities to develop a solution or complete a project.</p> <p>c. collect and analyze data to identify solutions and/or make informed decisions.</p> <p>d. use multiple processes and diverse perspectives to explore alternative solutions.</p>
<p>6. Evaluates the ability of a technological design to meet criteria established in the original purpose (e.g., considers factors that might affect acceptability and suitability for intended users or beneficiaries; develop measures of quality with respect to these factors), suggests improvements, and tries proposed modifications</p> <p>7. Understands that nonphysical objects (e.g., software) and physical objects (e.g., a</p>	

<p>telephone) are both subject to the design process <b>*Invention And Innovation</b></p> <p>8. Knows that invention is the process of creating a new system or object out of an idea while innovation is the process of modifying an existing system or object to improve it (e.g., the specialization of function of a subsystem)</p> <p>Level IV (Grades 9-12)</p> <p>1. Knows that an optimal solution to a design problem is more likely to be found when the process followed is systematic and repetitive</p>	
<p>2. Proposes designs and uses models, simulations, and other tests to choose an optimal solution</p> <p>3. Implements a proposed solution (e.g., constructs artifacts for intended users or beneficiaries)</p>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b></p> <p>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p> <ul style="list-style-type: none"> <li>a. identify and define authentic problems and significant questions for investigation.</li> <li>b. plan and manage activities to develop a solution or complete a project.</li> <li>c. collect and analyze data to identify solutions and/or make informed decisions.</li> <li>d. use multiple processes and diverse perspectives to explore alternative solutions.</li> </ul>
<p>4. Evaluates a designed solution and its consequences based on the needs or criteria the solution was designed to meet</p> <p>5. Knows that since there is no such thing as a perfect design, trade-offs of one criterion for another must occur to find an optimized solution</p> <p>6. Knows that a design involves different design factors (e.g., ergonomics, maintenance and repair, environmental concerns) and design principles (e.g., flexibility, proportion, function)</p>	
<p><b>Standard 5. Understands the nature and operation of systems</b></p> <p>Level Pre-K (Grades Pre-K)</p> <p>1. Not appropriate for this level</p> <p>Level I (Grades K-2)</p> <p>1. Knows that most things are made of parts and they may not work if some parts are missing</p>	

<ul style="list-style-type: none"> <li>2. Knows that when parts are put together, they can do things that they couldn't do by themselves <b>*Interaction of system components</b></li> <li>3. Understands how some elements of simple systems work together (e.g., people in a restaurant, parts of a bicycle) <b>*Interaction of system components</b></li> <li>4. Creates and tests a simple linear system (e.g., a production line process for making sandwiches)</li> </ul> <p>Level II (Grades 3-5)</p> <ul style="list-style-type: none"> <li>1. Knows that when things are made up of many parts, the parts usually affect one another <b>*Interaction of system components</b></li> <li>2. Knows that things that are made of parts may not work well if a part is missing, broken, worn out, mismatched, or misconnected</li> <li>3. Understands the relationships between elements (i.e., components, such as people or parts) in systems <b>*Interaction of system components</b></li> </ul>	
<ul style="list-style-type: none"> <li>4. Assembles, disassembles, and tests systems (e.g., in logo programming, using paper and pencil designs)</li> </ul>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b></p> <p>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p> <ul style="list-style-type: none"> <li>a. identify and define authentic problems and significant questions for investigation.</li> <li>b. plan and manage activities to develop a solution or complete a project.</li> <li>c. collect and analyze data to identify solutions and/or make informed decisions.</li> <li>d. use multiple processes and diverse perspectives to explore alternative solutions.</li> </ul>
<p>Level III (Grades 6-8)</p> <ul style="list-style-type: none"> <li>1. Knows that a system can include processes as well as components</li> <li>2. Knows how part of a system can provide feedback when its output (in the form of material, energy, or information) becomes input for another part of the system</li> <li>3. Identifies the elements, structure, sequence, operation, and control of systems</li> </ul>	
<ul style="list-style-type: none"> <li>4. Assembles and disassembles systems to manage, control, and improve their performance (e.g., a computer program, a simple machine based on a pulley mechanism)</li> </ul>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b></p> <p>Students use critical thinking skills to plan and conduct</p>

