Ohio’s Model Curriculum for Computer Science

Grade 7

ADOPTED SEPT. 2022

Ohio | Department of Education

Strand	Computing Systems
Topic	**Devices**

CS.D.7.a Develop and implement a process to evaluate existing computing devices capabilities based on personal interaction with the device.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students learned about the internal components of a computer. By the end of 7th grade, students use prior knowledge to evaluate devices dependent upon personal needs. In future grades, students will be able to identify improvements to make for a computing device for better interactions with users.

IMPORTANT CONCEPTS

- Select and use appropriate hardware and software components.
- Create an evaluative process for existing devices.

KEY SKILL/PROCEDURES

- Compare similar applications to determine similarities and differences between the applications.

Content Elaborations

CLARIFICATIONS

Students will develop and make comparisons between similar apps and be able to communicate the benefits and limitations of each.

CONTENT FOCUS

Students can determine computing devices that are better fit for completing a task than others.

COMPUTER SCIENCE PRACTICES

Practice 1. Fostering an Inclusive Computing Culture

1. Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computation products.

Strand	Computing Systems
Topic	**Hardware/Software**

CS.HS.7.a Evaluate hardware and software combinations used to accomplish a task.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students looked at the ways hardware and software components come together to collect and exchange data. By the end of 7th grade, students use/simulate hardware and software components to accomplish a task. In future grades, students will make decisions on the use of hardware and software combinations to effectively complete a task.

IMPORTANT CONCEPTS

- Select and use/simulate appropriate hardware and software components to accomplish a task with guidance.

KEY SKILL/PROCEDURES

- Evaluate input devices and software to determine which combination(s) will produce a proper outcome based on a request.

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.

CONTENT FOCUS

Students can summarize the possible computing device(s) and software to use to produce an outcome based on a requirement provided.

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.7.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 can 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.
3. 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.7.a Explain the role of hardware components and diagram the infrastructure of networks and the internet (including cloud servers).

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed a very basic understanding of how devices are connected to the internet. By the end of 7th grade, students can diagram specific hardware components used to understand the flow of information across the hardware of the internet. In future grades, students will model specific hardware components in the infrastructure of the internet.

IMPORTANT CONCEPTS

- Multiple devices are required for data to flow on the internet.
- Devices connected to the internet must have an address.
- Each device has its role in the flow of data on the internet.
- Understanding the role of each device allows the student to diagram the flow of data from one location to another across the internet.
- Specific hardware used in networking includes routers and switches.

KEY SKILL/PROCEDURES

- Diagram how data travels through devices to get from one location on the internet to others.
- Explain the role of key hardware that makes up the internet.
- Use knowledge of key hardware to diagram how data might flow from one location to another across the internet.

Content Elaborations

CLARIFICATIONS

Students will be able to identify and diagram basic components (e.g., computer, router, server); students can draw lines to make connections of how information travels across the internet.

CONTENT FOCUS

Students will identify specific components used to transfer data 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	**Networking**
	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	Networks and the Internet
Topic	**Networking**

NI.N.7.b Explain the protocols (i.e., rules) and why they are used to transmit data across networks and the internet.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed a very basic understanding of how devices are connected to the internet. By the end of 7th grade, students can understand that different protocols are used for different types of data being transmitted between devices. In future grades, students will identify a wider range of protocols used in networking.

IMPORTANT CONCEPTS

- Protocols are used for websites, including http and https (usage not mechanics).
- Protocols are used for email, including POP3 and IMAP (usage not mechanics).

KEY SKILL/PROCEDURES

- Identify the purpose of protocols.
- Identify the need for protocols.
- Identify how different protocols are used in different situations (http and https).

Content Elaborations

CLARIFICATIONS

Protocols are rules that define how messages between computers are sent. They determine how quickly and securely information is transmitted across networks and the internet, as well as how to handle transmission errors.

CONTENT FOCUS

Students will understand the purpose of protocols and how they enable secure and errorless communication. Knowledge of the details of how specific protocols work is not expected.

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.7.a Identify and apply introductory methods of encryption to model the secure transmission of information.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed a general understanding that private information should be protected from malware threats. By the end of 7th grade, students understand that encryption can be used to protect information for the secure transmission of information. In future grades, students will understand physical measures to protect information.

IMPORTANT CONCEPTS

- Research the history of encryption.
- Introduce the concept of encryption and decryption of plaintext.
- Introduce the technique of Caesar shift (Each letter in the plaintext will be replaced by a letter with some fixed number of positions down the alphabet.)

KEY SKILL/PROCEDURES

- Create one's encryption method.
- Utilize the Caesar shift to decrypt information.

Content Elaborations

CLARIFICATIONS

Students can explain how encryption can protect the confidentiality of data. Students examine the modifications of different Caesar shift encryptions. In addition, students will create a pattern of encryption based on a Caesar shift and decrypt other students' work.

CONTENT FOCUS

Students will understand encryption effectively protects the confidentiality of data for using secure transmissions.

