



# Ohio

Ohio's Model Curriculum for Computer Science

**Grade 2**

**ADOPTED SEPT. 2022**

Strand	Computing Systems	
Topic		Devices
<p><b>CS.D.2.a</b> Select and operate commonly used devices to perform a variety of tasks.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students began operating devices independently. In grade 2, students begin selecting devices with a purpose in mind. In grade 3, students will develop an understanding that the device they selected for a specific task has components that all play a role in the computer system. The data is entered into an external device and is then placed into the computer system where it can be shared locally and globally.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Different devices can be used to perform specific tasks.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Choose between devices that can perform specific tasks.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students will use their knowledge of hardware and software from kindergarten and grade 1 to make a selection to complete a task.</p> <p><b>CONTENT FOCUS</b> The focus is on the student making a selection (i.e., device, software, hardware) to complete a task.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 1. Fostering an Inclusive Computing Culture</i></p> <ol style="list-style-type: none"> <li>2. Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability.</li> </ol> <p><i>Practice 2. Collaborating Around Computing</i></p> <ol style="list-style-type: none"> <li>4. Evaluate and select technological tools that can be used to collaborate on a project.</li> </ol> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>2. Identify and fix errors using a systematic process.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>	

Strand	Computing Systems	
Topic	Hardware and Software	
<p><b>CS.HS.2.a</b> Select and use hardware and software necessary for accomplishing a task.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b>            In grade 1, students began comparing hardware and software and their functions with guidance. In grade 2, students begin selecting devices with a purpose in mind. In grade 3, students will select learning tools or devices to plan, implement and reflect upon tasks.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Select hardware and software to perform a specific task.</li> <li>• Hardware and software interact to work together.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Identify hardware and software interactions.</li> <li>• Select hardware and/or software to perform a specific task.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b>            Students will select hardware and software with a specific purpose in mind.</p> <p><b>CONTENT FOCUS</b>            The focus is on the selection of a tool to complete a specific task.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 1. Fostering an Inclusive Computing Culture</i></p> <ol style="list-style-type: none"> <li>2. Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability.</li> </ol> <p><i>Practice 2. Collaborating Around Computing</i></p> <ol style="list-style-type: none"> <li>4. Evaluate and select technological tools that can be used to collaborate on a project.</li> </ol> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>2. Identify and fix errors using a systematic process.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>	

Strand	Computing Systems	
Topic Troubleshooting		
<p><b>CS.T.2.a</b> Use problem-solving strategies to troubleshoot a problem.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, with guidance, and in grade 2, students continue using a problem-solving process to troubleshoot. In grade 3, students will begin to move beyond trial and error to apply more strategic troubleshooting techniques to fix their problems.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• There are a variety of problem-solving processes. A problem-solving process typically includes identifying the problem, brainstorming solutions, <i>making a plan, testing solutions and revising.</i></li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Apply a problem-solving process, using appropriate terminology to solve a problem.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students will identify problems (e.g., left- or right-click, no audio, no power, navigating windows) and attempt to solve them using a problem-solving process.</p> <p><b>CONTENT FOCUS</b> The focus is on solving a problem using a problem-solving process.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>1. Systematically test computational artifacts by considering all scenarios and using test cases.</li> <li>2. Identify and fix errors using a systematic process.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>	

