Ohio’s Model Curriculum for Computer Science

Grade 6

ADOPTED SEPT. 2022

Ohio | Department of Education

Strand	Computing Systems
Topic	**Devices**

CS.D.6.a Identify the benefits and limitations of a given computing device's functions (including individual components) to explain how the functions and components work together to create the computing system.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students learned about the internal components of a computer. By the end of 6th grade, students apply that knowledge to identify the benefits and limitations of devices. In future grades, students will evaluate devices dependent on personal needs.

IMPORTANT CONCEPTS

- There are benefits to the functionality of major hardware and software components of a system.
- Understand how changes in these components will benefit or limit the device.

KEY SKILL/PROCEDURES

- Explain the limitations and benefits of devices.
- Explain the functionality of a component of a system (hardware/software) and describe its benefits or limitations.

Content Elaborations

CLARIFICATIONS

Students will be able to take a particular device and know what it can or cannot do. For example, connecting a device to Wi-Fi, printing from a device and how much memory a file will take up.

CONTENT FOCUS

Students can determine which computing devices can be used for a particular task or to make everyday life easier.

COMPUTER SCIENCE PRACTICES

Practice 1. Fostering an Inclusive Computing Culture

3. Employ self- and peer advocacy to address bias in interactions, product design and development methods

Strand	Computing Systems
Topic	**Hardware/Software**

CS.HS.6.a Identify ways that hardware and software work together as a system to collect and exchange data.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students evaluated the digital learning tools and devices they had chosen across curricular areas. By the end of 6th grade, students look at the ways the hardware and software components come together to collect and exchange data. In future grades, students will evaluate hardware and software components to accomplish a task.

IMPORTANT CONCEPTS

- Identify functionalities of major hardware and software components of a system.
- Know a basic flow and order of how the data moves through the components.

KEY SKILL/PROCEDURES

- Evaluate input devices and software to determine which combination(s) will produce a proper outcome based on a request.
- Identify how the data is input, processed and output.

Content Elaborations

CLARIFICATIONS

Consider multiple components, such as functionality, cost, size, speed, accessibility and aesthetics, to select the appropriate hardware or software for a given task. Understand how data moves from input to output in a system.

CONTENT FOCUS

Students can determine computing devices and software that should be used to create a product and understand how the data flows through the system.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

2. Evaluate existing technological functionalities and incorporate them into new designs.

Strand	Computing Systems
Topic	**Troubleshooting**

CS.T.6.a Use a systematic process to identify and evaluate the source of a routine computing problem. Select the best solution to solve the computing problem and communicate the solution to others.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students worked to diagnose problems, describe the problem, and develop strategies to resolve technology issues. By the end of 8th grade, students will be able to identify and evaluate problems, determine the best solution and also communicate with others to help them solve those problems. In future grades, students will understand the troubleshooting process to evaluate a pre-determined situation.

IMPORTANT CONCEPTS

- Use a basic troubleshooting process.
- Have a working knowledge of computing devices.
- Communicate to others via electronic and/or in-person communication.

KEY SKILL/PROCEDURES

- Utilize knowledge of computing devices, hardware and software to locate and solve a problem.
- Create a list of possible solutions to implement.
- Evaluate solutions to determine the best one.
- Communicate a solution to others.

Content Elaborations

CLARIFICATIONS

As students gain more experience listing possible solutions, they need to be able to test the solutions and determine the best solution. They also need to learn how to communicate these solutions to others via electronic or in-person communication to help guide others to a solution.

CONTENT FOCUS

Students can identify troubleshooting steps that are key to solving the software/hardware problem. This process involves collaboratively working through the troubleshooting steps.

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts

1. Systematically test computational artifacts by considering all scenarios and using test cases.
2. Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability and accessibility.

Strand	Networks and the Internet
Topic	**Networking**

NI.N.6.a Identify the role of hardware components to understand the infrastructure of networks and the internet (including cloud servers).

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed a general knowledge of how information is broken down to be transmitted over a network. By the end of 6th grade, students understand the flow of information across the hardware of the internet. In future grades, students will identify specific hardware components in the infrastructure of the internet.

IMPORTANT CONCEPTS

- Devices must be connected to the internet to share information.
- Hardware devices are required to transfer information across the internet.
- Information travels from router to router across the internet.
- Servers retrieve (or store) information.

KEY SKILL/PROCEDURES

- Explain that the internet is made up of connected devices.
- Explain that data travels through devices to get from one location to another on the internet.

Content Elaborations

CLARIFICATIONS

Students should understand a simple flow diagram of how information travels from a networked computer across the internet to retrieve information.

CONTENT FOCUS

Students will understand that data travels through devices to get from one location to another location on the internet.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

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

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	Networks and the Internet
Topic	**Networking**
NI.N.6.b Identify protocols (i.e., rules) and explain why they are used to transmit data across networks and the internet.	**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students developed general knowledge of how information is broken down to be transmitted over a network. By the end of 6th grade, students can identify that protocols are rules that define how data between devices is sent and received. In future grades, students will identify specific protocols. **IMPORTANT CONCEPTS** • Devices connected to the internet use protocols. • Protocols used for websites include http and https (usage not mechanics). **KEY SKILL/PROCEDURES** • Identify the purpose of protocols. • Identify the need for protocols. **Content Elaborations** **CLARIFICATIONS** Students should understand that all devices connected to the internet use protocols. **CONTENT FOCUS** Students will understand that hardware combined with software protocols work together to get data from one location to another location on 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.6.a Identify cybersecurity concerns and measures needed to protect electronic information.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience using and creating a password for a personal account. By the end of 6th grade, students understand the concern that electronic information needs to and can be protected. In future grades, students will learn about encryption to protect information.

IMPORTANT CONCEPTS

- Personal information is valuable information.
- Social media information is valuable information.
- Information can be protected from theft and manipulation.

KEY SKILL/PROCEDURES

- Identify personal digital habits that help to protect information.
- Demonstrate software settings to protect information.

Content Elaborations

CLARIFICATIONS

Students will be able to define personal information, such as birthday, address and phone number to explain why it is important that this information is protected (i.e., identify theft). In addition, students will understand what constitutes social media information and explain which information should be shared and which information should remain private.

CONTENT FOCUS

Students will understand that there is personal information that should be kept private for security reasons. Students need to realize not all non-private information needs to be shared via social media.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

(Content Statement aligns to Core Practice rather than specific Practice Statements).

Strand	Networks and the Internet
Topic	**Cybersecurity**

NI.C.6.b Identify the different types of malware to understand threats to data security.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience using and creating a password for a personal account. By the end of 6th grade, students can identify some of the different types of malware that exist that threaten data security. In future grades, students will learn about encryption to protect information.