COMPUTER SCIENCE PRACTICES

Practice 7. Communicating about Computing

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

Practice 2. Collaborating Around Computing

1. Cultivating working relationships with individuals possessing diverse perspectives, skills and personalities.

Practice 3. Recognizing and Defining Computational Problems

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

Strand	Networks and the Internet
Topic	**Cybersecurity**

NI.C.7.b Describe the types of malware to show how malware affects information.

Expectations for Learning

LEARNING PROGRESSION
In previous grades, students developed a general understanding that private information should be protected from malware threats. By the end of 7th grade, students can identify additional types of malware that exist that threaten data security. In future grades, students will determine strategies to protect devices.

IMPORTANT CONCEPTS
- Obtain a general understanding of "what is ransomware?"
- Obtain a general understanding of "what is spyware?"

KEY SKILL/PROCEDURES
- Recognize malware has many forms.

Content Elaborations

CLARIFICATIONS
In this grade, students will understand malware has many forms and continues to be a challenge for cybersecurity.

CONTENT FOCUS
Students will understand malware is a cybersecurity threat to networks.

COMPUTER SCIENCE PRACTICES
Practice 7. Communicating about Computing

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

Practice 3. Recognizing and Defining Computational Problems
1. Identify complex, interdisciplinary, real-world problems that can be solved computationally.

Strand	Networks and the Internet
Topic	**Cybersecurity**

NI.C.7.c Identify cybersecurity concerns and measures needed to protect electronic information.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed a general understanding that private information should be protected from malware threats. By the end of 7th grade, students understand how information is protected and where it is needed. In future grades, students will learn about additional encryption algorithms.

IMPORTANT CONCEPTS

- Different protocols can be compared or contrasted (e.g., http versus https).

KEY SKILL/PROCEDURES

- Identify secure communication protocols across the internet.

Content Elaborations

CLARIFICATIONS

In this grade, students should be able to connect how encryption can protect data with https and understand where encryption is needed, such as online banking, versus where it is not, as in a simple online search.

CONTENT FOCUS

Students will understand the connection between encryption and https across the internet.

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	Networks and the Internet
Topic	**Internet of Things**

NI.IOT.7.a Explain the positive and negative impacts of IoT as it applies to daily life and create ways to mitigate the negative impacts on society.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students researched and defined how smart and intelligent devices were able to track their activities to be able to personalize the experience of utilizing the device. In grade 7, students will recognize the positive and negative impacts technology has on their daily lives, as well as the impact of technology on society as a whole.

IMPORTANT CONCEPTS

- Devices track our daily movements as well as our online activities to quickly deliver information that is pertinent to us.
- Data collected and stored has positive and negative effects.

KEY SKILLS/PROCEDURES

- List the positive and negative uses of IoT and discuss how it applies to our daily lives.
- Explain the benefits of the IoT, such as convenience, safety and health, and the risks, including data theft and other forms of criminality.

Content Elaborations

CLARIFICATIONS

On a personal level, IoT can provide great benefits such as home security, financial management, medical monitoring and treatment, home resource management and other valuable functions. At the same time, students should recognize that the data collected by our connected devices can be improperly or maliciously used.

CONTENT FOCUS

The same devices and information that can help us can also make us vulnerable.

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.

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.7.a Compare and contrast digital data collection tools to make them more useful and reliable.

Expectations for Learning

LEARNING PROGRESSION
In previous grades, students had the experience of identifying various data collection tools. By the end of 7th grade, students can determine the most appropriate tool(s) to use for data collection. In future grades, students will consistently choose appropriate file types.

IMPORTANT CONCEPTS
- Identify the strengths and weaknesses of various data collection tools.

KEY SKILL/PROCEDURES
- Select the appropriate tool for a particular data collection.

Content Elaborations

CLARIFICATIONS
Students will need to know the difference between data collection tools.

CONTENT FOCUS
Students can identify the method of data collection (for example, surveys versus sensor data). The method of data collection can affect the accuracy and precision of the data.
(K-12 Computer Science Framework, 2016)

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.7.b Evaluate various file formats to understand data storage capabilities.

Expectations for Learning

LEARNING PROGRESSION
In previous grades, students had limited experience in selecting and utilizing appropriate file types for various collections of text and data. By the end of 7th grade, students should be able to explain and utilize different types of file formats and explain the capacity limits of each file. In future grades, students will learn how data is stored on different computer systems.

IMPORTANT CONCEPTS
- The type of data file corresponds to the type of file format.
- Identify image and video file extensions and characteristics of file extensions including color, size and visual capabilities.
- When given an image or video, the student can identify the file format.

KEY SKILL/PROCEDURES
- Explain the differences in text and data files.
- Explain the differences in the quality of the image or video.
- Explain the type of file extension for various software.

Content Elaborations

CLARIFICATIONS
In addition to the Content Elaborations for DA.DCS.6.b, students need to be able to choose the correct image or video editing software tool for images and videos.