Strand	Networks and the Internet	
Topic	Networking	
<p><b>NI.N.2.a</b> Describe how information can be communicated electronically to gain a deeper understanding of how information is transmitted (e.g., email, social media).</p> <p><b>NI.N.2.b</b> Use computing devices that are connected to share and receive information from the global community.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b>            In grade 1, students began to develop an understanding of concepts of networking and unique identifiers within a global community. Students also began to develop an understanding of what devices people use to network and how each device people network with has a unique identifier. In addition, students recognized that computing devices with unique identifiers can be connected to access and retrieve information. In grade 2, students can describe what a network is, the devices we use to network, how devices can be identified, and how they can be connected. Additionally, students can network using devices to access and retrieve information within a global community. In grade 3, students will explore how information is sent and received over the internet. Students will continue to build an understanding of how information is shared, received and stored.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Users of the internet communicate with a global community.</li> <li>• All devices that are connected to the network have a unique identifier.</li> <li>• A variety of information can be communicated electronically.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Interact with the global community.</li> <li>• Create and use communications that are transmitted electronically.</li> <li>• Match devices with unique identifiers.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b>            Students will communicate and retrieve information. They will identify the devices we use to communicate.</p> <p>The internet is global. Each device has a unique identifier. This is not limited to IP addresses. A person's phone number can serve as a metaphor for a unique identifier. For example, two people can exchange information using their phones providing they call or connect to the correct phone number.</p> <p><b>CONTENT FOCUS</b>            The focus is on understanding and using networks, unique identifiers and electronic communication.</p>	

Strand	Networks and the Internet
Topic	Networking
	<p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 1. Fostering an Inclusive Culture</i></p> <ol style="list-style-type: none"><li>1. Include the unique perspectives of others and reflect on one's perspectives when designing and developing computational products.</li></ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"><li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li></ol>

Strand	Networks and the Internet
Topic	Cybersecurity
<p><b>NI.C.2.a</b> Explain and demonstrate secure practices (e.g., creating strong passwords) to protect private information.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In kindergarten through grade 2, students work to explain why it is important to use technology in a responsible way to make decisions about its use. Students also work to demonstrate how to use technology appropriately and safely and how to protect login information. In grade 3, students will identify personal information and how passwords are used to protect that information.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Use technology in decision-making.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Create and use passwords appropriately.</li> <li>• Log in and out of apps and devices.</li> <li>• Explain and demonstrate secure practices.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students need to be able to apply the skills below to demonstrate understanding of the content statement.</p> <ul style="list-style-type: none"> <li>• Protecting their password</li> <li>• Making strong passwords</li> <li>• Logging in and out of apps and devices</li> <li>• Being responsible</li> <li>• Discussing impacts of poorly secured information</li> </ul> <p><b>CONTENT FOCUS</b> The focus is on using passwords and devices appropriately and explaining the importance of secure practices.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 7. Communicating About Computing</i> 3. Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.</p>

Strand	Networks and the Internet
Topic Internet of Things	
<p><b>NI.IOT.2.a</b> With guidance and support, will explain how devices connect and exchange data over different environments to explore how information is shared.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b>            In grade 1, students began developing an understanding of smart devices. In grade 2 they explain how devices connect and exchange data. Additionally, they will explore different network connectivity. In grade 3, students will describe information transmission and explore and explain the difference between smart and intelligent devices.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Some networks are public and some are private.</li> <li>• Public networks are less secure than private networks.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Explain the difference between common types of network connections (such as the school Wi-Fi vs. home Wi-Fi) and which is more secure.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b>            Information can be shared via public or private internet connections, such as home, school or library.</p> <p><b>CONTENT FOCUS</b>            Public internet connections are less secure than private internet connections.</p> <p><b>COMPUTER SCIENCE PRACTICES</b>  <i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>



Strand	Data and Analysis	
Topic		
<p><b>DA.DCS.2.a</b> Collect and organize data to store, retrieve and modify.</p> <p><b>DA.DCS.2.b</b> Manipulate data to perform various tasks.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students began storing and retrieving data with guidance. In grade 2, students begin to retrieve data to modify. In grade 3, students will use different software tools to access data and store it in different locations. In grade 3, students will collect, record and maintain data, over time, using various tools, such as a thermometer, ruler, scale and surveys.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Data is information. When using technology, data is often quantities, characters or symbols that are the inputs and outputs of computer programs.</li> <li>• Data can be organized, collected, stored and retrieved in a variety of ways.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Use appropriate tools to organize data.</li> <li>• Use appropriate tools to collect data.</li> <li>• Store, retrieve and save data.</li> <li>• Edit, revise and rename data.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students can address this content with or without a computing device.</p> <p>A structured set of data can be used to help students learn the skills of retrieving and organizing data.</p> <p><b>CONTENT FOCUS</b> The focus is on modifying retrieved data.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 4.</i> Developing and Using Abstractions 2. Evaluate existing technological functionalities and incorporate them into new designs.</p>	

