Ohio’s Standards and Model Curriculum

Computer Science Grade 5

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Ohio | Department of Education

Computer Science Model Curriculum for Grade 5

Strand	Computing Systems
Topic	**Devices**

CS.D.5.a Explore the internal parts of the computing system and their function to understand and describe the role they play in a computer system.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students developed their understanding of what external components are used to share information. In grade 5, students develop their understanding of the internal parts of the computer and how they play a role in the computer system. In grade 6, students will apply knowledge to identify the benefits and limitations of devices.

IMPORTANT CONCEPTS

- Different internal parts of a computer have different purposes
- Each internal component has a different function in a computer system

KEY SKILL/PROCEDURES

- Identify key internal components (i.e., parts) such as RAM, hard drive, CPU, motherboard, etc.
- Describe the function of each of the key internal components
- Describe the internal components of the selected device

Content Elaborations

CLARIFICATIONS

Internal components (i.e., parts) at this grade level focus upon RAM, hard drive, CPU and the motherboard. Students do not need to have an in-depth understanding of these.

CONTENT FOCUS

The focus should be upon students understanding the role major internal components (i.e., parts) play in a computing system. Unlike external components which are not all needed in order for a device to function, internal components are critical to the device running properly.

COMPUTER SCIENCE PRACTICES

Practice 2. Collaborating Around Computing

4. Evaluate and select technological tools that can be used to collaborate on a project.

Strand	Computing Systems
Topic	**Hardware/Software**

CS.HS.5.a Evaluate digital learning tools/devices to support planning, implementing and reflecting across curricular areas.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students continued to select learning tools/devices and used them to aid in planning, implementing, and reflecting on given tasks. In grade 5, students use and evaluate the digital learning tools and devices they've chosen and consider the planning, implementing, and reflecting across curricular areas. In grade 6, students will look at the ways hardware and software components come together in a computer system to complete a task.

IMPORTANT CONCEPTS

- Software and hardware need to be chosen and evaluated to ensure they support the task
- Learning tools should be used for planning, implementing, and reflecting across curricular areas

KEY SKILL/PROCEDURES

- Verbally evaluate the tools and devices chosen to accomplish tasks for their usefulness in planning, implementing, and reflecting
- Use and verbally evaluate tools across curricular areas

Content Elaborations

CLARIFICATIONS

Students should recognize if the tool or device they have chosen is appropriate for the task. For example, if the assignment is to make a presentation, a word processing program would not be the best selection. Tasks should be cross-curricular (i.e. blending math, science, and computer science, tasks which require an analysis of data from science or social studies).

CONTENT FOCUS

The focus is on students using and evaluating tools in cross-curricular tasks.

COMPUTER SCIENCE PRACTICES

Practice 2. Collaborating Around Computing

4. Evaluate and select technological tools that can be used to collaborate on a project.

Strand	Computing Systems
Topic	**Troubleshooting**

CS.T.5.a Diagnose problems and develop strategies to resolve technology issues.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students focused on diagnosing and describing potential hardware and software problems. In grade 5, students work to diagnose problems, describe the problem, and develop strategies to resolve technology issues. In grade 6, the problems will become more advanced. It will require the combination of critical thinking skills and basic knowledge of computing hardware and software to identify the problem.

IMPORTANT CONCEPTS

- Multiple troubleshooting strategies exist for each issue

KEY SKILL/PROCEDURES

- Diagnose problems in hardware and software
- Apply a solution for the problem
- Describe the problem and reason for the problem in detail

Content Elaborations

CLARIFICATIONS

Students are working on diagnosing problems, describing them and applying a solution where appropriate. Students should be able to describe the problem to a peer or adult.
Students should be able to troubleshoot their own problems. Problems may include an unplugged computer, a computer not connecting to the network or a program not loading. Troubleshooting should also occur within individual programs, such as a block-based coding environment or a word processing program.

CONTENT FOCUS

The focus is on students diagnosing problems, describing them, and applying a potential fix.

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts
2. Identify and fix errors using a systematic process.

Strand	Networks and the Internet
Topic	**Networking**

NI.N.5.a Model how information is broken down to be transmitted and then reassembled to help students gain a better understanding of the internet and networks.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students described how information is broken apart, sent, and received over the internet. In grade 5, students demonstrate how information is broken apart, sent and reassembled when received over the internet. In grade 6, students will explore the protocols (i.e., rules) in transmitting data across the internet.