CONTENT FOCUS
Students can create videos of different file types such as wav, webm and mp4. Students should have experience with various file formats (e.g., .docx, .GDOC, .xlsx, GSHEET .pdf, .txt, .dat, .gif, .jpg, .tiff, .png, .bmp, .bpg, .avi, .mov, .mpeg, .mp4, and .wmv and other formats).

COMPUTER SCIENCE PRACTICES
Practice 2. Collaborating Around Computing
4. Evaluate and select technological tools that can be used to collaborate on a project.

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.7.c Create a logical file structure to organize data to support individual and collaborative work.	**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students had experience organizing, saving, accessing, and sharing files. By the end of 7th grade, students can understand a logical process for organizing data in folders and subfolders on the hard drive or the cloud. In future grades, students will be knowledgeable about the organization of files and how to properly share them with others. **IMPORTANT CONCEPTS** • Files should be placed in a given organizational system. **KEY SKILL/PROCEDURES** • Explain that files should be separated based on content into folders and subfolders. **Content Elaborations** **CLARIFICATIONS** Students need to be able to create their logical file structure. **CONTENT FOCUS** Students understand the importance of organizing their files. Create and utilize shortcuts to their file system (on the desktop, create a shortcut to a file system). **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.7.a Communicate relations between data sets to interpret results.	**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students made connections between data sets. By the end of 7th grade, students can explain relationships in data models and suggest patterns. Data visualization includes visual, auditory, tactile, oral and other sensory representations. In future grades, students will be able to utilize raw data and develop models. **IMPORTANT CONCEPTS** • Data models are used to explain and make predictions. **KEY SKILL/PROCEDURES** • Suggest patterns by comparing data in the models. • Explain the suggested patterns in verbal or written form. **Content Elaborations** **CLARIFICATIONS** Given a pair of data models (e.g., graphs, charts), students will identify relationships between the two and suggest patterns that are evident in both models to tell the story about what the models are saying. **CONTENT FOCUS** Students will read two or more data models to find relationships and list patterns they see that make sense of the data. Students should be able to do this using a variety of types of models. **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.7.b Create a spreadsheet utilizing formulas, functions and graphs to represent and analyze data.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience observing graphs created from spreadsheets. By the end of 7th grade, students can use formulas and functions in a spreadsheet to answer questions and draw conclusions. In future grades, students will use formulas and functions that help represent collections of data.

IMPORTANT CONCEPTS

- Formulas and functions are used to create meaning from a set of data.

KEY SKILL/PROCEDURES

- Utilize the formulas and basic functions of a spreadsheet.

Content Elaborations

CLARIFICATIONS

Given a data set, students will use functions and formulas to make conclusions. (e.g. Given raw data about the number and type of pets that their peers own, students will find the average number of pets per family, etc.)

CONTENT FOCUS

Students will be able to use sum, average, min, max and count formulas and functions in a spreadsheet.

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.

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.7.a Create and analyze models and simulations to accurately hypothesize a real-world situation.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students should have had experience analyzing data models (e.g., charts, graphs). By the end of 7th grade, students are able to provide evidence to support or refute a hypothesis (prediction) about a collection of data. In future grades, students will be able to hypothesize about self-generated data.

IMPORTANT CONCEPTS

- Develop a hypothesis for a problem and then determine if the data trend supports the hypothesis.

KEY SKILL/PROCEDURES

- Given a problem statement, create a hypothesis (prediction), collect data (e.g., survey results), interpret data trends and compare these interpretations to the hypothesis.
- Research data trends.

Content Elaborations

CLARIFICATIONS

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

CONTENT FOCUS

Students will research and find information that exemplifies data trends.

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.7.a Select and modify pseudocode for a multi-step process to solve a problem.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students should have developed a basic understanding of what goes into an algorithm and learned how to write pseudocode. As students create an algorithm, they should be able to evaluate the solution and make modifications in their pseudocode to solve the problem. At the end of 7th grade, students should be able to identify the parts of a program's pseudocode (input, output, decisions). In future grades, students will write their own pseudocode and be able to justify the most efficient solution for a multi-step process.

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.
- Use proper symbols to create flow charts to represent pseudocode.

Content Elaborations

CLARIFICATIONS

Students should be able to write pseudocode to model an algorithm. This could be writing a recipe for making a sandwich, writing directions between two locations, or writing the steps necessary to compute a semester grade. At this level, the expectation is that looping is done utilizing iteration, not recursion.

CONTENT FOCUS

Students should be able to identify the inputs, outputs, and decision steps within the algorithms they create in pseudocode. Students should be able to create a flow chart representation of their pseudocode, using proper symbols for inputs, outputs and decisions.

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts

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

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	**Algorithms**
	Practice 4. Developing and Using Abstractions 4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes. *Practice 5.* Creating Computational Artifacts 3. Modify an existing artifact to improve or customize it.

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

ATP.VDR.7.a Use test cases to trace variable values to determine the result.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students developed an understanding of what it means to vary (as opposed to being constant) and that this abstract value is expressed with an alphanumeric representation. By the end of 7th grade, students understand how to use variables in a test case. 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 the top and low range of values that will successfully run a solution.
- Identify out of bound values.