Strand	Data and Analysis
Topic Visualization and Communication	
<p><b>DA.VC.2.a</b> Organize, analyze and present data in various formats.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1 students will make observations of representations of data. In grade 2, they will continue to analyze data in various formats. In grade 3, students will extend their knowledge by creating scaled pictures and bar graphs. They will also create line plots using scales that include whole numbers and fractions (e.g., halves and fourths).</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Data can be sorted by attributes.</li> <li>• Data can be presented in a variety of formats.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Collect, organize and analyze data for peer understanding.</li> <li>• Describe and sort data by different attributes to create multiple representations of the same data sets.</li> <li>• Transfer data between grids to lists.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students can address this content with or without a computing device.</p> <p>Various formats can include:</p> <ul style="list-style-type: none"> <li>• concept maps,</li> <li>• Venn diagrams,</li> <li>• categorical sort,</li> <li>• modeling,</li> <li>• drawings and</li> <li>• sorting by different attributes.</li> </ul> <p>Students can analyze data by looking at the data of two mammals, for example. What traits do they have in common? What traits are different?</p> <p><b>CONTENT FOCUS</b> The focus is on the analysis of representations of data.</p>
	<p><b>COMPUTER SCIENCE PRACTICES</b></p>

Strand	Data and Analysis
Topic	Visualization and Communication
	<p><i>Practice 5. Creating Computational Artifacts</i></p> <ol style="list-style-type: none"><li>1. Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, considering key features, time and resource constraints and user experience.</li><li>2. Create a computational artifact for practical intent, personal expression or to address a societal issue.</li><li>3. Modify an existing artifact to improve or customize it.</li></ol> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"><li>1. Systematically test computational artifacts by considering all scenarios and using test cases.</li></ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"><li>1. Select, organize and interpret large data sets from multiple sources to support a claim.</li><li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li></ol>

Strand	Data and Analysis
Topic Inference and Modeling	
<p><b>DA.IM.2.a</b> Interpret and analyze data, graphs, models or charts.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b>            In grade 1, students continued to model data and identify patterns and began explaining their model. In grade 2, students begin interpreting models. In grade 3, students will analyze and explain relationships or patterns and predict an unknown.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Data can be represented through modeling.</li> <li>• Patterns within the data can be discovered, explained and interpreted.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Model data to discover and identify patterns.</li> <li>• Explain the model and patterns discovered.</li> <li>• Interpret the meaning of the patterns discovered.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b>            Students can address this content with or without a computing device.</p> <p>Students model data through representation data visually; although, not necessarily using paper and pencil as in graphs. Data can be modeled using manipulatives and physical models.</p> <p><b>CONTENT FOCUS</b>            The focus is on the interpretation and analysis of the model.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 5. Creating Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>1. Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, considering key features, time and resource constraints and user experience.</li> <li>2. Create a computational artifact for practical intent, personal expression or to address a societal issue.</li> <li>3. Modify an existing artifact to improve or customize it.</li> </ol>
	<p><i>Practice 6. Testing and Refining Computational Artifacts</i></p>

Strand	Data and Analysis
Topic	Inference and Modeling
	<ol style="list-style-type: none"><li>1. Systematically test computational artifacts by considering all scenarios and using test cases.</li></ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"><li>1. Select, organize and interpret large data sets from multiple sources to support a claim.</li><li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li></ol>