IMPORTANT CONCEPTS

- Obtain a general understanding of "what is a computer virus?"
- Obtain a general understanding of "what is spyware?"

KEY SKILL/PROCEDURES

- Describe various computer threats, such as how malware is spread via email.

Content Elaborations

CLARIFICATIONS

At this level, students will be able to define effective strategies used to safeguard their personal information, such as not clicking on links in an email.

CONTENT FOCUS

Students will be able to identify simple measures they can use to protect their personal information.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

(Content Statement aligns to Core Practice rather than specific Practice Statements.)

Strand	Networks and the Internet
Topic	**Cybersecurity**

NI.C.6.c Identify ways to protect private information.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience using and creating a password for a personal account. By the end of 6th grade, students need to understand private information can be protected by individuals and by software. In future grades, students will have a deeper understanding of how information is protected.

IMPORTANT CONCEPTS

- Access rights include but are not limited to reading, writing, renaming and deleting files.
- Software is available to detect and protect information.
- Shared files and privacy filters are safety measures.
- Settings can be accessed to disable options to download and print files.

KEY SKILL/PROCEDURES

- Access rights as a security measure.
- Identify the advantages and disadvantages of safety measures.

Content Elaborations

CLARIFICATIONS

At this level, students deepen their understanding of security measures to safeguard online information and documents in various file formats. For example, students should be able to share documents on a shared server, understanding specific security settings.

CONTENT FOCUS

Students will be able to identify how specific software settings (e.g., public vs. private settings) for files can safeguard their data.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

(Content Statement aligns to Core Practice rather than specific Practice Statements.)

Strand	Networks and the Internet
Topic	Internet of Things

NI.IOT.6.a Define and explore aspects of embedded devices, smart devices and intelligent devices and the way they record, observe and mimic human habits.

NI.IOT.6.b Identify and define blockchains to recognize how every device made has unique identifiers and the weaknesses that allow programmers and hackers to see personally identifiable information.

Expectations for Learning

LEARNING PROGRESSION

In grade 5, students gained an understanding of how information is broken into pieces to be transferred over the internet and to use risk/benefit analysis in device utilization. In grade 6 students research and define how different smart/intelligent devices track human activities to record and mimic their habits. In grade 6, students define the term blockchain to recognize how every bit of information shared over networks is personally identifiable. They also explore the weaknesses in networks that allow programmers, both legitimate and illegitimate, to access that personal information. In grade 7, students will be able to explain the positive and negative uses of IoT as it applies to daily life.

IMPORTANT CONCEPTS

- Our devices use data collected from our daily habits to personalize our experience (i.e., advertisements, mapping, daily routines).
- Personally identifiable information is gathered and transmitted across networks.

KEY SKILLS/PROCEDURES

- Review the phrase Internet of Things and how it connects to the blockchain.
- Recognize that connections to the internet are key to IoT and these connections can mimic human behavior and respond to input.
- Recognize that devices have unique identifiers that allow programmers to access identifiable information.

Content Elaborations

CLARIFICATIONS

Humans interact with the world through our senses: touch, smell, sight, taste and hearing. Sense receptors in the body are constantly receiving information about the world, from the heat of a coffee cup to the smell of flowers, and transmitting it to the brain, where the information is processed. The Internet of Things (IoT) derives its power from technologies that mimic these functions: sensors embedded in devices and internet connections that allow networked devices to gather massive amounts of information and analyze it all for meaning.

All information that is sent and received over the internet is identifiable.

Blockchain is a system of recording information in a way that makes it difficult or impossible to change, hack or cheat the system. A blockchain is essentially a digital ledger of transactions that is duplicated and distributed across the entire network of computer systems on the blockchain.

Strand	Networks and the Internet
Topic	**Internet of Things**
	CONTENT FOCUS Devices track our habits both online and in the real world to adapt content to cater to our habits to provide a custom personal experience. All information on the network is identifiable and able to be tracked to the originator. **COMPUTER SCIENCE PRACTICES** *Practice 3.* Recognizing and Defining Computational Problems 1. Identify complex, interdisciplinary, real-world problems that can be solved computationally. 2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures. *Practice 4.* Developing and Using Abstractions 4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

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

DA.DCS.6.a Identify and use an appropriate digital data collection tool to compile information.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students have explored data sets and can define types of data. In 6th grade, students experience collecting data with a specific tool. They develop an understanding that different tools are used to manage specific data. In future grades, students will be able to evaluate the tools that would provide the best solution.

IMPORTANT CONCEPTS

- Use different data capturing tools (e.g., electronic survey, digital thermometer, yard sticks, meter sticks).

KEY SKILL/PROCEDURES

- Identify and use different types of data collection tools that are available.
- Select and use the appropriate tool to collect different types of data.

Content Elaborations

CLARIFICATIONS

Students need to experience the difference between the use of tools, such as rulers, yardsticks, meter sticks, thermometers, electronic surveys, phones, computers and tablets.

CONTENT FOCUS

Students can collect data from individual tools or systems.

COMPUTER SCIENCE PRACTICES

Practice 5. Creating Computational Artifacts

(Content Statement aligns to Core Practice rather than specific Practice Statements.)

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

DA.DCS.6.b Select and utilize appropriate file formats to organize collected data.

Expectations for Learning

LEARNING PROGRESSION
In previous grades, students explored files of different types and were able to differentiate the uses of the various types. By the end of 6th grade, students need to know the type of data and how it is stored and select the appropriate type of file. In future grades, students will be able to determine the limitation of various file types.

IMPORTANT CONCEPTS
- Identify picture and text file extensions and the characteristics of these file extensions.

KEY SKILL/PROCEDURES
- Explain that not all file extensions are the same.
- Explain the differences in the quality of the image.

Content Elaborations

CLARIFICATIONS
Students select and utilize the correct file type for various sets of data and text.

CONTENT FOCUS
Students understand the difference between size and quality for various images. Students should have experience with various file formats (e.g., .docx, .GDOC, .xlsx, GSHEET .pdf, .txt, .dat, .gif, .jpg, .tiff, .png, .bmp, .bpg, and other formats).

COMPUTER SCIENCE PRACTICES
Practice 5. Creating Computational Artifacts

(Content Statement aligns to Core Practice rather than specific Practice Statements.)

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

DA.DCS.6.c Utilize a file structure to logically organize data to support individual and collaborative work.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience saving files to a school or portable device. By the end of 6th grade, students know how to organize data, save files and access files, including shared files, on different mediums. In future grades, students will provide a more logical structure for storing files.

IMPORTANT CONCEPTS

- Files can be shared.
- Documents can be organized in folders and subfolders on a hard drive or cloud.