KEY SKILL/PROCEDURES

- Use Input /output charts.

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 will be able to identify variables and choose appropriate test values for each variable. Students will be able to identify "good" vs. "bad" input values for variables by tracking results on an input/output chart while running test cases.

COMPUTER SCIENCE PRACTICES

Practice 6. Testing and Refining Computational Artifacts

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

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 Structures**

ATP.CS.7.a Use and apply decisions and loops in a program to solve a problem.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students need to have learned how to create and utilize self-descriptive variables. Students also need to have learned to identify simple conditionals and loops and to trace the processes. At the end of 7th grade, students understand and incorporate proper processes, loops and conditionals in programs to solve problems. In future grades, students will understand that variables have different storage requirements and restrictions, and can choose the correct one to use for a task. Students will use parameters to pass variable information into methods and return values to get information out of a method. Students will be introduced to the scope and how a program can access or change a variable.

IMPORTANT CONCEPTS

- Utilize and apply the decision structures properly in an algorithm.
- Utilize and apply the loop structures properly in an algorithm.

KEY SKILL/PROCEDURES

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

Content Elaborations

CLARIFICATIONS

Conditional statements can have varying levels of complexity, including compound and nested conditionals. Compound conditionals combine two or more conditions in a logical relationship, and nesting conditionals within one another allow the result of one conditional to lead to another being evaluated. 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. Different types of control structures can be combined, such as loops and conditionals. Different types of programming languages implement control structures in different ways. For example, functional programming languages implement repetition using recursive function calls instead of loops. At this level, understanding implementation in multiple languages is not essential. (K-12 Computer Science Framework, 2016)

Strand	Algorithmic Thinking and Programming
Topic	**Control Structures**
	CONTENT FOCUS Students will identify and create compound conditional statements, such as the one described by first choosing the weather: if sunny, then will you go running or biking; else if rainy, will you read or watch TV. Then, the student should include nesting conditions and looping (e.g., Input an integer and if it is even, print a row of "E"s; if it is odd, print a column of "O"s.) **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.

Strand	Algorithmic Thinking and Programming
Topic	**Modularity**

ATP.M.7.a Decompose problems into parts to facilitate the design, implementation and review of increasingly complex programs.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience decomposing an event, experience or problem. For example, to create a mural or draw a scene, several "parts" must be chosen first (the background, the characters placed, the action programmed). By the end of 7th grade, students can identify and utilize the procedures/modules within a set of instructions or code. Students should also be able to reuse the modules in new problem sets or coding. In future grades, students will be able to utilize the procedures/modules within a set of complex 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.
- Reuse the smaller components of the program (modules) in new problem situations.

KEY SKILL/PROCEDURES

- Group and organize steps that work together to produce a result.
- When provided with a result, identify the steps that were used.
- Reuse the identified module/procedure (organized set of steps) in a new problem situation.

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 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 be able to utilize modules to increase the organization of code, the ability to hide details and the reusability.

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. 3. Evaluate whether it is appropriate and feasible to solve a problem computationally. *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.7.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 use parameters in a block-based programming. By the end of 7th grade, students begin the transition to text-based coding in order to design and create their own project or to solve a problem. They should use procedures that require parameters. In future grades, students will design and create their own text-based programs.

IMPORTANT CONCEPTS

- Write code to solve a problem using programming software that will transition them from block-based to text-based programming.

KEY SKILL/PROCEDURES

- Explore programming with software that is intended to transition students from block-based to text-based code.
- Use procedures containing parameters.

Content Elaborations

CLARIFICATIONS

A transitional programming language will help the student convert to text-based coding. This transitional software will still hide some of the details of coding, automatically fix a few typographical errors, but will allow students to define variables and create control structures.

CONTENT FOCUS

Students should be able to define variables, implement control structures (loops, if/then/else) and use procedures containing variables.

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, 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
	Career Connections **CAREER EXPLORATION** Students explore careers in coding like computer programming, as well as those careers that support creative professions such as filmmaker, podcaster, digital imaging specialist and other creative professions. Students present or create an artifact showing their learning.

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

ATP.PD.7.b Test, trace and debug to refine code.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students identified and corrected errors in block-based code to make the program run correctly and produce the expected result. By the end of 7th grade, students can identify and correct two types of errors (run-time and logical) when using a transitional programming language. In future grades, students will continue to refine their programs using a range of text cases.

IMPORTANT CONCEPTS

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

KEY SKILL/PROCEDURES

- Use troubleshooting techniques to debug the code.
- Debug one's code.

Content Elaborations

CLARIFICATIONS

Students need to understand that errors often occur when writing code and some of those errors can only be found by verifying that the output is correct. Many transitional programming languages have built-in features to help students identify and correct errors.

CONTENT FOCUS

Students will be able to differentiate between run-time (when a program crashes) and logical (when the results are incorrect) errors and then correct those errors.