Strand	Algorithmic Thinking and Programming
Topic	Algorithms
<p><b>ATP.A.2.a</b> Model a real-world process by constructing and following step-by-step instructions (i.e., algorithms) to complete tasks.</p>	<p><b>Expectations for Learning</b></p> <p>In grade 1, students constructed and followed directions through pictures and written words with guidance. In grade 2, students construct and follow directions in a real-world context through written words, statements and visual symbols. In grade 3, students will create step-by-step tasks (i.e., algorithms) and find errors within an algorithm.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Step by step directions can be constructed to complete a real-world task.</li> <li>• Directions can be given verbally or visually.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Construct and complete a verbal and/or visual task with multiple steps.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b></p> <p>Students identify a task from their daily life (e.g., brushing teeth, getting ready for school, walking home from school) and break it into a sequence of steps (i.e., algorithm). Students should construct a sequence of steps to complete a task using precise language and visuals/symbols, to see the effects of a sequence. Students should compare sequences for the same task, to identify similarities and differences within the sequence. Algorithms are commonly implemented using a precise language that computers can interpret.</p> <p><b>CONTENT FOCUS</b></p> <p>The focus is on the construction of multi-step directions and the sequence of steps to complete a task.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 4. Developing and Using Abstractions</i></p> <ol style="list-style-type: none"> <li>4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.</li> </ol> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>2. Identify and fix errors using a systematic process.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>

Strand	Algorithmic Thinking and Programming
Topic	Variables and Data Representation
<p><b>ATP.VDR.2.a</b> Construct a model that shows the way programs store and manipulate data by using numbers or other symbols to represent information.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students used numbers, symbols and pictures to represent information. In grade 2, students model the use of numbers, symbols and pictures to manipulate and store information. In grade 3, students will define and identify variables to understand how they are used in algorithms.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Numbers, symbols or pictures can be used to model programming.</li> <li>• Information is stored in a variety of ways.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Model programming using symbols, numbers or pictures.</li> <li>• Store information in a variety of ways.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Information in the real world can be represented in computer programs. (K-12 Computer Science Framework, 2016)</p> <p>Computers use stored information by choosing only relevant information.</p> <p><b>CONTENT FOCUS</b> The focus is on modeling the way programs store and manipulate data.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 4. Developing and Using Abstractions</i></p> <ol style="list-style-type: none"> <li>4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.</li> </ol> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>2. Identify and fix errors using a systematic process.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>

Strand	Algorithmic Thinking and Programming
Topic	Control Structures
<p><b>ATP.CS.2.a</b> Develop a program that uses sequencing and repetition (i.e., loops) to solve a problem or express ideas.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, with guidance, students modeled loops in their sequence of steps or programs to show repetition. In grade 2, students create a program that utilizes sequencing and loops. In grade 3, students will build on their skills and knowledge to create programs with more refined strategies, such as loops and conditionals, and consider the components of an event.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Programs are made of algorithms and loops.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Create a program utilizing algorithms and loops.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students can address this content with or without a computing device. Students create, or construct a program. Loops are repeated sequences.</p> <p><b>CONTENT FOCUS</b> The focus is on using sequencing, process, loops and problem solving to create an algorithm (i.e., program).</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 5. Creating a Computational Artifact</i></p> <ol style="list-style-type: none"> <li>1. Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, considering key features, time and resource constraints and user expectations.</li> <li>2. Create a computational artifact for practical intent, personal expression or to address a societal issue.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>



Strand	Algorithmic Thinking and Programming	
Topic	Modularity	
<p><b>ATP.M.2.a</b> Break down (i.e., decompose) a series of steps and separate the necessary from the unnecessary steps to create a precise sequence of instructions to solve a problem or express an idea.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students determined what information is necessary to complete a sequence or process with guidance. In grade 2, students determine what information is necessary to complete a more complex sequence or process. In grade 3, students will decompose abstractions into sequences to design algorithms.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Decomposition is to break down a series of steps.</li> <li>• Abstraction is to use the relevant information.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Decompose a problem into a series of steps.</li> <li>• Abstract information relevant to the problem being solved.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students can address this content with or without a computing device. Students will work with a more complex sequence of more than three steps. Abstraction is to determine which information is relevant or irrelevant to the problem. Decomposition is taking a problem and breaking it into steps.</p> <p><b>CONTENT FOCUS</b> The focus is on decomposing and the abstraction of information in a sequence of instructions to solve a problem.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 3. Recognizing and Defining Computational Problems</i> 2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures.</p>	