KEY SKILL/PROCEDURES

- Utilize procedures for how to share file(s) with others.
- Explain the importance of files being separated into folders and subfolders based on content.
- Demonstrate how to follow directions to organize files into folders and subfolders.

Content Elaborations

CLARIFICATIONS

Students need to be able to organize their files within logical structures. (e.g., A contextual example would be using a file cabinet to store folders, notebooks, and papers.) Put folders inside of folders that are labeled appropriately.

CONTENT FOCUS

Students can store files in a system where they can be located later. Students should be able to locate files on the hard drive or cloud.

COMPUTER SCIENCE PRACTICES

Practice 5. Creating Computational Artifacts

(Content Statement aligns to Core Practice rather than specific Practice Statements.)

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

DA.VC.6.a Identify and label patterns in models or representations to infer connections between data sets.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, had experience with patterns and collection of information in math classes. By the end of 6th grade, students can find patterns in data sets and infer connections between them. Data visualization includes visual, auditory, tactile, oral and other sensory representations. In future grades, students will be able to analyze relationships and patterns between them.

IMPORTANT CONCEPTS

- Identify patterns within a given data set.
- Compare two or more models or representations (e.g., two graphs or box-and-whisker charts) to discover similarities or trends between them.

KEY SKILL/PROCEDURES

- Find patterns and infer connections.

Content Elaborations

CLARIFICATIONS

Given a pair of graphs, students will read the graphs and make comparisons between the two and ask the following questions:

- What is the same,
- What is different and
- What story is each telling?

CONTENT FOCUS

Students should be able to read a graph and make comparisons between two graphs.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

1. Select, organize and interpret large data sets from multiple sources to support a claim.

Career Connections

CAREER EXPLORATION

Students identify careers that use data to drive business decisions. Students research to find an instance where different data sets were used to make a specific business decision. Students examine the data sets to identify patterns to see why the specific business decision was made.

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

DA.VC.6.b Create a spreadsheet utilizing formulas, functions and graphs to represent and analyze data.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, student analyzed graphs in classes. By the end of 6th grade, students recognize that a graph can be created from data using a spreadsheet. In future grades, students will be able to utilize formulas and functions.

IMPORTANT CONCEPTS

- Graphs are a representation of data.
- Formulas and functions are used to represent data.

KEY SKILL/PROCEDURES

- Explain that data can be used to draw conclusions.

Content Elaborations

CLARIFICATIONS

Given a data set, students will construct a graphical representation.

CONTENT FOCUS

Students will be able to recognize pie charts, bar graphs, histograms and other data models. Students will find statistical results, such as mean, median, mode, percentage and degrees in a circle.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

1. Select, organize and interpret large data sets from multiple sources to support a claim.

Practice 5. Creating Computational Artifacts

2. Create a computational artifact for practical intent, personal expression or to address a societal issue.

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

DA.IM.6.a Identify and utilize data sets to support or refute a hypothesis.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students should have had experience analyzing data models (e.g., charts, graphs). By the end of 6th grade, students can provide evidence to support or refute a prediction about a collection of data. In future grades, students will be able to hypothesize about self-generated data.

IMPORTANT CONCEPTS

- Develop a hypothesis (a prediction) for a problem and then determine if the data collected around the problem supports the hypothesis.

KEY SKILL/PROCEDURES

- Given a problem statement, students will be able to create a hypothesis (prediction), collect data (e.g., survey results), analyze a data set and compare the analysis to the hypothesis.

Content Elaborations

CLARIFICATIONS

Students will be given a problem statement and asked to create a hypothesis, collect data, organize the results in an electronic tool, and support or disprove the hypothesis.

CONTENT FOCUS

Students will understand what type of data would be appropriate to help analyze a problem. They should then be able to complete the processes necessary to support or disclaim a hypothesis.

COMPUTER SCIENCE PRACTICES

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	**Algorithms**

ATP.A.6.a Compare and refine multiple algorithms for the same task to determine which is the most efficient.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students have had experience developing an algorithm for a simple process. At the end of 6th grade, students should be able to choose an algorithm for a multi-step process and evaluate multiple algorithms to determine the most efficient solution. In future grades, students will be able to create algorithms for the most efficient solution.

IMPORTANT CONCEPTS

- Understand the flow of a program.
- Compare different sets of pseudocode and determine the most efficient solution.

KEY SKILL/PROCEDURES

- Identify the inputs, outputs, processes and decisions.

Content Elaborations

CLARIFICATIONS

An algorithm is a series of instructions to obtain the desired result. One example could be a set of directions to travel from the school to the pizza shop or the process of calculating a nine-week grade. Comparing algorithms can be comparing different sets of directions between two locations; all sets of directions end at the same location, but one set may be shorter, safer or have fewer turns. This would be analyzing the algorithms to determine which one is more efficient where efficiency is not necessarily the "fastest" path.

CONTENT FOCUS

An algorithm is a series of instructions to obtain the desired result. One example could be a set of directions to travel from the school to the pizza shop or the process of calculating a nine-week grade. Comparing algorithms can be comparing different sets of directions between two locations; all sets of directions end at the same location, but one set may be shorter, safer or have fewer turns. This would be analyzing the algorithms to determine which one is more efficient where efficiency is not necessarily the "fastest" path.

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts

1. Systematically test computational artifacts by considering all scenarios and using test cases.

Strand	Algorithmic Thinking and Programming
Topic	**Algorithms**
	Practice 4. Developing and Using Abstractions 1. Extract common features from a set of interrelated processes or complex phenomena. 4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

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

ATP.VDR.6.a Identify unknown values that need to be represented by a variable within a multi-step process.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students created variables to store and modify data. By the end of 6th grade, students understand how to use variables in a multi-step process. In future grades, students will be able to understand that variables have different storage requirements and will use parameters. They will learn about scope.

IMPORTANT CONCEPTS

- Identify unknown values in an algorithm.

KEY SKILL/PROCEDURES

- Explain the concept of a variable.

Content Elaborations

CLARIFICATIONS

Students will deepen their understanding of variables, including when and how to declare and name new variables. A variable is like a container with a name, in which the contents may change, but the name (identifier) does not. The identifier makes keeping track of the data that is stored easier, especially if the data changes. Naming conventions for identifiers, and thoughtful choices of identifiers, improve program readability. (K-12 Computer Science Framework, 2016)

CONTENT FOCUS

Students should be able to identify variables and be able to explain the advantages of using self-descriptive variable names. They will utilize and understand the importance of self-descriptive variables.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

3. Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

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

ATP.VDR.6.b Create variables and use them within a multi-step process.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed an understanding of what it means to vary (opposed to being constant) and that this abstract value is expressed with an alphanumeric representation. By the end of 6th grade, students understand how to create and use variables. In future grades, students will be able to understand that variables have different storage requirements and will use parameters. They will learn about scope.