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	Algorithmic Thinking and Programming
Topic	**Program Development**

ATP.PD.7.c Identify procedures that utilize parameters.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experience using procedures with parameters in block-based coding. For example, there might be a procedure called "move _steps" where the amount of steps is a parameter. By the end of 7th grade, students continue this experience and extend it in a transitional programming language. They are also comfortable with procedures and parameters. In future grades, students will expand their experience with parameters.

IMPORTANT CONCEPTS

- Identify and utilize a procedure and its parameters needed to solve a solution in a transitional text-based programming language.

KEY SKILL/PROCEDURES

- Implement a given procedure and use appropriate values for the parameters in a transitional text-based programming language.

Content Elaborations

CLARIFICATIONS

At this level, it is appropriate to have students implement canned procedures with parameters in both block-based and text-based programming languages. Examples of procedures for block-based programming languages are: switch costume to ___, go to x:__ y:__, say _ for _ secs. Examples of procedures for text-based languages are: pam.turnLeft(), pam.waddle(), pam.isFish(here), pam.isWater(right).
These procedures are canned methods which students implement. Students are not expected to write procedures with return types (methods, functions) from scratch; they are expected to be able to implement them with correct values for the required parameters.

CONTENT FOCUS

Students will understand how to implement canned procedures (methods) with proper parameter values in a text-based programming language.

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	Natural Interactions

AI.NI.7.a Curate a data set to train a language processing algorithm to create a program that incorporates voice commands.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students individually and collaboratively compared language processing algorithms to solve a problem based on given criteria. In grade 8, students will create a program, individually and collaboratively, that implements a language processing algorithm to create a functioning chatbot.

IMPORTANT CONCEPTS

- Describe a situation in which voice commands would be used.
- Determine what voice commands a program should be able to understand and the reasons for the chosen commands.
- Explain the process of making language processing algorithms more accurate.
- Explain where data sets for language processing algorithms come from.

KEY SKILLS/PROCEDURES

- Students will be able to identify applications of voice commands to determine what algorithm will work best for a given set of data.
- Students will be able to develop a data set to train a language processing program.
- Students will be able to train a language processing algorithm to recognize a data set of voice commands to complete a task or problem.

Content Elaborations

CLARIFICATIONS

Voice command is a conversational Artificial Intelligence (AI) tool that uses voice commands to receive and interpret directives.

CONTENT FOCUS

For a language processing algorithm to function accurately, it needs to be trained on a set of data that will give the desired outcome to the user. Data sets need to be as thorough as possible to ensure accuracy, so more data will yield better results for the language processing algorithm in practice.

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.

Strand	Artificial Intelligence
Topic	**Natural Interactions**

AI.NI.7.b Identify the components of a chatbot and explain how each component contributes to the chatbot's human-like responses.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students identified and described how computers mimic human behavior to better serve humans. In grade 8, students will critically analyze and discuss features that make an entity "intelligent," including discussing differences between human, animal and machine intelligence to identify how machine intelligence varies from natural intelligence.

IMPORTANT CONCEPTS

- List the components of a chatbot.
- Explain the function of each component of a chatbot.
- Explain how chatbot components function together to create a human-like response.

KEY SKILLS/PROCEDURES

- Students will be able to identify and describe the components of a chatbot and how they function independently and collaboratively to mimic human behavior.

Content Elaborations

CLARIFICATIONS

Chatbot components include (not exhaustive): question and answer system; environment (natural language processing); front-end systems (the part the users see and use); traffic servers (determines where information should go, e.g., response goes to front-end system); custom integrations (how it works with other programs like calendars, placing orders, taking payments, etc.)

CONTENT FOCUS

Chatbots have a core set of components that are required for them to function and respond in a human-like manner. Some chatbots have additional components that make their responses more human-like and add layers of problem-solving to the response.

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	**Perception**

AI.P.7.a Give examples of how intelligent agents combine information from multiple sensors to react to an input.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students learned about the different types of computer perception, how computer perception can extract meaning from sensory signals and how humans combine information from multiple modalities. In grade 8, students will explain how sounds and images are represented digitally on a computer.

IMPORTANT CONCEPTS

- Describe the types of information an intelligent agent gathers from its sensors.
- Explain the process of putting sensory data together to help the intelligent agent.
- Describe the types of input an intelligent agent would react to.

KEY SKILLS/PROCEDURES

- Students will be able to identify different types of sensory data and how it combines.
- Students will be able to identify how intelligent agents use sensory data.
- Students will be able to explain how an input starts a reaction with an intelligent agent.

Content Elaborations

CLARIFICATIONS

An intelligent agent is anything that perceives its environment and can take action on an input. It may react to sensory input and learn from it over time to improve reactions.

CONTENT FOCUS

Students study how combining sensory data helps an intelligent agent react to an input.

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.

Strand	Artificial Intelligence
Topic	**Perception**

AI.P.7.b Describe how edge detectors can be composed to form more complex feature detectors, e.g., for letters or shapes.