	<p>research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p> <ol style="list-style-type: none"> <li>a. identify and define authentic problems and significant questions for investigation.</li> <li>b. plan and manage activities to develop a solution or complete a project.</li> <li>c. collect and analyze data to identify solutions and/or make informed decisions.</li> <li>d. use multiple processes and diverse perspectives to explore alternative solutions.</li> </ol>
<ol style="list-style-type: none"> <li>5. Knows that systems are usually linked to other systems, both internally and externally, and can contain subsystems as well as operate as subsystems</li> <li>6. Knows that an open-loop system (e.g., a microwave as a heating system) has no feedback and requires human intervention, where a closed-loop system (e.g., a household heating system with a thermostat) uses feedback</li> </ol> <p>Level IV (Grades 9-12)</p> <ol style="list-style-type: none"> <li>1. Knows that a system usually has some properties that are different from those of its parts, but appear because of the interaction of those parts <b>*Interaction of system components</b></li> <li>2. Knows that understanding how things work and designing solutions to problems of almost any kind can be facilitated by systems thinking, which employs mathematical modeling and simulation</li> <li>3. Knows that in defining a system, it is important to specify its boundaries and subsystems, indicate its relation to other systems, and identify what its input and its output are expected to be</li> <li>4. Knows how feedback can be used to help monitor, control, and stabilize the operation of a system</li> <li>5. Knows that even in simple systems, accurate prediction of the effect of changing some part of the system is not always possible <b>*Interaction of system components</b></li> </ol>	
<ol style="list-style-type: none"> <li>6. Constructs and operates systems (e.g., organizes and adjusts subsystems)</li> </ol>	<p><b>4. Critical Thinking, Problem Solving, and Decision Making</b></p> <p>Students use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources. Students:</p>

	<ul style="list-style-type: none"> <li>a. identify and define authentic problems and significant questions for investigation.</li> <li>b. plan and manage activities to develop a solution or complete a project.</li> <li>c. collect and analyze data to identify solutions and/or make informed decisions.</li> <li>d. use multiple processes and diverse perspectives to explore alternative solutions.</li> </ul>
<ul style="list-style-type: none"> <li>7. Knows that complex systems are subject to failure and are designed with various elements and procedures (e.g., performance testing, overdesign, redundancy, more controls) that help reduce system failure</li> <li>8. Knows that systems are embedded within larger systems, including technological, social, and environmental systems</li> </ul>	
<p><b>Standard 6. Understands the nature and uses of different forms of technology</b></p>	
<p>Level Pre-K (Grades Pre-K)</p> <ul style="list-style-type: none"> <li>1. Knows different materials (e.g., glass, metal, plastic, wood) and their uses</li> <li>2. Knows that for certain purposes some materials work better than others</li> </ul>	
<p>Level I (Grades K-2)</p> <ul style="list-style-type: none"> <li>1. Knows that technology is used in medicine to prevent and cure disease (e.g., through vaccinations and medications)</li> <li>2. Knows that technology is used to improve what humans get from crops by reducing the amount of work needed, keeping food fresh, and moving it long distances to where people need it</li> <li>3. Knows that energy comes from different sources (e.g., electricity, gas, water) and is used in many common objects (e.g., a stove, some toys)</li> </ul>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ul style="list-style-type: none"> <li>e. advocate and practice safe, legal, and responsible use of information and technology.</li> <li>f. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>g. demonstrate personal responsibility for lifelong learning.</li> <li>h. exhibit leadership for digital citizenship.</li> </ul>
<ul style="list-style-type: none"> <li>4. Knows that communication technology allows people to exchange and find information quickly, cheaply, and reliably over a distance <b>*Communications Systems</b></li> </ul>	<p><b>2. Communication and Collaboration</b>  Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:</p> <ul style="list-style-type: none"> <li>a. interact, collaborate, and publish with peers,</li> </ul>