IMPORTANT CONCEPTS

- Manipulating a URL (i.e., web address) can change what information is accessed
- Information is broken into packets (i.e., parts) at the sending point and reassembled at the receiving point
- Information is sent to specific places based on web addresses

KEY SKILL/PROCEDURES

- Modify a URL (i.e., web address) to access content
- Demonstrate what occurs when a URL is modified
- Use a metaphorical example to describe how information is broken down into parts and reassembled

Content Elaborations

CLARIFICATIONS

Students begin manipulating a URL to access desired information within a site.
Students begin using applications to shorten web addresses for ease of access.
An example of a metaphorical connection students could make to describe how information is transmitted would be a roller coaster ride. The track could be seen as the internet connection and the cars and the people are the information traveling through the connection.

CONTENT FOCUS

The focus is on students modifying a URL, or web address, to reach a specific site and describing how the modification impacts the information accessed. Students model how information is transmitted.

Strand	Networks and the Internet
Topic	**Networking**
	COMPUTER SCIENCE PRACTICES *Practice 4.* Developing and Using Abstractions 4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Strand	Networks and the Internet
Topic	**Networking**

NI.N.5.b Apply knowledge of network addresses, names and rules (i.e., protocols) to discuss real-world scenarios.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students described how different naming techniques are related to the type of information accessed. In grade 5, students apply this knowledge by interacting with networks appropriately and apply these concepts to real-world scenarios. In grade 6, students will continue to apply this knowledge to more advanced concepts of networks.

IMPORTANT CONCEPTS

- Information is broken into parts and reassembled at the end point
- The end point is identified by an IP address

KEY SKILL/PROCEDURES

- Use knowledge of top level naming rules (.com, .edu, .gov) as it relates to reliability of information
- Explain the fundamental workings of the internet using appropriate terminology (e.g., packets, IP address)

Content Elaborations

CLARIFICATIONS

Students need to explain the steps required to transmit information over the internet.
Students should explain that information is broken into packets, transmitted to another place identified by an IP address and reassembled at the end site, similar to a puzzle being taken apart, given to other people, and assembled somewhere else.
Similar to a mailing address and a letter, the IP address serves as the location where information is sent.
No discussion of IP address components (i.e., parts) are needed at this level.

CONTENT FOCUS

The focus is on explaining the fundamental workings of the internet.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Strand	Networks and the Internet
Topic	**Cybersecurity**

NI.C.5.a Demonstrate password creation techniques to develop and use a strong password used on personal accounts.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students described personal information and how passwords are used to protect that information. In grade 5, students create, implement, and store secure passwords to protect personal information. In grade 6, students will understand the concerns that information needs to be protected.

IMPORTANT CONCEPTS

- Password creation techniques
- Apply personally created passwords to personal accounts
- Protection techniques of passwords for personal accounts

KEY SKILL/PROCEDURES

- Create secure passwords utilizing password creation techniques
- Build a strong password using password creation techniques
- Apply password protection techniques

Content Elaborations

CLARIFICATIONS

Explain alpha-numerics, symbols, and non-dictionary words.
Use alpha-numerics, symbols and non-dictionary words to build a secure password.
Students often misuse password storage techniques. They need to understand the difference of using an online password storage system, saving passwords on the computer, writing down passwords, or remembering them and the benefits of types of passwords and storage techniques.

CONTENT FOCUS

The focus is on students building strong, secure passwords using password creation techniques and protecting passwords using different protection techniques.

Strand	Networks and the Internet
Topic	**Cybersecurity**
	COMPUTER SCIENCE PRACTICES *Practice 3.* Recognizing and Defining Computational Problems 1. Identify complex, interdisciplinary, real-world problems that can be solved computationally. 3. Evaluate whether it is appropriate and feasible to solve a problem computationally.

Strand	Data and Analysis
Topic	**Data Collection and Storage**

DA.DCS.5.a Gather and organize multiple quantitative data elements using a tool to perform various tasks.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students built upon the use of tools from grade 3 to collect data from multiple sources within a singular topic over time. In grade 5, students begin to select appropriate tools to collect data from multiple sources within a singular topic over time. In grade 6, students will begin to evaluate the validity of data collection tools.