IMPORTANT CONCEPTS

- Create a variable to represent an unknown value.

KEY SKILL/PROCEDURES

- Define and utilize a variable in an algorithm.

Content Elaborations

CLARIFICATIONS

At this level, students deepen their understanding of variables, including when and how to declare and name new variables. A variable is like a container with a name, in which the contents may change, but the name (identifier) does not. The identifier makes keeping track of the data that is stored easier, especially if the data changes. Naming conventions for identifiers, and thoughtful choices of identifiers, improve program readability. (K-12 Computer Science Framework, 2016)

CONTENT FOCUS

Students should be able to identify and assign variables. Students should focus on using self-descriptive variable names. Students will utilize and understand the importance of self-descriptive variables. They will create new self-descriptive variables.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

3. Create modules and develop points of interaction that can apply to multiple situations and reduce complexity.

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

ATP.CS.6.a Identify and trace decisions and loops that exist in a multi-step process within a program.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students applied sequences, events, loops and conditionals in increasingly complex ways. By the end of 6th grade, students are able to identify decisions and loops in programs to solve problems. In future grades, students will understand and incorporate proper processes, loops and conditionals in programs to solve problems.

IMPORTANT CONCEPTS

- Identify the decision structures within an algorithm.
- Identify and apply the structures within an algorithm.

KEY SKILL/PROCEDURES

- Properly use if statements (if-then and if-then-else).
- Properly use Pre-test (do-while), post-test (while) and definite loop (for, for next).

Content Elaborations

CLARIFICATIONS

An example of a nested conditional structure is deciding what to do based on the weather outside. If it is sunny outside, I will further decide if I want to ride my bike or go running, but if it is not sunny outside, I will decide whether to read a book or watch TV. (K-12 Computer Science Framework, 2016)

CONTENT FOCUS

Students at this level will be able to work with single-decision statements, as opposed to nested, and single loops (i.e., iterative processes). Students should be able to identify the decision (if/then) statement(s) and the loop statements (for, while, do) and understand the conditions of when the body of the code (the choice to go running or ride the bike) will be executed and/or how often that code would be executed.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

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

Strand	Algorithmic Thinking and Programming
Topic	**Control Structure**
	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, considering key features, time and resource constraints and user expectations. *Practice 6.* Testing and Refining Computational Artifacts 1. Systematically test computational artifacts by considering all scenarios and using test cases. 2. Identify and fix errors using a systematic process.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**

ATP.M.6.a Decompose problems into parts to facilitate the design, implementation and review of programs.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students began to use abstraction to further refine and design an algorithm. By the end of 6th grade, students can identify and utilize the procedures/modules within a set of instructions or code. In future grades, students will continue to identify and utilize the procedures/modules within a set of text-based instructions or code.

IMPORTANT CONCEPTS

- Identify smaller components of an algorithm.
- Identify a set of steps of an algorithm's component that produces a result.

KEY SKILL/PROCEDURES

- Group and organize steps that work together to produce a result.
- Identify the steps that were used when provided with the result.

Content Elaborations

CLARIFICATIONS

A procedure is a module (a group of instructions within a program) that performs a particular task. Procedures are invoked to repeat groups of instructions. For example, a procedure, such as one to draw a circle, involves many instructions, but all of them can be invoked with one instruction, such as drawing a circle. Procedures that are defined with parameters are generalizable to many situations and will produce different outputs based on a wide range of inputs (arguments). (K-12 Computer Science Framework, 2016)

CONTENT FOCUS

Students will utilize modules to increase the organization of code, the ability to hide details and the reusability.

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.
3. Evaluate whether it is appropriate and feasible to solve a problem computationally.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**
	Practice 4. Developing and Using Abstractions 1. Extract common features from a set of interrelated processes or complex phenomena 2. Evaluate existing technological functionalities and incorporate them into new designs. 3. Create modules and develop points of interaction that can apply to multiple situations and reduce complexity. *Practice 6.* Testing and Refining Computational Artifacts 3. Evaluate and refine a computational artifact multiple times to enhance its performance, reliability, usability and accessibility.

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

ATP.PD.6.a Write code that utilizes algorithms, variables and control structures to solve problems or as a creative expression.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students learned how to create a program through block-based programming. By the end of 6th grade, students can advance in designing and creating their block-based programs utilizing parameters. In future grades, students will begin text-based programming.

IMPORTANT CONCEPTS

- Write code to solve a problem using block-based coding software.
- Utilize block-based code that has parameters and understand the impact of using different parameter values.

KEY SKILL/PROCEDURES

- Use block-based programming.
- Use procedures (block-based code) with parameters effectively.

Content Elaborations

CLARIFICATIONS

Block-based programming is an accessible entry point for writing code. It teaches fundamental programming skills and encourages experimentation and creativity. Students can "drag" and/or "link" blocks to produce a result, such as animation and picture drawing.

CONTENT FOCUS

Students are to be introduced to a programming language through block-based code. Students should be able to use proper commands to move an object, add to an object and change the color of an object.

COMPUTER SCIENCE PRACTICES

Practice 3. Recognizing and Defining Computational Problems

1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.

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, considering 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.6.b Test and trace to debug and refine code.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students became less dependent on guided questions and began to debug more complex programs. By the end of 6th grade, students can identify errors in code and modify and fix errors so that a program will run correctly and produce the expected result. In future grades, students will learn to test and refine programs using a range of text cases.

IMPORTANT CONCEPTS

- Test a variety of solutions within the programming solution.
- Identify errors within the program.

KEY SKILL/PROCEDURES

- Debug (fix) one's code.

Content Elaborations

CLARIFICATIONS

Students need to understand that errors often occur when writing code. While using block-based coding, students will be able to find errors and make corrections.

CONTENT FOCUS

Students will be able to correct errors when the code will not execute correctly.

Students will experience two types of errors: runtime (this happens when the program "crashes") and logical (this happens when the program is successfully executed but the results were incorrect).

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts

1. Systematically test computational artifacts by considering all scenarios and using test cases.
2. Identify and fix errors using a systematic process.

Strand	Artificial Intelligence
Topic	**Natural Interactions**

AI.NI.6.a Individually and collaboratively compare language processing algorithms to solve a problem based on a given criteria (e.g., time, resource, accessibility).

Expectations for Learning

LEARNING PROGRESSION

In grade 5, students described ways that Artificial Intelligence (AI) systems, or the science and engineering of making intelligent machines and computer programs, can be designed to support inclusivity in AI. In grade 7, students will model how unsupervised learning finds patterns in unlabeled data to identify how machine learning takes place.