Expectations for Learning

LEARNING PROGRESSION

In lower grades, students illustrate how the outlines of partially occluded objects in an image differ from the real shapes of objects. In grade 7, students will describe how edge detectors can be composed to form more complex feature detectors. In high school, students will demonstrate how perceptual reasoning at a higher level of abstraction draws upon earlier, lower levels of abstraction.

IMPORTANT CONCEPTS

- Describe how edge detectors can be used to form letters.
- Describe how edge detectors can be used to form shapes.
- Explore more complex feature detectors.

KEY SKILLS/PROCEDURES

- Students will be able to identify edge detectors and their uses.
- Students will be able to identify the functions of edge detectors.

Content Elaborations

CLARIFICATIONS

The progression from signal to meaning takes place in stages, with increasingly complex features extracted at each stage.

CONTENT FOCUS

Students can try detecting an "A" by looking for a combination of three oriented edges. Edges are detected by looking at pixels.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

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

Strand	Artificial Intelligence
Topic	**Perception**

AI.P.7.c Illustrate the concept of feature extraction from images by simulating an edge detector.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students learned how to classify an image and describe the kind of knowledge a computer would need to understand scenes. In grade 8, students will illustrate how sequences of words can be recognized as phrases by looking at how the words fit together.

IMPORTANT CONCEPTS

- Explain situations that vision would be required to solve a problem.
- Describe the function of an edge detector and explain how it works.
- Explain how an edge detection can help with feature extraction from an image.

KEY SKILLS/PROCEDURES

- Students will be able to simulate an edge detector through online or offline activities utilizing pixels and grids.
- Students will be able to explain how an edge detector aids in feature extraction from images and create a visualization of the process.

Content Elaborations

CLARIFICATIONS

Feature extraction is a transformation of input data into a set of features. Edge detection is the process of determining which pixels are the edge pixels.

CONTENT FOCUS

Students explore how a program determines where the edges of a feature in an image are located and how it is used to extract features.

COMPUTER SCIENCE PRACTICES

Practice 4. Developing and Using Abstractions

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

Strand	Artificial Intelligence
Topic	Representation & Reasoning

AI.RR.7.a Compare several algorithms that could be used to solve a specific type of reasoning problem.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students illustrated 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. In grade 8, students model the process of solving a graph search problem using breadth-first search to draw a search tree.

IMPORTANT CONCEPTS

- Describe and explain algorithms students encounter daily and the problems the algorithm solving.

KEY SKILLS/PROCEDURES

- Students will be able to identify types of algorithms by name, describe what each one does and give an example of how it used.
- Students will be able to select one or more algorithms to solve a specific type of reason problem and explain why the chosen algorithms would solve that problem.

Content Elaborations

CLARIFICATIONS

Types of algorithms (not exhaustive):

- Brute Force Algorithm
- Recursive Algorithm
- Dynamic Programming Algorithm
- Divide and Conquer Algorithm
- Greedy Algorithm
- Backtracking Algorithm
- Randomized Algorithm

CONTENT FOCUS

Algorithms are used to solve problems and specific ones work better than others as solutions.

Strand	Artificial Intelligence
Topic	**Representation & Reasoning**
	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. 3. Modify an existing artifact to improve or customize it.

Strand	Artificial Intelligence
Topic	Machine Learning

AI.ML.7.a Model how unsupervised learning finds patterns in unlabeled data to identify how machine learning takes place.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students contrasted the unique characteristics of human learning with the ways machine learning systems operate to identify the limitations of machine learning. In grade 8, students will train a classification or prediction model using machine learning on a tabular data set to evaluate the quality of the data set.

IMPORTANT CONCEPTS

- A classification model is the process of finding a good model that describes the data classes or concepts, The purpose of classification is to predict the class of objects whose class label is unknown.
- A prediction model identifies or predicts the missing or unavailable data for a new observation based on the previous data and based on the future assumptions. In prediction, the output is a continuous value; tabular data set: a collection of rows and columns.

KEY SKILLS/PROCEDURES

- Explain the difference between a classification and a prediction model.
- Discuss how the same tabular data set can create different results when run through a classification model vs. a prediction model.
- Be able to judge the quality of a data set once a model has been run, including and discussing strategies for improving your data set.

Content Elaborations

CLARIFICATIONS

Machine learning models have specific applications based on the desired outcome of a given data set. Classification models sort a data set into groups of similar data (e.g., grouping students by interest in specific sports) vs. Prediction models create a prediction based on previous data to take a new data set and predict where it will go or do (e.g., predicting a student's lunch order based on their previous orders.)

CONTENT FOCUS

Different t ypes of machine learning can produce different outcomes.

Strand	Artificial Intelligence
Topic	**Machine Learning**
	COMPUTER SCIENCE PRACTICES *Practice 4.* Developing and Using Abstractions. Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity. By the end of Grade 12, students should be able to: 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. 4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.
AI.ML.7.b Create a data set for training a decision tree classifier or predictor to explore the impact that different feature encodings have on the decision tree.	**Expectations for Learning** **LEARNING PROGRESSION** In grade 6, students created a labeled data set with explicit features of several types. In grade 8, students will compare the features of two real-world data sets. **IMPORTANT CONCEPTS** • Classifier • Feature Types • Decision Tree classifiers • Nodes **KEY SKILLS/PROCEDURES** • Students will create a data set. • Students will choose different features to include. • Students will explore the impact of different feature encodings. **Content Elaborations** **CLARIFICATIONS** The choice of features to include, and the best encoding to use for these features, depends on the reasoning problem being solved.