IMPORTANT CONCEPTS

- Keeping an organized record of data from multiple sources, over time, is critical to analyzing data
- Different tools are used to collect different types of data
- Tools impact the accuracy of data

KEY SKILL/PROCEDURES

- Select and use appropriate tools to collect and organize data
- Maintain accurate data from multiple sources, using multiple tools, within a singular topic over a period of time
- Collect data from multiple sources within a singular topic, by making repeated observations over time

Content Elaborations

CLARIFICATIONS

Tools that may be explored are digital thermometers, GPS sensors, calculators, scales, digital forms (survey tools), length measurement tools, a stopwatch, etc.
Data can be organized by using various digital and non-digital tables and charts. Digital organizational resources could include spreadsheets, online graphing programs, etc.
An example of collecting data from multiple sources within a singular topic could be collecting the height of students in three different classes, throughout the school year. Students should select the most appropriate tool for data collection. Students could choose between an online form, table, or simple document.

CONTENT FOCUS

The focus is on students selecting an appropriate data collection tool to improve the accuracy of data.

Strand	Data and Analysis
Topic	**Data Collection and Storage**
	COMPUTER SCIENCE PRACTICES *Practice 7.* Communicating About Computing 1. Select, organize, and interpret large data sets from multiple sources to support a claim.

Strand	Data and Analysis
Topic	**Data Collection and Storage**

DA.DCS.5.b Compare and contrast file formats to demonstrate the advantages and disadvantages of each.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students began to gain an understanding that different file types may require different storage. In grade 5, students discuss the advantages and disadvantages of different file types. In grade 6, students will make choices about their file formats in order to organize data.

IMPORTANT CONCEPTS

- Different file types can be different sizes
- Different file types have different purposes
- How data is stored impacts accessibility

KEY SKILL/PROCEDURES

- Store data as a specific file type
- Locate and retrieve data on a computing device (i.e. computer)
- Consider file size when sharing and saving data

Content Elaborations

CLARIFICATIONS

Examples of file types would be image (i.e., .jpg, .png, .gif .bmp), document (e.g., .doc, .docx, .pages, .txt), multi-media (e.g., .mov, mp4, .wmb) and presentation (e.g., .ppt, .pptx, .key). For example, when creating a presentation, use slides instead of a document.

Examples of data storage could include saving to a device, local network or the cloud. An example of file size impacting storage is the inability to download an app on a tablet due to lack of storage.

Accessibility refers to the ability to retrieve data. Students should understand that data saved to a device will not be accessible without that same device. Accessibility also refers to the ability to open file formats on different devices.

Information refers to data, which could include pictures, audio, video, and documents.

Strand	Data and Analysis
Topic	**Data Collection and Storage**
	CONTENT FOCUS The focus is different file types accomplish different tasks. There are pros and cons in using various file types. **COMPUTER SCIENCE PRACTICES** *Practice 7.* Communicating About Computing 1. Select, organize, and interpret large data sets from multiple sources to support a claim.

Strand	Data and Analysis
Topic	**Visualization and Communication**

DA.VC.5.a Organize and present collected data using visual or other types of representations to highlight relationships and support a claim.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students interpreted data in self-created graphs to present insights. In grade 5, students use graphs created to highlight and support a claim they have made. In grade 6, students will look for patterns and communicate relationships between data sets.

IMPORTANT CONCEPTS

- Data from a graph can be used to gain insights or solve a problem
- The way data is interpreted and highlighted from a graph can support or disprove a claim

KEY SKILL/PROCEDURES

- Record data, with several categories, on a scaled bar graph or picture graph
- Determine appropriate scale for data given
- Interpret and answer questions regarding data presented in a bar or picture graph
- Use a visual representation of data (e.g., picture/bar graph, line plot) to support a claim

Content Elaborations

CLARIFICATIONS

An important concept for students is to begin to understand is that a scale is chosen based on data available.
Students should begin understanding that data is used to solve problems. For example, if the majority of people report they do not recycle due to lack of recycling bins, we can conclude that providing recycling bins to people will increase recycling and improve the environment.

CONTENT FOCUS

The focus is on students using a representation of data they have created to support a claim they have made.