IMPORTANT CONCEPTS

- Explain how people learn how to do something.
- Discuss how people learning is a process unique and different than how a machine may learn.
- Explain how machines learn information.
- Explain and discuss whether humans can learn things that machines cannot and why.

KEY SKILLS/PROCEDURES

- Students will be able to analyze their learning processes (metacognition) and compare and contrast how a machine learns information.
- Students will be able to identify the limitations of machine learning and explain why those limitations exist.

Content Elaborations

CLARIFICATIONS

Metacognition is the awareness and understanding of one's thought processes.

CONTENT FOCUS

Human learning is complex and impacted by a variety of factors including social, environmental and emotional factors. There are limitations to what a machine can learn because machine learning does not happen the same way as human learning and machines do not share the same experiences as humans.

COMPUTER SCIENCE PRACTICES

Practice 3. Recognizing and Defining Computational Problems

1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.

Strand	Artificial Intelligence
Topic	**Natural Interactions**

AI.NI.6.b Identify and describe how computers mimic human behavior to better serve humans.

Expectations for Learning

LEARNING PROGRESSION

In grade 7, students modeled how unsupervised learning finds patterns in unlabeled data to identify how machine learning takes place. In high school, students will explain at least one way bias can be introduced to a machine learning system and explain how that bias impacts people.

IMPORTANT CONCEPTS

- Explain the process of training in machine learning.
- Discuss using a reason model in machine learning.
- Compare the differences between the process of training in machine learning.
- Describe when to use training and when to use a reasoning model in machine learning.

KEY SKILLS/PROCEDURES

- Students will be able to define training in terms of machine learning.
- Students will be able to define what a reasoning model is.
- Students will be able to explain the difference is between training and using a reasoning model.

Content Elaborations

CLARIFICATIONS

Training is the process of providing a machine learning algorithm with training data to learn from and create a machine learning model. The reasoning model, also known as machine reasoning, generates conclusions from available knowledge by using logical techniques like deduction and induction.

CONTENT FOCUS

Training is the process of creating a machine learning model by using a machine learning algorithm on a data set that will give the desired result. Reasoning models use logic like deduction and induction to determine an action to a set of data based on what knowledge the machine has available.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

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

Strand	Artificial Intelligence
Topic	**Perception**

AI.P.6.a Give examples of different types of computer perception that can extract meaning from sensory signals to understand how computers collect information from sensors.

Expectations for Learning

LEARNING PROGRESSION

In grade 5, students learned about how sensor inputs are converted as analog or digital signals to describe their uses. In grade 7, students will learn how intelligent agents combine information from multiple sensors.

IMPORTANT CONCEPTS

- Compare the ways computers perceive the world around them.
- Categorize and describe sensors that work with computers.
- Explain the types of data that are collected from sensors and used by computers.

KEY SKILLS/PROCEDURES

- Students will be able to identify a sensor.
- Students will be able to describe the data a sensor collects.
- Students will be able to identify how computers perceive the world.

Content Elaborations

CLARIFICATIONS

Computer perception is a system for computers to understand the world. Signals come from sensors such as thermometers, accelerometers and cameras.

CONTENT FOCUS

Students focus on how computers perceive the world through sensors.

COMPUTER SCIENCE PRACTICES

Practice 3. Recognizing and Defining Computational Problems

1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.
2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures.
3. Evaluate whether it is appropriate and feasible to solve a problem computationally.

Strand	Artificial Intelligence
Topic	**Perception**
AI.P.6.b Give examples of how humans combine information from multiple modalities to understand how computers use sensors to collect data.	**Expectations for Learning** **LEARNING PROGRESSION** In earlier grades, students learned about the various types of sensors and their applications. In grade 7, students will learn how intelligent agents combine information from multiple sensors. **IMPORTANT CONCEPTS** • Discuss and explain how computers and humans capture information. • Explain how data from multiple sources combine to create a more complete data set. **KEY SKILLS/PROCEDURES** • Students will be able to describe how the human body uses its senses together in comparison to a computer using sensors. **Content Elaborations** **CLARIFICATIONS** Modalities are one of the main avenues of sensation. **CONTENT FOCUS** How are computers and humans alike in how they perceive the world? **COMPUTER SCIENCE PRACTICES** *Practice 3.* Recognizing and Defining Computational Problems 1. Identify complex, interdisciplinary, real-world problems that can be solved computationally. 2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures. 3. Evaluate whether it is appropriate and feasible to solve a problem computationally.
AI.P.6.c Give examples of different types of computer perception that can extract meaning from sensory signals to show the connection between sensors and computer perception.	**Expectations for Learning** **LEARNING PROGRESSION** In grade 5, students learned about how sensor inputs are converted as analog or digital signals to describe their uses. In grade 7, students will learn how edge detectors can be composed to form more complex feature detectors. **IMPORTANT CONCEPTS** • Explain how computers perceive the world around them. • Explain how computers use sensors. • Describe the types of data that are collected from sensors and used by computers.

Strand	Artificial Intelligence	
Topic	**Perception**	
		KEY SKILLS/PROCEDURES • Students will be able to identify different types of computer perception. • Students will be able to identify how computer perception can extract meaning from sensory signals. • Students will be able to show the connection between sensors and computer perception. **Content Elaborations** **CLARIFICATIONS** Computer perception is the ability of a computer to perceive data in a way similar to humans. **CONTENT FOCUS** How do sensors work with computers to perceive the world? **COMPUTER SCIENCE PRACTICES** *Practice 4.* Developing and Using Abstractions 1. Extract common features from a set of interrelated processes or complex phenomena.
AI.P.6.d Classify a given image (e.g., "traffic scene", "nature scene", "social gathering", etc.) and then describe the kinds of knowledge a computer would need in order to understand scenes of this type to utilize the image in an algorithm.		**Expectations for Learning** **LEARNING PROGRESSION** In grade 5, students learned about how sensor inputs are converted as analog or digital signals to describe their uses. In grade 7, students will learn how to illustrate the concept of feature extraction from images by simulating an edge detector. **IMPORTANT CONCEPTS** • Explain the kind of information a computer needs to classify an image. • Describe what kinds of information may not be in the image that would be important for utilizing it in an algorithm. • Distinguish how to ensure a computer has enough information to classify an image. **KEY SKILLS/PROCEDURES** • Students will be able to explain what image classification is in terms of artificial intelligence and computers. • Students will be able to describe the information a computer needs to classify an image. • Students will be able to explain how computers use image classification in an algorithm.