	<p>experts, or others employing a variety of digital environments and media.</p> <ol style="list-style-type: none"> <li>b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.</li> <li>c. develop cultural understanding and global awareness by engaging with learners of other cultures.</li> <li>d. contribute to project teams to produce original works or solve problems.</li> </ol>
<ol style="list-style-type: none"> <li>5. Knows that a transportation system is tailored to a society's needs and consists of rules (e.g., which side of the road to drive on) and components (e.g., vehicles and the surface upon which they move)</li> <li>6. Knows that manufacturing technology first creates a complete and detailed design of a product and then produces this product in quantity</li> <li>7. Knows that there are different types of structures (e.g., house, airport, highway) and each one requires different materials and parts</li> </ol>	
<p>Level II (Grades 3-5)</p> <ol style="list-style-type: none"> <li>1. Knows that medical technology is used to provide information about a patient's body (e.g., measuring blood glucose levels) and to repair, replace, and support parts of the body</li> <li>2. Knows that elements of an agricultural system are designed to maximize the interaction and production of all the elements in the system (e.g., by composting, using plants for food, oxygen, and water and air filtration)</li> <li>3. Knows that different types of energy (e.g., solar, fossil fuels) have different advantages and disadvantages (e.g., solar energy is a cleaner source of energy than fossil fuels, but currently is more expensive), and that regardless of the source of energy, the technological design should attempt to maximize the use of it</li> </ol> <p><b>*Technological design and development</b></p>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>a. advocate and practice safe, legal, and responsible use of information and technology.</li> <li>b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>c. demonstrate personal responsibility for lifelong learning.</li> <li>d. exhibit leadership for digital citizenship.</li> </ol>
<ol style="list-style-type: none"> <li>4. Knows that technology facilitates better communication by providing storage and retrieval of large amounts of data, an easy means of accessing data, a means of processing and displaying data, and faster communication among individuals</li> </ol> <p><b>*Communications Systems</b></p>	<p><b>2. Communication and Collaboration</b>  Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:</p> <ol style="list-style-type: none"> <li>a. interact, collaborate, and publish with peers,</li> </ol>

	<p>experts, or others employing a variety of digital environments and media.</p> <ul style="list-style-type: none"> <li>b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.</li> <li>c. develop cultural understanding and global awareness by engaging with learners of other cultures.</li> <li>d. contribute to project teams to produce original works or solve problems.</li> </ul>
<ul style="list-style-type: none"> <li>5. Knows that transportation systems affect society (e.g., where people live) and are affected by society and nature (e.g., activists may request more public transit, a severe thunderstorm may cause flights to be canceled)</li> <li>6. Knows that manufacturing processes include designing the product, gathering natural and/or synthetic resources, and final production</li> <li>7. Knows that construction technology requires building materials, specialized tools and machines, money, time, energy, land, and human work and that the final structures are subject to local building codes</li> <li>8. Knows that buildings require several subsystems (e.g., a phone system, heating) and these subsystems may be associated with other types of technology (e.g., communications, energy) <b>*Interaction of system components</b></li> </ul>	
<p>Level III (Grades 6-8)</p> <ul style="list-style-type: none"> <li>1. Understands ways in which medical technology improves the quality of health care (e.g., advanced diagnosing equipment, increased hospital sanitation)</li> <li>2. Knows ways in which biotechnology results in benefits for humans, including more convenience, less labor, improved health and medicine, and improved food</li> <li>3. Knows that most technological systems require an input of energy, which is an important consideration both in designing an object or a system and in conserving energy (e.g., so many things require energy that alternative sources to fossil fuels should be used when possible)</li> </ul>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ul style="list-style-type: none"> <li>a. advocate and practice safe, legal, and responsible use of information and technology.</li> <li>b. exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>c. demonstrate personal responsibility for lifelong learning.</li> <li>d. exhibit leadership for digital citizenship.</li> </ul>
<ul style="list-style-type: none"> <li>4. Knows the components of a communication system (i.e., a source, encoder, transmitter, receiver, decoder, and destination) <b>*Communications Systems</b></li> </ul>	<p><b>2. Communication and Collaboration</b>  Students use digital media and environments to communicate and work collaboratively, including at a</p>