Strand	Data and Analysis
Topic	**Visualization and Communication**
	COMPUTER SCIENCE PRACTICES *Practice 7.* Communicating About Computing 1. Select, organize, and interpret large data sets from multiple sources to support a claim. 2. Describe justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

Strand	Data and Analysis
Topic	**Inference and Modeling**

DA.IM.5.a Utilize data to propose cause and effect relationships and predict outcomes.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students determined if adequate data had been collected and ran simulations to explore outcomes. In grade 5, students run simulations to test theories and make predictions about how larger data sets affect outcomes. In grade 6, students will validate or invalidate a prediction about a collection of data.

IMPORTANT CONCEPTS

- Sample size affects outcomes
- Trends can be found by analyzing data sets

KEY SKILL/PROCEDURES

- Use data to highlight or propose cause and effect relationships Predict outcomes using a data set
- Manipulate data and explain outcomes

Content Elaborations

CLARIFICATIONS

Students explain patterns in data and identify missing values. They begin to manipulate data and reflect on how the quantity of data affects outcomes. Students will use software tools, such as spreadsheets to manipulate the quantity of data and reflect on changes that occur.

CONTENT FOCUS

The focus is on students identifying patterns in data to find missing values. They predict outcomes to continue patterns. They manipulate the quantity of data and reflect on changes that occur.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

1. Extract common features from a set of interrelated processes or complex phenomena.

Strand	Algorithmic Thinking and Programming
Topic	**Algorithms**

ATP.A.5.a Evaluate a multi-step process to diagram the proper steps to solve a problem.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students refined an algorithm to accomplish a given task. In grade 5, students compare and refine algorithms with a focus on the end result. In grade 6, students will evaluate a multi-step process to diagram the proper steps to find the most efficient solution.

IMPORTANT CONCEPTS

- An algorithm is a series of steps to complete a process or task
- Once algorithms are created and written, they need to be tested and possibly revised based on the results
- Pseudocode and flowcharts can be used to create and modify an algorithm

KEY SKILL/PROCEDURES

- Utilize logical patterns of progression within an algorithm to modify and refine the algorithm to efficiently accomplish a given task
- Utilize pseudocode and flow charts to assist with communicating, creating and modifying an algorithm to accomplish a given task

Content Elaborations

CLARIFICATIONS

Students will utilize processes of computational thinking (i.e., logical thought) to sort through, identify errors, and modify algorithms. They will need to utilize communication techniques (i.e., pseudocode, flowcharts) in order to document the potential errors and solutions.

CONTENT FOCUS

The focus is on students determining the necessity of decomposition, abstraction, modification, and reassembly of the algorithm with an emphasis on the resulting algorithm. Students should utilize communication strategies to further refine their algorithm.

COMPUTER SCIENCE PRACTICES

Practice 3. Recognizing and Defining Computational Problems
2. Decompose real-world problems.

Strand	Algorithmic Thinking and Programming
Topic	Algorithms
Strand	Algorithmic Thinking and Programming
Topic	Variables and Data Representation

ATP.VDR.5.a Create a variable, a placeholder for storing a value, to understand how it is used in a multi-step process (i.e., algorithm).

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students expanded on defining and identifying variables. In grade 5, students create variables to store and modify data. In grade 6, students will identify unknown values that need to be represented by a variable within a multi-step process.

IMPORTANT CONCEPTS

- Variables are placeholders for values that can be used in an algorithm
- Data can be stored in the variable
- Variables can represent multiple pieces of information from multiple lines
- Coding language places the variable at the front of the algorithm

KEY SKILL/PROCEDURES

- Use logical variable representations (i.e., letter or symbol)
- Write or edit an algorithm that substitutes a variable for a value
- Edit the variable to show how it changes the algorithm's result
- Determine if a variable is needed within an algorithm

Content Elaborations

CLARIFICATIONS

Symbols such as letters are used in programming to hold values. Students need to learn that the syntax (i.e., the order of symbols in the equation) may impact the success of a program. Students can explore what happens when the data stored in a variable is changed.
For example, using a repetitive nursery rhyme (e.g., Five Little Monkeys), students can create a variable to change the number of monkeys. Here, the changing value is the number of monkeys.

Students are not expected to only use the formal terms of "variable" and "algorithm."

Strand	Algorithmic Thinking and Programming
Topic	**Algorithms**
	CONTENT FOCUS The focus is on students being able to define and identify variables as symbols such as letters and understand how they are used in algorithms to store data. Students should begin using variables within equations. Students should explore how variables store data and modify equations. **COMPUTER SCIENCE PRACTICES** *Practice 4.* Developing and Using Abstractions 1. Extract common features from a set of interrelated processes or complex phenomena.