Strand	Artificial Intelligence
Topic	Perception
	Content Elaborations **CLARIFICATIONS** Image classification is the process of categorizing and labeling groups of pixels or vectors within an image based on specific rules. An algorithm is a process or set of rules to be followed in calculations or other problem-solving operations. **CONTENT FOCUS** Identify the information a computer needs to classify an image for use in an algorithm. **COMPUTER SCIENCE PRACTICES** *Practice 3.* Recognizing and Defining Computational Problems 1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.

Strand	Artificial Intelligence
Topic	**Representation & Reasoning**

AI.RR.6.a Illustrate how a computer can solve a maze, find a route on a map or reason about concepts in a knowledge graph by drawing a search tree.

Expectations for Learning

LEARNING PROGRESSION

In grade 5, students described how Artificial Intelligence (AI) representations support reasoning to answer questions. In grade 7, students will compare several algorithms that could be used to solve a specific type of reasoning problem.

IMPORTANT CONCEPTS

- Explain how a search tree guides a person through the process of doing an activity.
- Describe how a computer might use a search tree to solve a problem or complete a task.

KEY SKILLS/PROCEDURES

- Students will be able to create a search tree that will generate a series of directions or instructions to navigate a maze, map or concept to see the connection between search trees and algorithms.
- Students will be able to explain how their search tree functions to follow the series of directions and complete the process.

Content Elaborations

CLARIFICATIONS

A tree is a non-linear data structure organized hierarchically through a collection of nodes.

CONTENT FOCUS

Describe the process a search tree uses in a computer program to locate information and complete a task.

COMPUTER SCIENCE PRACTICES

Practice 5. Creating Computational Artifacts

2. Create a computational artifact for practical intent, personal expression, or to address a societal issue.

Strand	Artificial Intelligence
Topic	**Machine Learning**
AI.ML.6.a Contrast the unique characteristics of human learning with the ways machine learning systems operate to identify the limitations of machine learning.	**Expectations for Learning** **LEARNING PROGRESSION** In grade 5, students described ways that Artificial Intelligence (AI) systems can be designed for inclusivity to support inclusivity in AI. In grade 7, students will model how unsupervised learning finds patterns in unlabeled data to identify how machine learning takes place. **IMPORTANT CONCEPTS** • Understand how a person learns how to do something. • Understand how machines learn how to do something. • Compare and contrast the differences between human learning and machine learning. • Discuss whether there are things machines cannot learn that humans can and why. **KEY SKILLS/PROCEDURES** • Students will be able to analyze their learning processes (metacognition). • Compare and contrast how a machine learns information. • Students will be able to identify the limitations of machine learning and explain why those limitations exist. **Content Elaborations** **CLARIFICATIONS** Human learning is complex and impacted by a variety of factors including socialization, environment, emotions, etc. There are limitations to what a machine can learn because machine learning does not happen the same way as human learning and machines do not share the same experiences as humans **CONTENT FOCUS** Understand the differences between human learning and machine learning. **COMPUTER SCIENCE PRACTICES** *Practice 3.* Recognizing and Defining Computational Problems 1. Identify complex, interdisciplinary, real-world problems that can be solved computationally. 2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures. 3. Evaluate whether it is appropriate and feasible to solve a problem computationally.

Strand	Artificial Intelligence
Topic	**Machine Learning**
AI.ML.6.b Illustrate the structure of a neural network to describe how its parts form a set of functions that compute an output.	**Expectations for Learning** **LEARNING PROGRESSION** In grade 5, students illustrated how a neural network is a function that computes an output. In grade 7, students will describe neural network architectures. **IMPORTANT CONCEPTS** • Understand what a neural network is. • Understand how neural networks are organized. • Understand how a neural network computes an output. **KEY SKILLS/PROCEDURES** • Students will be able to illustrate the structure of a neural network. • Students will be able to describe how the neural network's parts form a set of functions. • Students will be able to compute the output of a neural network. **Content Elaborations** **CLARIFICATIONS** Human Neural networks are organized as layers of units (input, hidden and output layers), with weighted connections between units in successive layers. Each unit computes the sum of its weighted inputs. It passes that sum through a transfer function to produce a numeric output. **CONTENT FOCUS** A neural network maps input patterns to output patterns in a complex way. Each neuron computes a function, and the network computes a complex function that can be considered a very wiggly mathematical function. **COMPUTER SCIENCE PRACTICES** *Practice 3.* Recognizing and Defining Computational Problems 1. Identify complex, interdisciplinary, real-world problems that can be solved computationally. 2. Decompose complex real-world problems into manageable subproblems that could integrate existing solutions or procedures. 3. Evaluate whether it is appropriate and feasible to solve a problem computationally.

Strand	Artificial Intelligence
Topic	**Societal Impacts**

AI.SI.6.a Identify and explain how humans have control in curating training data sets to identify bias in machine learning.

Expectations for Learning

LEARNING PROGRESSION

In grade 5, students explored how data is influenced by bias and how it affects decision-making to defend arguments in Artificial Intelligence (AI). In grade 7, students will identify and explain the effect training data has on the accuracy of an artificial intelligence system to uncover bias in training data.

IMPORTANT CONCEPTS

- Explain what it means to have agency in creating something.
- Explain the purpose and process of curating a data set.
- Define bias and how it might show up in machine learning.
- List how to avoid bias in machine learning.

KEY SKILLS/PROCEDURES

- Students will be able to identify ways data sets can contain bias in machine learning by analyzing a data set for bias.
- Students will be able to explain how humans have agency in curating training data sets to ensure bias is not present in machine learning programs.
- Students will be able to explain how bias impacts machine learning.

Content Elaborations

CLARIFICATIONS

Bias in machine learning is a phenomenon that skews the result of an algorithm in favor or against an idea.

CONTENT FOCUS

Humans have biases and those biases may be present in data sets because they are created and curated by humans. This can cause a machine learning program to exhibit bias in its responses. Bias can include sample bias, exclusion bias, measurement bias, recall bias, observer bias, racial bias and association bias. There are strategies for avoiding bias in data sets, such as knowing your users, having a diverse development team, pulling data from multiple sources and testing for bias.

COMPUTER SCIENCE PRACTICES

Practice 3. Recognizing and Defining Computational Problems

1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.