Strand	Artificial Intelligence
Topic	**Machine Learning**
	CONTENT FOCUS At each node of the decision tree, the learning algorithm tries to pick a feature that will be most helpful in separating the remaining instances into different classes. Features that do not correlate strongly with any class will not be chosen. **COMPUTER SCIENCE PRACTICES** *Practice 4.* Developing and Using Abstractions. Abstractions are formed by identifying patterns and extracting common features from specific examples to create generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity. By the end of Grade 12, students should be able to: 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. 4. Model phenomena and processes and simulate systems to understand and evaluate potential outcomes.

Strand	Artificial Intelligence
Topic	Societal Impacts

AI.SI.7.a Identify and explain the effect training data has on the accuracy of an artificial intelligence system to uncover bias in training data.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students identified and explained how humans have agency in curating training data sets to identify bias in machine learning. In grade 8, students will identify and explain how the composition of training data affects the outcome of supervised artificial intelligence system to identify bias in future data sets.

IMPORTANT CONCEPTS

- Describe the effects of training data on the accuracy of an Artificial Intelligence (AI) system.
- Discuss how the effects of training data might be used to determine if an AI system is biased/accurate.

KEY SKILLS/PROCEDURES

- Students will be able to identify and explain the effect of training data on an AI system.
- Students will be able to explain how the effect of training data on an AI system can help uncover bias in the training data.
- Students will be able to come up with strategies to create a more accurate and bias-free data set.

Content Elaborations

CLARIFICATIONS

Bias (in machine learning) is the 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. Strategies for avoiding bias in data sets include 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.7.b Identify and explain the problems of classification in the supervised artificial intelligence context to create data sets that are inclusive and accurate.

Expectations for Learning

LEARNING PROGRESSION

In grade 6, students identified and explained how algorithmic bias impacts artificial intelligence systems to prevent bias in future data sets. In grade 8, students will identify bias potential in the design of artificial intelligence systems and describe how to utilize inclusive Artificial Intelligence (AI) design to prevent algorithmic bias.

IMPORTANT CONCEPTS

- Explain how classification in a data set can create problems in supervised AI systems.
- Explain how data sets can be developed that are inclusive and accurate by improving classification.

KEY SKILLS/PROCEDURES

- Students will be able to explain how classification works in a data set and how it is used in a supervised AI system.
- Students will be able to develop strategies for creating inclusive and accurate data sets using classification.

Content Elaborations

CLARIFICATIONS

Classification means identifying shared characteristics of certain classes in a data set.

CONTENT FOCUS

Classification of data sets can create an algorithmic bias if the data are not complete, balanced, selected or labeled appropriately. Ensuring classes represent as many possible data points as possible is one means of creating a more inclusive and accurate data set to mitigate algorithmic bias in AI.

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.7.a Compare current technologies from the present to the past to evaluate the effect on people's everyday activities.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students should have become familiar with how we communicate via technology in today's world. At the end of grade 7, students study the history of computing and technology, including cultural differences, and develop a better understanding of the advancement of computing and its global impact. In future grades, students will study how current technologies affect the economy.

IMPORTANT CONCEPTS

- Examine the change in communication and collaboration styles.
- Review the history of computing and technology to understand diversity.
- Examine the change in technology skills and tools that are required for the workforce.

KEY SKILL/PROCEDURES

- Communicate via school technology with one's family, class and teacher.
- Trace the advancement of computing and indicate where globally the advancement has occurred.

Content Elaborations

CLARIFICATIONS

Students need to understand how today's technology has increased the amount and speed of information that can be accessed and shared. Students can safely experience this phenomenon through technology provided by their school and/or in their classroom. Students should be able to demonstrate/illustrate the basic timeline of the advancement of computing.

CONTENT FOCUS

Students can compare how a task was accomplished in the past and compare it to how the task is accomplished now, emphasizing how technology has impacted the change.

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.7.b Evaluate various technologies to identify issues of bias and accessibility.

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 7th grade, students can identify technologies that have bias and accessibility issues for many areas of the world. There are still areas of the world and individuals who do not have the same access. In future grades, students will propose guidelines to positively impact bias and accessibility.

IMPORTANT CONCEPTS

- Computing makes all aspects of our lives more efficient. It gives us the opportunity to communicate on a global scale.
- Bias and accessibility within technology include third world countries, equity, socio-economic status, and persons with disabilities.

KEY SKILL/PROCEDURES

- Explain that access is important for everyone regardless of their socioeconomic status, disability or geographic location.
- Research the issue of accessibility, identify some of the technologies with this issue and report their 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 and identify access 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 identify the technology bias and accessibility issues that many people have globally.