Strand	Algorithmic Thinking and Programming
Topic	**Control Structures**

ATP.CS.5.a Create a program using sequences, events, loops and conditionals to solve a problem.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students refined their programming skills using established structures, such as loops and conditionals. In grade 5, students apply these new skills in increasingly complex ways and will continue to refine these to work towards programming efficiency. In grade 6, students will identify decisions and loops in programs to solve problems.

IMPORTANT CONCEPTS

- Loops are statements that repeat and make programming more efficient for the computer and the programmer
- Conditionals are typically in the form of "if/then" statements and enable the program to follow different paths
- Events are structures that programmers can use to explain how the program will react when the user interacts
- Proper sequencing of steps within the program ensures efficiency

KEY SKILL/PROCEDURES

- Insert a loop in a program in order to avoid typing a command several times
- Insert a conditional in a program in order to make the program more powerful by creating several paths (if/then or if/then/else)
- Create an event in the format "When (action), then (result) occurs"
- Diagram the flow of a program to demonstrate the sequence of its events and products
- Combine statements within other statements (nesting) to make compound statements

Content Elaborations

CLARIFICATIONS

Loops can occur in programming by having the robot or pen repeat a motion several times, such as going forward ten paces and then turning thirty degrees. In an algorithm, students can program to have a number added several times.

Strand	Algorithmic Thinking and Programming
Topic	**Control Structures**
	Conditionals occur in a program by inserting a command to complete when a condition is met. For instance, if a condition states "If n=5," when the value n=5 is achieved, then the program will execute the command given. Events can be thought of as an action as a result of an action. Such as, "When I click the mouse, the image rotates." Sequencing of events and commands is an important part of programming when creating a program from scratch or remixing an existing one. Students can diagram or describe the steps of a program using a flowchart or other graphic organizer. **CONTENT FOCUS** The focus is on using a loop to eliminate several redundant commands, using a conditional to add complexity to a program and to program efficiently, creating an event in the format "When (action), then (result) occurs," and diagraming or describing the flow of a program. The complexity of the loops, conditionals, events, and sequences continues to increase from the prior grade level. **COMPUTER SCIENCE PRACTICES** *Practice 4.* Developing and Using Abstractions 1. Extract common features from a set of interrelated processes or complex phenomena.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**

ATP.M.5.a Decompose (i.e., break down) the steps needed or not needed (i.e., abstraction) into precise sequences of instructions to design an algorithm.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students refined the decomposition, abstraction and algorithm creation process. In grade 5, students begin to use abstraction to further refine and design an algorithm. In grade 6, students will utilize decomposition, abstraction, modification and creation of an algorithm to accomplish a given task.

IMPORTANT CONCEPTS

- Modularity refers to components of a program that complete a procedure or task. Modules within a program may need to be evaluated, refined, and/or copied

KEY SKILL/PROCEDURES

- Regroup or redesign sets of a decomposed algorithm in order to modify the result of the algorithm in the most efficient manner possible
- Determine if the logic of an algorithm requires decomposition, abstraction, modification to efficiently accomplish a given task
- Utilize pseudocode and flow charts as related to the algorithm

Content Elaborations

CLARIFICATIONS

Processes of logical thought should include dissection of a whole to its parts. Solving smaller sections of a larger equation to determine its functionality toward the end goal. Ensure that sets of instructions include all needed parts to modify the result to reach the end goal. These instructions can be written in code, pseudocode, real language or flowcharts related to the language of the algorithm.

CONTENT FOCUS

The focus is on students utilizing processes of logical thought, decomposing the algorithm and abstracting, modifying, and reassembling it to accomplish a given task in the most efficient means possible. Students need to utilize communication strategies to document and reduce the algorithm to the most efficient result.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**
	COMPUTER SCIENCE PRACTICES *Practice 3.* Recognizing and Defining Computational Problems 2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures. *Practice 4.* Developing and Using Abstractions 3. Create modules and develop points of interaction that can apply to multiple situation and reduce complexity. *Practice 7.* Communicating about Computing 1. Select, organize and interpret large data sets from multiple sources to support a claim.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**

ATP.M.5.b With grade appropriate complexity, modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students modified and elaborated the portions of code used in their own programs. In grade 5, students use portions of code to develop something new based on a given problem. In grade 6, students will be able to identify the parts of the program they designed.