Strand	Artificial Intelligence
Topic	**Societal Impacts**
AI.SI.6.b Identify and explain how algorithmic bias impacts artificial intelligence systems to prevent bias in future data sets.	**Expectations for Learning** **LEARNING PROGRESSION** In grade 5, students explored how data is influenced by bias and how it affects decision-making to defend arguments in Artificial Intelligence (AI). In grade 7, students will identify and explain the problems of classification in the supervised artificial intelligence context to create data sets that are inclusive and accurate. **IMPORTANT CONCEPTS** • Explain how algorithmic bias can impact artificial intelligence systems. • Explain the process of identifying bias in algorithms to help prevent bias in future data sets. **KEY SKILLS/PROCEDURES** • Students will be able to identify and explain algorithmic bias. • Students will be able to identify and explain how algorithmic bias impacts AI systems. • Students will be able to explain how to prevent bias in future data sets by identifying bias in algorithms. **Content Elaborations** **CLARIFICATIONS** Algorithmic bias describes systematic and repeatable errors in a computer system that create unfair outcomes, such as privileging one arbitrary group of users over others. This occurs when an algorithm produces results that are systemically prejudiced due to erroneous assumptions in the machine learning process. **CONTENT FOCUS** Strategies for overcoming algorithmic bias include narrowing data sets to be more specific to the problem, structuring data to represent different opinions, knowing where data is coming from and understanding it, considering the end-user while developing a program, and seeking feedback from a diverse pool of people to use in improving the algorithm. **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	Impacts of Computing
Topic	**Culture**

IC.Cu.6.a Identify the change that current technologies have on people's everyday activities to understand the impact within a society.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students should have become familiar with some of the ways in which we communicate in today's world. By the end of 6th grade, students begin to develop a better understanding of how we connect to people around the country and the world. Students study how these communication tools impact society. In future grades, students will study the history of computing to evaluate the impact on everyday activities.

IMPORTANT CONCEPTS

- Current technology provides efficiency and convenience for everyday activities.
- The use of technology increases personal communication and collaboration.
- Technology has an impact on culture.

KEY SKILL/PROCEDURES

- Communicate via school technology with one's parents, class and teacher.
- Provide feedback to one's peers using existing technologies.

Content Elaborations

CLARIFICATIONS

Students need to understand how today's technology has impacted the amount and speed of information that can be accessed and shared. Students can safely experience this phenomenon through technology provided through their school and/or classroom.

CONTENT FOCUS

Students should list different types of technology they use at school and home, as well as technology that is used in the world around them. Students can identify what they can do with the technology to improve their quality of life.

COMPUTER SCIENCE PRACTICES

Practice 1. Fostering an Inclusive Computing Culture

(Content Statement aligns to Core Practice rather than specific Practice Statements.)

Strand	Impacts of Computing
Topic	**Culture**

IC.Cu.6.b Identify issues of bias and accessibility in the design of existing technologies to address equality and equity in society.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students need to have developed an understanding that computing has become a global connection. At the end of 6th grade, students understand that even though computing has increased global connections, there are still areas of the world and individuals who do not have the same access. In future grades, students will evaluate technologies for issues of bias and accessibility.

IMPORTANT CONCEPTS

- Computing makes all aspects of our lives more efficient. It allows us to communicate on a global scale.
- Access for those in third-world countries is not equitable to those living in many other countries.
- Computing in the educational setting is not equitable globally or even within our own country.
- Social-economic status impacts the access for many in our country.
- Access may be an issue for persons with disabilities.

KEY SKILL/PROCEDURES

- Explain that access is important for everyone regardless of their social-economic status, disability or geographic location.
- Research the issue of accessibility and report our findings.

Content Elaborations

CLARIFICATIONS

The educational system tries to level the computing access playing field for all students when in reality, not all students have the same opportunities or access once they leave the school setting. Helping students become aware of the world in which they live will help foster citizenship and problem solving (i.e., "thinking outside the box"). Students may experience accessibility limitations personally or observe the bias against a family member or friend. This bias may exist due to disabilities or economic status. Students also need to be exposed to the bias and accessibility issues that many people have globally.

CONTENT FOCUS

Students will be able to understand that computing on a global level is made easier through the efficiency of computing. There is also a disconnect in equity for all students having access to computing. This refers to accessibility based on socio-economic status, persons with disabilities and third-world countries. Students will learn to identify tools that allow equity of accessibility for all students.

Strand	Impacts of Computing	
Topic	**Culture**	
		COMPUTER SCIENCE PRACTICES *Practice 1.* Fostering an Inclusive Computing Culture 3. Employ self- and peer-advocacy to address bias in interactions, product design and development methods.
IC.Cu.6.c Identify and explore careers related to the field of computer science.		**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students should have had some experience using technology. At the end of 6th grade, students understand that there are many different people and jobs involved in creating the technologies that they utilize. There is a wide variety of computer science careers available and many new careers being developed daily that students should explore. In future grades, students will learn about how computing impacts other career fields. **IMPORTANT CONCEPTS** • It is necessary to stay up-to-date on future industry needs. • Computer science is more than writing code or building a piece of hardware. **KEY SKILL/PROCEDURES** • Describe several different existing careers involving computer science and understand that there will be positions in the future that have not yet been defined. **Content Elaborations** **CLARIFICATIONS** There are many careers under the umbrella of computer science, many of which do not involve coding and building a piece of hardware. Students should be aware of the possibilities that exist today and realize that there will be new jobs for them when they graduate that does not even exist today. **CONTENT FOCUS** Students need to understand that a computer science career is not just writing code, but it is a current and new frontier for careers. **COMPUTER SCIENCE PRACTICES** *Practice 1.* Fostering an Inclusive Computing Culture *(Content Statement aligns to Core Practice rather than specific Practice Statements.)*

Strand	Impacts of Computing
Topic	**Social Interactions**

IC.SI.6.a Analyze and present beneficial and harmful effects of electronic communications to understand their impacts on interpersonal, global, economic, political, business and cultural interactions.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students collaborated with others to share the workload, increase diverse perspectives and improve an artifact. By the end of 6th grade, students can differentiate between the beneficial and harmful effects of technology on a global aspect. In future grades, students will continue to practice safety and proper personal use of devices.

IMPORTANT CONCEPTS

- Identify positive and negative impacts of devices and computing on the health and well-being of businesses, economics, politics and cultural interactions.
- Provide examples of beneficial and harmful effects on persons through social media, phones and other devices.

KEY SKILL/PROCEDURES

- Differentiate between the harmful and beneficial effects of computing and devices globally and locally on economics, businesses, politics and cultural differences.
- Describe ways in which the internet globally impacts business, politics and economics.
- Communicate the pros and cons of personal interaction with email, phones and social media.
- Describe the advantages and disadvantages of electronic collaboration for interpersonal use.

Content Elaborations

CLARIFICATIONS

Computing and devices have a significant impact on connecting with other people, sharing information, and expressing ideas. Students need to understand the power of these devices and differentiate between their beneficial and harmful effects. The economic/business/political uses of these devices can be quantified. The interpersonal effects may be a good transition to an anti-bullying lesson/unit.