Strand	Algorithmic Thinking and Programming
Topic	Program Development
<p><b>ATP.PD.2.a</b> Plan and create an artifact to illustrate thoughts, ideas and problems in a sequential (step-by-step) manner (e.g., story map, storyboard, sequential graphic organizer).</p> <p><b>ATP.PD.2.b</b> Identify and fix (i.e., debug) a multi-step process that includes sequencing.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, with guidance, students continued to plan and create, as well as began to debug an artifact to illustrate thoughts, ideas, and problems in a sequential manner. In grade 2, students continue to plan, create or fix an artifact to illustrate thoughts, ideas and problems sequentially. In grade 3, students will use these skills to design and create programs to solve a problem. In grade 3, guided questions will be asked to help students think more strategically about how to solve a problem in their program</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Artifacts illustrate thoughts, ideas and problems in a sequential manner.</li> <li>• When creating artifacts, it is important to review your artifact for errors.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Plan and create an artifact to illustrate thoughts, ideas and problems sequentially.</li> <li>• Evaluate an artifact for errors.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> An artifact is anything created by a human. An artifact could be a visual program, story map, storyboard or sequential graphic organizer. Debug is defined as "to identify and fix."</p> <p><b>CONTENT FOCUS</b> The focus is on creating and debugging artifacts and programs.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 5. Creating a Computational Artifact</i></p> <ol style="list-style-type: none"> <li>1. Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, considering key features, time and resource constraints and user expectations.</li> <li>2. Create a computational artifact for practical intent, personal expression, or to address a societal issue.</li> </ol> <p><i>Practice 6. Testing and Refining Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>2. Identify and fix errors using a systematic process.</li> </ol>
	<p><i>Practice 7. Communicating About Computing</i></p>

<b>Strand</b>	<b>Algorithmic Thinking and Programming</b>
<b>Topic</b>	<b>Program Development</b>
	2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

Strand	Artificial Intelligence	
Topic	Machine Learning	
<p><b>AI.ML.2.a</b> Use a classifier that recognizes drawings and discuss how the program knows what they are drawing.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b>            In grade 1, students discuss how machine learning uses classifiers to recognize drawings. In grade 2, students use a classifier that recognizes drawings and discuss how the program knows what they are drawing. In grade 3, students will be introduced to specific forms of machine learning.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Define and understand the uses of classifiers.</li> <li>• Discuss how Artificial Intelligence (AI) can recognize various drawings as a form of machine learning.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Apply the use of AI in a classifier to gain knowledge of how machine learning works.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b>            AI can recognize human inputs through the use of classifiers.</p> <p><b>CONTENT FOCUS</b>            AI uses machine learning to learn new things.</p> <p><b>COMPUTER SCIENCE PRACTICES</b>  <i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>1. Select, organize and interpret large data sets from multiple sources to support a claim.</li> </ol>	

Strand	Artificial Intelligence	
Topic	Natural Interactions	
<p><b>AI.NI.2.a</b> List possible attributions computers can use to distinguish humans from each other by comparing these attributions.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students used recognition software and describe attributes of the software used. In grade 2, students list possible attributions computers can use to distinguish humans from each other. In grade 3, students identify tasks Artificial Intelligence (AI) does that humans used to do.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>List and discuss attributes that can be used to identify individuals.</li> <li>Explore variations in attributions.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>List attributions AI might use to describe how computers recognize human faces from each other.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Exploring attributions and changes in them such as faces and expressions.</p> <p><b>CONTENT FOCUS</b> The focus of the content is on how computers can recognize humans even if humans change their expressions.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 4. Developing and Using Abstractions</i></p> <ol style="list-style-type: none"> <li>Extract common features from a set of interrelated processes or complex phenomena.</li> </ol>	