IMPORTANT CONCEPTS

- Smaller portions of code should be grouped together so the end result will complete a task. These small portions should accomplish a task from start to finish independently of any other sections of code. These sections of code can then be reused to create a new program to solve a problem

KEY SKILL/PROCEDURES

- Break down steps into repeatable chunks
- Use chunks to repeat steps to accomplish a given task
- Create a program using chunked code

Content Elaborations

CLARIFICATIONS

Chunks of code can be grouped together, named, and used as a module (method, class, function) to build a new or modified version of a program (i.e., grouping a set of code used accomplish the task of climbing stairs into a module that can be used anytime stairs need to be climbed).

CONTENT FOCUS

The focus is on students using chunks of code (i.e., modules), repeating, and reorganizing them to create a new program to solve a different problem.

COMPUTER SCIENCE PRACTICES

Practice 3. Recognizing and Defining Computational Problems

2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**
	Practice 4. Developing and Using Abstractions 3. Create modules and develop points of interaction that can apply to multiple situation and reduce complexity. *Practice 7.* Communicating about Computing 1. Select, organize and interpret large data sets from multiple sources to support a claim.

Strand	Algorithmic Thinking and Programming
Topic	**Program Development**

ATP.PD.5.a Use a design process to plan and develop a program that includes multiple steps and end user preferences.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students designed and created a program for a multi-step problem. In grade 5, students design and create a program that addresses a multi-step problem and the preferences of the end user. In grade 6, students will advance in designing and creating their own code-based program using block-based languages. Students may begin using text-based coding to program.

IMPORTANT CONCEPTS

- A flow chart is one type of organizational tool that can be used to plan a program considering the sequence of its features
- An algorithm can be used to build a program
- Programs can execute multiple steps
- The end user's preferences can be considered in the creation of a program

KEY SKILL/PROCEDURES

- Design a program that can solve a problem
- Use the design process when planning a program
- Create a program for a multi-step problem
- Incorporate the preferences of the end user into the program

Content Elaborations

CLARIFICATIONS

Programs can be designed in a plugged (i.e., using a computer) or unplugged environment (i.e., not using a computer).

Programs can be designed using a block-based environment.

Programs should address a multi-step problem.

A flow chart is a type of organizational tool that can be used to plan a program.

End user preferences are additional components included in the problem.

Strand	Algorithmic Thinking and Programming
Topic	**Program Development**
	CONTENT FOCUS The focus is on designing a program that can solve a problem with 3 or more steps and incorporating the preferences of the end user. **COMPUTER SCIENCE PRACTICES** *Practice 5.* Creating Computational Artifacts 1. Plan the development of a computational artifact using an iterative process that includes reflection on and modification of the plan, taking into account key features, time and resource constraints, and user expectations. 2. Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Strand	Algorithmic Thinking and Programming
Topic	**Program Development**

ATP.PD.5.b Using guided questions, work through a program to identify errors and discuss possible solutions to repair the program.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students continued with guided questions that assisted them in debugging their program. In grade 5, students become less dependent upon guided questions and begin to debug more complex programs. In grade 6, students will modify and fix their own errors in a block-based environment and will begin the debugging process in a text-based environment.

IMPORTANT CONCEPTS

- A computer bug is a series of commands that do not properly interact with each other and causes interruptions in the program execution (i.e., error in the program)
- To "debug" is to find the error within a program and then apply an appropriate fix

KEY SKILL/PROCEDURES

- Identify errors in a program
- Apply a fix to errors in a program

Content Elaborations

CLARIFICATIONS

If a program will not execute properly, programmers often refer to the issue as the program "breaks" or the program has a "bug" error. "Debugging" a program refers to scanning through the program code to find the error in the commands and then correcting or repairing that programming code.

Guided questions are questions that prompt the programmer to think more about their error and problem solve potential solutions without being given the answer.

CONTENT FOCUS

The focus is on locating errors in a block-based environment program and determining solutions and applying the fix.

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts
2. Identify and fix errors using a systematic process.

Strand	Impacts of Computing
Topic	**Culture**

IC.Cu.5.a Explain how computing technologies have changed the global community and express how those technologies influence and are influenced by cultural practices.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students recognized the impact of technology on the global community. In grade 5, students explain how technology has changed everyday life globally. In grade 6, students will develop a better understanding of how we connect to people around the world.