CONTENT FOCUS

Students will determine appropriate technologies for making computing accessible to all. Through research, students will identify a particular need and then determine the appropriate technology or adaptation.

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.7.c Identify and explore careers related to the field of computer science.		**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students had experience using technology on personal and/or school devices. They had classroom conversations about a few computer science employment opportunities. At the end of 7th grade, students understand that there are many different people and jobs involved in creating the technology that they utilize and this fact equates to numerous jobs in the computer science fields. In future grades, students will evaluate how new technologies and professions will solve real-world problems. **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. • The ever-evolving area of computing will create jobs that do not exist today. **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 is an integral part of all industries and world culture. **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.7.d Explain how computing impacts innovation in other fields.

Expectations for Learning

LEARNING PROGRESSION

In previous grades, students had experiences utilizing several different mediums of technology, such as email, shared school documents, electronic grade books and research on the internet. By the end of 7th grade, students should be able to identify both the positive and negative impact that computing has had in other fields (e.g., robotics in manufacturing, virtual meetings, medical advances). In future grades, students will evaluate how new technologies and professions will solve real-world problems.

IMPORTANT CONCEPTS

- The communication, computation, and connection opportunities provided by computing technologies have provided a wave of innovation in other fields.
- Due to the current data processing, networking and computational abilities of computers, we are now able to accomplish things that we had never dreamed possible.

KEY SKILL/PROCEDURES

- Identify areas where the benefits of computing technology could be applied to other fields to make them more efficient and/or successful.

Content Elaborations

CLARIFICATIONS

The big idea here is that computing applies to a wide variety of fields. Students should be allowed to make connections between computing technologies and how they could impact and continue to improve people's lives.

CONTENT FOCUS

Students should have the ability to identify current computing innovations and explore the relationship of how those innovations both positively and negatively affect various careers and other fields of study. Students should study how computing can relate to a variety of careers and explain the advantages and disadvantages of current technologies.

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.

Strand	Impacts of Computing
Topic	**Social Interactions**

IC.SI.7.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 had continual conversations with teachers about the proper use of electronic devices whenever there was a lesson that involved use of a computing device. In 7th grade, students explore the global, economic, political, business and cultural effects a little more deeply. In future grades, interpersonal use of devices should be a continual conversation and not contained to this single strand.

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 of 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.7.a Describe tradeoffs between allowing information to be public and keeping information private and secure to inform decision-making.

IC.SLE.7.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 and had lessons/teacher conversations about information sharing. By the end of 7th grade, students understand and can explain 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, birth date, social security number, financial information).
- Be familiar with some of the "attacks" made by third parties trying to misuse private information.
- Identify the consequences of providing misinformation.

KEY SKILL/PROCEDURES

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

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)

Strand	Impacts of Computing
Topic	**Safety, Law and Ethics**
	CONTENT FOCUS Students will be able to identify and understand what information is considered to be personal (e.g., address, phone number, birth date, social security number, financial information) vs. public. 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. Students will additionally be able to understand how the release or sharing of personal information can publicly harm their livelihood or others. **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.7.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 7th grade, students can 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 on 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.

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	**Safety, Law and Ethics**	
	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.7.d Provide appropriate credit when using resources or artifacts that are not our own.	**Expectations for Learning** **LEARNING PROGRESSION** In previous grades, students had some experience creating original work that may include code, text, video or graphics and had discussions on citing/providing credit to any sources that were copied/inserted into their work. By the end of 7th 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 you represent someone else's work as your 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 their 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 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.
IC.SLE.7.e Explain the connection between the longevity of data on the internet, personal online identity and personal privacy.	**Expectations for** Learning **LEARNING PROGRESSION** In previous grades, students should have had experience using the internet, school email, school electronic communication and an electronic grade book. Students should have also learned to differentiate between appropriate and inappropriate websites and behavior on the internet and social media. By the end of 7th grade, students understand the tracking that is done while they are electronically communicating and the fact that they leave a "digital footprint." In future grades, students will be able to apply these concepts. **IMPORTANT CONCEPTS** • Identify the type of information contained in a "digital footprint." **KEY SKILL/PROCEDURES** • Identify the data points accessed by apps on a phone (e.g., email, location, phone number, call logs, calendar events). • Identify online tracking with websites, cookies, cross-device tracking, passwords and hotspots.

Strand	Impacts of Computing
Topic	Safety, Law and Ethics
	Content Elaborations **CLARIFICATIONS** As students access the internet and search online, whether it is via apps on their phones or a web browser on a computing device, they are providing information about themselves. These pieces of information can be equated to puzzle pieces where more pieces are needed to complete the picture. Computing devices (e.g., through web browsers and phone apps) collect these puzzle pieces to form this complete picture. Students need to be aware of this "digital footprint" that is being collected about them, and they need to investigate strategies to reduce this footprint. **CONTENT FOCUS** Students should focus on the contents of their digital footprint and what information they leave behind about themselves on the internet. **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.