Strand	Artificial Intelligence	
Topic	Perception	
<p><b>AI.P.2.a</b> Tell where sensors are on computers, robots and intelligent appliances to relate their location with their function such as motion, pressure/touch, temperature, proximity, light, sound, moisture or gases.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students will recognize various sensors and their functions. In grade 2, students tell where sensors are on computers and intelligent appliances. In grade 3, students will understand the difference in sensor inputs.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Computers use specific sensors in specific places to gather data.</li> <li>• Each type of sensor captures specific information such as motion, pressure/touch, temperature, proximity, light, sound, moisture or gases.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Tell where the sensors are and why they are placed there.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students will discover why sensors are placed where they are. For example, accelerometer sensors are placed in smartphones that can track steps.</p> <p><b>CONTENT FOCUS</b> Sensors are needed for computers to gather information and then use that data to give or process information.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 3.</i> Recognizing and Defining Computational Problems</p>	

Strand	Artificial Intelligence	
Topic	Perception	
<p><b>AI.P.2.b</b> Apply the use of intelligent agents to assist in basic research (look up answers to specific questions).</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students used intelligent agents to answer simple questions. In grade 2, apply the use of intelligent agents to assist in basic research. In grade 3, they will begin to see that there are limitations to intelligent agents.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>Intelligent agents are a form of Artificial Intelligence (AI).</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>Use intelligent agents to assist in research.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Examples of intelligent agents are virtual assistant technology that can play music, provide information, deliver news, control smart homes and give other information.</p> <p><b>CONTENT FOCUS</b> Students can use an intelligent agent to help them do simple research that can be used to report back to the class.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 4. Developing and Using Abstractions</i></p> <ol style="list-style-type: none"> <li>Identify complex, interdisciplinary, real-world problems that can be solved computationally.</li> </ol>	

Strand	Artificial Intelligence
Topic	Representation & Reasoning
<p><b>AI.RR.2.a</b> With guidance and support, create a simple decision tree (conditionals) to create a pathway for decisions.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students used simple decision trees. In grade 2, students create a simple decision tree with guidance and support. In grade 3, students will create a decision tree to help them understand how computers "think."</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• With guidance and support, create decision trees.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Demonstrate the creation of a decision tree to find a logical solution to a problem.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Decision trees are a way of organizing information.</p> <p><b>CONTENT FOCUS</b> Students can draw a tree by repeatedly splitting each branch into sub-branches multiple times and putting a piece of data at each branch.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 5. Creating Computational Artifacts</i></p> <ol style="list-style-type: none"> <li>1. Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, considering key features, time and resource constraints and user expectations.</li> </ol>



Strand	Artificial Intelligence	
Topic	Societal Impacts	
<p><b>AI.SI.2.a</b> To determine how AI can help in daily life, group applications used into two categories: "AI" and "Not AI."</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students identified Artificial Intelligence (AI) applications in their daily life. In grade 2, students group applications used as AI or not AI to determine how AI can help in daily life. In grade 3, students will discuss how AI can be inclusive.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>AI devices are used to help everyone have equal access to technology.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>Identify the use of AI in daily life and show how it can help everyone have equal access to technology.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Some of the different ways humans can access technology include speech, typing, motion and thought.</p> <p><b>CONTENT FOCUS</b> Not everyone accesses technology the same way. AI can help everyone access technology equally.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 4. Developing and Using Abstractions</i></p> <ol style="list-style-type: none"> <li>Extract common features from a set of interrelated processes or complex phenomena.</li> </ol>	