IMPORTANT CONCEPTS

- People within a region use technology in various ways
- Daily life is influenced by the technology within the community

KEY SKILL/PROCEDURES

- Identify specific types of technology used globally
- Describe ways that various technology resources impact daily life
- Compare and contrast the use of technology and the impacts it has on different communities

Content Elaborations

CLARIFICATIONS

New computing technology is created, and existing technologies are modified for many reasons, including to increase their benefits, decrease their risks, and meet societal needs. Students explore topics that relate to the history of technology and the changes in the world due to technology. Topics could be based on current news content, such as robotics, wireless internet, mobile computing devices, GPS systems, wearable computing, or ways social media has influenced social and political changes. (CSTA K-12 Computer Science Standards, 2017)

Students should begin to realize that the effects of technology on their community or region are not necessarily the same as the effects on other communities or regions. For example, one community may be experiencing the effects of having clean energy (e.g., solar power, wind power), whereas another community may not have the same experience.

CONTENT FOCUS

The focus is on the history and influence of technology in the world.

Strand	Impacts of Computing	
Topic	**Culture**	
		COMPUTER SCIENCE PRACTICES *Practice 1.* Fostering an Inclusive Computing Culture 1. Include the unique perspective of others and reflect on one's own perspectives when designing and developing computational products.

Strand	Impacts of Computing
Topic	**Culture**

IC.Cu.5.b Develop, test and refine digital artifacts to improve accessibility and usability.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students identified and anticipated diverse needs and ways to improve devices to make them more accessible to users. In grade 5, students are modifying artifacts to meet diverse user needs to increase accessibility. In grade 6, students will identify issues of bias and accessibility in the design of existing technologies to address equality and equity in society.

IMPORTANT CONCEPTS

- Users have diverse needs that impact accessibility
- Computing devices have built-in features to increase accessibility for all users
- Artifacts can be modified to increase accessibility for diverse users

KEY SKILL/PROCEDURES

- Locate and use built-in features to increase accessibility
- Identify the diverse needs of users
- Modify artifacts to meet diverse needs and to increase accessibility

Content Elaborations

CLARIFICATIONS

Students may consider using both speech and text when they wish to convey information in a game. They may also wish to vary the types of programs they create, knowing that not everyone shares their own tastes. (CSTA K-12 Computer Science Standards, 2017)

CONTENT FOCUS

The focus is on the diverse needs of users, the impact needs have on accessibility, and the modification of artifacts to improve accessibility.

COMPUTER SCIENCE PRACTICES

Practice 1 Fostering an Inclusive Computing Culture

2. Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability.

Strand	Impacts of Computing
Topic	**Social Interactions**

IC.SI.5.a Collaborate and consider diverse perspectives to improve digital artifacts.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students collaborated with others to share the workload, increase diverse perspectives, and improve the artifact. In grade 5, students collaborate with others outside of the classroom to share the workload, increase diverse perspectives, and improve the artifact. In grade 6, students will analyze and present beneficial and harmful effects of communicating using technology. They will begin to examine their impacts on the global, economic, political, business and cultural interactions.

IMPORTANT CONCEPTS

- Collaborating with peers to include diverse perspectives can improve digital artifacts
- Reflecting on feedback from others can improve digital artifacts
- Providing feedback to others can help them improve the quality of their work
- Collaborating with others outside of the classroom can provide a different cultural aspect
- People use technology to work together remotely (i.e., different building, city, state, country)

KEY SKILL/PROCEDURES

- Leave thoughtful feedback for peers that will help improve their digital artifacts
- Reflect on feedback from peers to improve digital artifacts
- Collaborate with others digitally (i.e., different building, city, state, country), to improve an artifact

Content Elaborations

CLARIFICATIONS

Seeking feedback from people from diverse backgrounds and geographical areas can provide insights for improving a project.

Students can collaborate digitally through various means, such as online video chats, docs, and surveys/forms, and social networking sites.

Strand	Impacts of Computing
Topic	**Social Interactions**
	CONTENT FOCUS The focus is on collaborating digitally with people from diverse backgrounds and geographic areas. **COMPUTER SCIENCE PRACTICES** *Practice 2.* Collaborating Around Computing 1. Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities. 2. Create team norms expectation and equitable workloads to increase efficiency and effectives 3. Solicit and incorporate feedback from and provide constructive feedback to team members and other stakeholders. 4. Evaluate and select technological tools that can be used to collaborate on a project.