	<p>distance, to support individual learning and contribute to the learning of others. Students:</p> <ol style="list-style-type: none"> <li>interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.</li> <li>communicate information and ideas effectively to multiple audiences using a variety of media and formats.</li> <li>develop cultural understanding and global awareness by engaging with learners of other cultures.</li> <li>contribute to project teams to produce original works or solve problems.</li> </ol>
<ol style="list-style-type: none"> <li>Knows that individual transportation vehicles contain several subsystems (e.g., structural, propulsion, control)</li> <li>Knows that manufacturing processes use hand tools, human-operated machines, and automated machines to separate, form, combine, and condition natural and synthetic materials; these changes may either be physical or chemical</li> <li>Knows that construction design is influenced by factors such as building laws and codes, style, convenience, cost, climate, and function</li> </ol>	
<p>Level IV (Grades 9-12)</p> <ol style="list-style-type: none"> <li>Knows that genetic engineering is the process by which controlled changes in a genetic structure can be made and that this process is used to research and diagnose disease and create pharmaceuticals</li> <li>Knows that biotechnology is used in a variety of areas (e.g., agriculture, pharmaceuticals, food and beverage, fuels and energy, the environment, genetic engineering) and requires specific scientific knowledge about the natural system being modified</li> </ol>	<p><b>5. Digital Citizenship</b>  Students understand human, cultural, and societal issues related to technology and practice legal and ethical behavior. Students:</p> <ol style="list-style-type: none"> <li>advocate and practice safe, legal, and responsible use of information and technology.</li> <li>exhibit a positive attitude toward using technology that supports collaboration, learning, and productivity.</li> <li>demonstrate personal responsibility for lifelong learning.</li> <li>exhibit leadership for digital citizenship.</li> </ol>
<ol style="list-style-type: none"> <li>Understands scientific principles of energy, work, and power in relation to technological design (e.g., the Second Law of Thermodynamics means that a system cannot be designed which is 100% efficient) <b>*Technological design and development</b></li> </ol>	

<p>4. Knows that power systems (i.e., systems which convert energy from one form to another) have a source of energy, a process, loads, and some have a feedback system</p>	
<p>5. Knows that communication systems can transfer information from person to person (e.g., a telephone), person to machine (e.g., a person inputting information into a computer), or machine to machine (e.g., an automated payroll system where the record of the money goes from one computer to another) *<b>Communications Systems</b></p>	<p><b>2. Communication and Collaboration</b>  Students use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others. Students:</p> <ul style="list-style-type: none"> <li>a. interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.</li> <li>b. communicate information and ideas effectively to multiple audiences using a variety of media and formats.</li> <li>c. develop cultural understanding and global awareness by engaging with learners of other cultures.</li> <li>d. contribute to project teams to produce original works or solve problems.</li> </ul>
<p>6. Knows that modern transportation systems are diverse (allowing humans to combine types of transportation for the most direct and convenient route), intelligent (requiring coordinated subsystems, such as a traffic light system), and are necessary in the functioning of most other technologies</p> <p>7. Knows that there are different types of manufacturing systems (customized, batch, and continuous production) and manufacturing results in two different types of goods, durable and non-durable</p> <p>8. Knows different requirements for structural design (e.g., strength, maintenance, appearance) and that these structures require maintenance</p>	