Strand	Artificial Intelligence	
Topic	Societal Impacts	
<p><b>AI.SI.2.b</b> Discuss AI and how it can be used for good or bad to discuss the ethical use of AI.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students discussed if computers and/or technology are good or bad. In grade 2, students discuss Artificial Intelligence (AI) and how it can be used for good or bad. In grade 3, students are introduced to the concept of bias.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Technology can help or harm us depending on how we interact with AI and its data sets.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Demonstrate the use of a data set to show that AI's use data sets.</li> <li>• Data sets can be incorrect and may make our life better or worse.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Technology has faults. For example, facial recognition, various skin colors and accents may or may not be recognizable.</p> <p><b>CONTENT FOCUS</b> AI uses data sets to learn more about its surroundings and those data sets can be incomplete.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 3. Recognizing and Defining Computational Problems</i></p> <ol style="list-style-type: none"> <li>1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.</li> </ol>	

Strand	Impacts of Computing
Topic	Culture
<p><b>IC.Cu.2.a</b> Compare and contrast how the use of technology has changed to understand its impact on everyday life.</p> <p><b>IC.Cu.2.b</b> Describe the ways people use technologies in their daily work and personal lives to understand technology's impact on one's community.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, students recognized the different ways technology impacts and the role technology plays in their lives. In grade 2, students compare and contrast how technology use has changed and the impact it has on their lives positively and negatively. In grade 3, students will identify the impact technology has on everyday life in the local community. Students will identify diverse user needs and how computing devices have features built in to increase accessibility to all users.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Technology is always changing. These changes affect our communities and the role it plays in our lives.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Describe the changes in technology and how we interact with technology over time.</li> <li>• Demonstrate how humans adapt technology to serve their needs.</li> <li>• Demonstrate how technology can have negative consequences.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students can identify and explain the connections between their lives and technology and how technology affects their lives.</p> <p><b>CONTENT FOCUS</b> The focus is on how technology has changed and the impact on students' lives.</p> <p><b>COMPUTER SCIENCE PRACTICES</b> <i>Practice 1. Fostering an Inclusive Computing Culture</i></p> <ol style="list-style-type: none"> <li>1. Include the unique perspectives of others and reflect on one's perspectives when designing and developing computational products.</li> <li>2. Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability.</li> </ol>

Strand	Impacts of Computing
Topic	Culture
	<p><i>Practice 2. Collaborating Around Computing</i></p> <ol style="list-style-type: none"><li>1. Cultivate working relationships with individuals possessing diverse perspectives, skills and personalities.</li></ol> <p><i>Practice 3. Recognizing and Defining Computational Problems</i></p> <ol style="list-style-type: none"><li>1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.</li></ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"><li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li></ol>

Strand	Impacts of Computing
Topic	Social Interactions
<p><b>IC.SI.2.a</b> Compare and contrast safe and responsible behaviors to those that are not when using information and technology.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, with guidance, students were able to explain safe and responsible behaviors associated with using information and technology while working with others online. In grade 2, students should be able to compare and contrast safe and responsible technology behaviors. In grade 3, students will apply a code of conduct to use technology safely and responsibly within an online community. In grade 3, students will collaborate through feedback and reflection to improve a digital artifact and begin to explore how diverse perspectives improve a digital product.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>Schools develop their own technology rules, regulations and etiquette.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>Create rules based on the school technology rules, regulations and etiquette on how to use technology.</li> <li>Apply created rules within the classroom and during students' use of technology.</li> <li>Identify inappropriate actions and the consequences.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Etiquette topics might include cyberbullying, school policy, and safe privacy practices.</p> <p><b>CONTENT FOCUS</b> The focus is on the responsible use of technology in and out of the classroom.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 1. Fostering an Inclusive Computing Culture</i></p> <ol style="list-style-type: none"> <li>Include the unique perspectives of others and reflect on one's perspectives when designing and developing computational products.</li> <li>Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>