Strand	Impact of Computing
Topic	**Safety, Law and Ethics**

IC.SLE.5.a Use public domain or Creative Commons media, and refrain from copying or using material created by others without permission.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students were introduced to more formal terminology used when evaluating the sharing of resources. Students identified the type of source and give credit to the source. In grade 5, students apply proper procedures when giving credit to a source. In grade 6, students will be exposed to a broader range of resources that must be given proper credit.

IMPORTANT CONCEPTS

- Certain resources can be shared freely; some resources can be shared with proper citation and others can only be shared with permission from the creator
- Sources must be cited formally to give credit for the use of materials
- Citations should consider copyright, Creative Commons, fair use, open source, etc.

KEY SKILL/PROCEDURES

- Determine whether a source can or cannot be used freely
- Use proper format to cite online sources

Content Elaborations

CLARIFICATIONS

Ethical complications arise from the opportunities provided by computing. The ease of sending and receiving copies of media on the internet (e.g., video, photos, music) creates the opportunity for unauthorized use, such as online piracy, and disregard of copyrights. Students should consider the licenses on computational artifacts that they wish to use. For example, the license on a downloaded image or audio file may have restrictions that prohibit modification, require attribution, or prohibit use entirely. (CSTA K-12 Computer Science Standards, 2017)

CONTENT FOCUS

The focus is on recognizing that some resources are public domain and can be used freely and other materials needs to be cited properly.

Strand	Impact of Computing	
Topic	**Safety, Law and Ethics**	
		COMPUTER SCIENCE PRACTICES *Practice 7.* Communicating about Computing 3. Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution.

Strand	Impacts of Computing
Topic	**Safety, Law and Ethics**

IC.SLE.5.b Communicate the effects of sharing personal information on the safety of student identity to determine how to protect students.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students started to make distinctions between what information should be shared and what information should be kept private. In grade 5, students consider the effects of sharing private information. In grade 6, students should evaluate shareable information in a more broad context relating to society.

IMPORTANT CONCEPTS

- For safety and security, personal information should be kept private
- Sharing personal information could have a positive or negative effect on a person

KEY SKILL/PROCEDURES

- Determine whether information should or should not be shared digitally
- Recognize that keeping information private protects your identity
- Recognize consequences of sharing too much personal information online as well as the consequences of sharing others' information
- Protect the identity of others by protecting their personal information

Content Elaborations

CLARIFICATIONS

Examples of information to be kept private are first and last name, birthday, addresses, phone number, or other personal identifiers.
Students should also understand that they should not share the personal information of others.

CONTENT FOCUS

The focus is on understanding and identifying the consequences of sharing personal information online.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

2. Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.

Strand	Impacts of Computing
Topic	**Safety, Law and Ethics**

IC.SLE.5.c Evaluate the need to keep personal information secure and protect the digital footprint.

Expectations for Learning

LEARNING PROGRESSION

In grade 4, students considered how their current online behavior affects their digital footprint. In grade 5, students expand on the subject by further examining their online behaviors and how they affect others. In grade 6, students will describe tradeoffs between allowing information to be public and keeping information private and secure to inform decision making. In addition, they will consider the effect of third parties on their personal information.

IMPORTANT CONCEPTS

- When information is not shared properly, it can become an issue of ethics, safety and security and have an impact on your digital footprint
- Ongoing evaluation of one's digital footprint is important

KEY SKILL/PROCEDURES

- List examples of what would be included in your digital footprint and evaluate the security of what is already a part of your footprint

Content Elaborations

CLARIFICATIONS

Students should evaluate their personal digital footprint and consider the security of their online behavior. If needed, students should take steps to secure online information.
Students should be able to evaluate the security of personal information shared online. For instance, it might be safe to share only a first name, whereas sharing a first name, last name, and birthdate would not be secure or safe.

CONTENT FOCUS

The focus is on making personal connections to online security and social media privacy. Students should evaluate their online and social media activity.

Strand	Impacts of Computing	
Topic	**Safety, Law and Ethics**	
		COMPUTER SCIENCE PRACTICES Practice 7. Communicating about Computing 2. Describe, justify, and document computational processes and solutions using appropriate terminology consistent with the intended audience and purpose.