CONTENT FOCUS

Students should be able to evaluate how the use of computing devices can contribute or be a detriment to the economics, businesses, politics and cultural differences at the global and local levels. Students also should be able to determine how social media and technological devices can contribute to or have consequences in their daily lives.

Strand	Impacts of Computing
Topic	**Social Interactions**
	COMPUTER SCIENCE PRACTICES *Practice 1.* Fostering an Inclusive Computing Culture 1. Include the unique perspectives of others and reflect on one's perspectives when designing and developing computational products. 2. Address the needs of diverse end-users during the design process to produce artifacts with broad accessibility and usability. *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.6.a Describe tradeoffs between allowing information to be public and keeping information private and secure to inform decision making.

IC.SLE.6.b Identify the social and economic implications of privacy in the context of safety, law or ethics to understand how privacy impacts these areas.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students should have had experience with devices at school. By the end of 6th grade, students understand the difference between public and personal information and the necessity of not sharing personal information. In future grades, students should be able to apply these concepts and continually investigate security concerns and legal rights.

IMPORTANT CONCEPTS

- Identify what is considered to be personal information (e.g., address, phone number, birthdate, social security number, financial information.)
- Have a familiarity with some of the "attacks" made by third parties trying to misuse private information

KEY SKILL/PROCEDURES

- Differentiate between personal and public information and make decisions about which items can be safely shared within social media.
- Communicate the contents of one's digital footprint.
- Recognize third party attempts of retrieving personal information (e.g., emails, phishing.)

Content Elaborations

CLARIFICATIONS

Social engineering is based on tricking people into breaking security procedures and can be thwarted by being aware of various kinds of attacks, such as emails with false information and phishing. Security attacks often start with personal information that is publicly available online. All users should be aware of the personal information, especially financial information, that is stored on the websites they use. Protecting personal online information requires authentication measures that can often make it harder for authorized users to access information. (K-12 Computer Science Framework, 2016)

CONTENT FOCUS

Students will be able to identify and understand what information is considered to be personal (e.g., address, phone number, birthdate, social security number, financial information). It is vital that students understand what information should be kept private and secure to protect themselves. Teachers need to reinforce that decisions made regarding their personal information will become a "digital footprint" and be at risk for "attacks" made by third parties trying to misuse private information.

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.
IC.SLE.6.c Evaluate the development of new technologies in communication, entertainment and business to understand the impact.	**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students had experiences with collaborative documents, school email, electronic grade books and electronic school communication. By the end of 6th grade, students are able to identify some of the positive and negative effects that technology in communication has in the business world, including the entertainment business. In future grades, students will be able to apply these concepts. **IMPORTANT CONCEPTS** • Technology has had a profound effect in the business world. **KEY SKILL/PROCEDURES** • Explain how communication in the business world has become faster and easier and has expanded opportunities. • Describe the advantages (e.g., speed and efficiency, communication log, mobile workers.) • Describe the disadvantages (e.g., lack of relationship building, informal communication, distractions.) • Explain why communication must be more deliberate; reacting to electronic messages should be well thought out. **Content Elaborations** **CLARIFICATIONS** Technology has changed the business world in many ways and perhaps the biggest impact computing has had is in the way businesses communicate. It has expanded the market and business partnerships with companies and allowed for expansion. Overall, this has been a positive impact for businesses and the economy, but it can make communication more distracting and less clear. **CONTENT FOCUS** Students will be able to focus on the positive and negative impacts of computing on the business world.

Strand	Impacts of Computing	
Topic	**Safety, Law and Ethics**	
		COMPUTER SCIENCE PRACTICES *Practice 1.* Fostering an Inclusive Computing Culture (Content Statement aligns to Core Practice rather than specific Practice Statements.) *Practice 2.* Collaborating Around Computing 1. Cultivate working relationships with individuals possessing diverse perspectives, skills and personalities. 2. Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness. 3. Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders.
IC.SLE.6.d Provide appropriate credit when using resources or artifacts that are not our own.		**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students should have had some experience creating original work that may include code, text, video or graphics. There should have been discussions on citing/providing credit to any sources that are copied/inserted into their work. By the end of 6th grade, students should continue providing credit for all sources. In future grades, students should continue providing credit for all sources. **IMPORTANT CONCEPTS** • Plagiarism/cheating is when an individual represents someone else's work as their own. • In creating a computational artifact, students can create their original work, including video, music, text, images, graphs and program code. • When using external work to integrate into a computational artifact, one must acknowledge, attribute and/or cite sources and include a bibliography with their submission. External work that should be acknowledged includes video, music, text, images, graphs and programmed code that are used in the creation of computational artifacts. **KEY SKILL/PROCEDURES** • Provide proper credit for items inserted into one's work; the credit may be in MLA or APA formatted citations or some other accepted format. • Give credit to not only textbooks, scientific reports and websites, but also appropriate persons in a collaboration effort.

Strand	Impacts of Computing
Topic	Safety, Law and Ethics
	Content Elaborations **CLARIFICATIONS** Ethical complications arise from the opportunities provided by computing. The ease of sending and receiving copies of media on the internet, such as video, photos and music, creates the opportunity for unauthorized use, such as online piracy, and disregard of copyrights, such as lack of attribution. (CSTA K-12 Computer Science Standards, 2017) Students need to learn the importance of providing proper credit for all the sources, not only the electronic sources but also those persons with whom they have worked. **CONTENT FOCUS** Students will be able to give appropriate credit for items, such as information, videos and pictures, that they use in their work. **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.6.e Differentiate between the appropriate and inappropriate content on the internet and identify unethical and illegal online behavior.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, most students had some experience finding information on the internet and used the internet for communication. By the end of 6th grade, students should have experience differentiating between appropriate and inappropriate content and behavior on the internet. In the future, students will continue using the internet for communication and be able to identify unethical and illegal online behavior.

IMPORTANT CONCEPTS

- The internet contains sites and information that are for adults only.
- Some sites and programs have a minimum age requirement.
- Students should have permission from adults before using social media.
- The internet should not be used for bullying.

KEY SKILL/PROCEDURES

- Explain that one should not use sites that encourage vandalism, gambling, crime, terrorism, racism, eating disorders or suicide, nor should they use pictures or videos from the internet which show images of pornography, violence or cruelty to other people or animals.

Content Elaborations

CLARIFICATIONS

Increased computing through numerous devices has increased access globally for all ages. At much younger ages, students have access to the internet through devices such as phones and tablets. Not all information on the internet is appropriate for students and they should be made aware of the dangers of access this information.

CONTENT FOCUS

Students will learn that they should have adult (parent) permission to use devices and that they should report inappropriate information that they may find to an adult.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating About Computing

(Content Statement aligns to Core Practice rather than specific Practice Statements.)