Strand	Impacts of Computing
Topic Safety, Law and Ethics	
<p><b>IC.SLE.2.a</b> Discuss appropriate and ethical uses of technology to guide informed decisions.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In grade 1, with guidance, students continued to identify and explain basic security practices that should be applied when using the internet. In grade 2, in concert with cybersecurity activities, students can recognize weak security practices, implement secure practices to protect private information to ensure security is not compromised and explain why it is important to apply these measures. In grade 3, the focus will continue to focus on security, while also giving students more explanations regarding why it is important to keep information secure. Information security and the concept of a digital footprint will be introduced in grade 3.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>Guidelines and practices to stay safe on the internet should be discussed and practiced.</li> <li>Awareness of what private information is, what should and should not be shared and the potential consequences of sharing private information.</li> </ul> <p><b>KEY SKILL/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>Identify practices to stay safe on the internet; Provide examples of situations where these practices should be applied and describe different consequences that may result from not using safe practices.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Provide students guidelines for safe navigation of the internet. Provide students opportunities to practice these guidelines by using teacher-selected internet sites.  Provide students guidelines on what constitutes personal information and the consequences of misuse. Provide them guidelines on how to create strong passwords.  Students have the opportunity to apply security practices as part of their activities addressing cybersecurity (NI.C.2.a)</p> <p><b>CONTENT FOCUS</b> The focus is to keep students safe when using the internet.</p>

## COMPUTER SCIENCE PRACTICES

Strand	Impacts of Computing
Topic	Safety, Law and Ethics
	<p><i>Practice 1. Fostering an Inclusive Computing Culture</i></p> <ol style="list-style-type: none"> <li>1. Include the unique perspectives of others and reflect on one's perspectives when designing and developing computational products.</li> <li>2. Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability.</li> </ol> <p><i>Practice 2. Collaborating Around Computing</i></p> <ol style="list-style-type: none"> <li>1. Cultivate working relationships with individuals possessing diverse perspectives, skills and personalities.</li> </ol> <p><i>Practice 7. Communicating About Computing</i></p> <ol style="list-style-type: none"> <li>2. Describe, justify and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.</li> </ol>
<p><b>IC.SLE.2.b</b> Compare and contrast appropriate and inappropriate behavior online, including cyberbullying, and the steps to keep yourself and others safe and out of harm's way.</p>	<p><b>Expectations for Learning</b></p> <p><b>LEARNING PROGRESSION</b> In kindergarten through second grade, student discussions should focus on examples of what to do when someone is acting inappropriately online and what behavior should be modeled when online.</p> <p><b>IMPORTANT CONCEPTS</b></p> <ul style="list-style-type: none"> <li>• Students know whom to contact if they experience inappropriate behavior while online.</li> <li>• Students know what steps to take when they experience inappropriate behavior online.</li> </ul> <p><b>KEY SKILLS/PROCEDURES</b></p> <ul style="list-style-type: none"> <li>• Recognize when students should report observed inappropriate online behavior to those in authority.</li> <li>• Understand and discuss ways to keep yourself and others safe online.</li> </ul> <p><b>Content Elaborations</b></p> <p><b>CLARIFICATIONS</b> Students need to make good choices when they interact with others online. They also need to understand that in addition to interacting with others, it is important that they use websites and other apps as they were intended.</p> <p>Some online behavior is illegal, and students could be held responsible for their actions online.</p>
	<b>CONTENT FOCUS</b>

Strand	Impacts of Computing
Topic	Safety, Law and Ethics
	<p>Students should understand the appropriate and inappropriate behavior to use when operating online. Students should also know who to talk to if they feel threatened or report inappropriate behavior.</p> <p><b>COMPUTER SCIENCE PRACTICES</b></p> <p><i>Practice 1. Fostering an Inclusive Computing Culture</i></p> <ol style="list-style-type: none"><li>2. Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability.</li><li>3. Employ self and peer advocacy to address bias in interactions, product design and development methods.</li></ol>