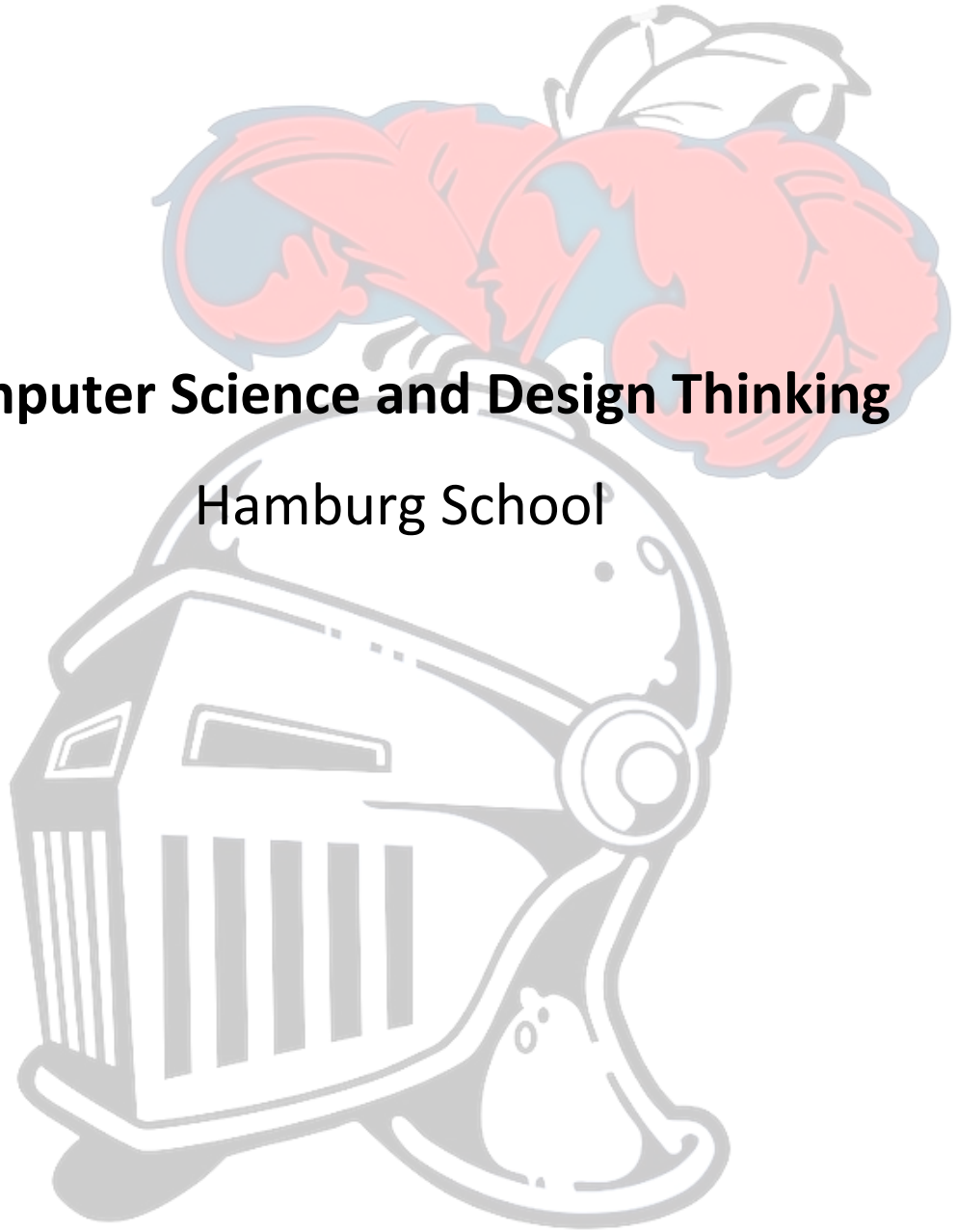
# Computer Science and Design Thinking

Hamburg School



CONTENT

## Rationale

Hamburg students need to understand the incorporation of computing technologies and computational-design thinking into daily life. The support of students' knowledge of the ethics and social responsibility of computers and how they impact society requires that educators develop these sensibilities. Computer Science and Design Thinking has become prominent in most aspects of modern life and in most career choices. As such, it is a fundamental curriculum requirement within schools. Computer Science and Design Thinking promotes students' development as global minded people in a technology infused world.

## Mission

Computer Science and Design Thinking classes support a foundation for students to succeed in today's society. As well, the education will build skills to provide high quality, equitable, and standards-based computer science and technology education.

## Vision

All students have equitable access to a rigorous computer science and design thinking education. Students will benefit from opportunities to engage in high-quality technology programs that foster their ability to:

- develop and apply computational and design thinking to address real-world problems and design creative solutions;
- engage as collaborators, innovators, and entrepreneurs on a clear pathway to success through postsecondary education and careers;
- navigate the dynamic digital landscape to become healthy, productive, 21st century global-minded individuals; and
- participate in an inclusive and diverse computing culture that appreciates and incorporates perspectives from people of different genders, ethnicities, and abilities.

**Coding of Performance Expectations**

To promote a unified vision of the NJSLS-CSDT, an abbreviated form of the disciplinary concepts is included in the alphanumeric code. The disciplinary concepts are abbreviated as follows:

- Computing Systems (CS)
- Networks and the Internet (NI)
- Impacts of Computing (IC)
- Data & Analysis (DA)
- Algorithms & Programming (AP)
- Engineering Design (ED)
- Interaction of Technology and Humans (ITH)
- Nature of Technology (NT)
- Effects of Technology on the Natural World (ETW)
- Ethics & Culture (EC)

The performance expectation alphanumeric code should be interpreted as follows (e.g., 8.1.2.NI.1):

| 8.1 | or 8.2 | 2 | NI | 1 |
|---|---|---|---|---|
| Standard number | | By the end of grade | Disciplinary Concept | Performance Expectation |

**PACING GUIDE**

| **By the end of Grade:** | **2** | **5** | **8** |
|---|---|---|---|
| Computing Systems | 5 | 5 | 5 |
| Networks and the Internet | 3 | 2 | 2 |
| Impacts of Computing | 3 | 2 | 2 |
| Data & Analysis | 4 | 5 | 5 |
| Algorithms and Programming | 4 | 5 | 5 |
| Engineering Design | 2 | 2 | 2 |
| Interaction of technology and Humans | 2 | 2 | 3 |
| Nature of Technology | 2 | 2 | 1 |
| Effects of Technology on the Natural World | 2 | 2 | 2 |
| Ethics & Culture | 1 | 1 | 1 |

**Computer Science and Design Thinking Practices**

The practices describe the behaviors and ways of thinking that computationally literate students use to fully engage in today's data-rich and interconnected world. Computational thinking is at the heart of the practices and refers to the thought processes involved in expressing solutions as computational steps that can be carried out by a computer. It requires understanding the capabilities of computers, formulating problems addressed by a computer, and designing algorithms that a computer can execute. Curriculum writers and educators will want to consider how they can design learning experiences that will enable their students to develop these skills in conjunction with the content knowledge reflected in the core ideas and performance expectations.

| PRACTICE | Description |
|---|---|
| **Fostering an Inclusive Computing and Design Culture** | Building an inclusive and diverse computing culture requires strategies for incorporating perspectives from people of different genders, ethnicities, and abilities. Incorporating these perspectives involves understanding the personal, ethical, social, economic, and cultural contexts in which people operate. Considering the needs of diverse users during the design process is essential to producing inclusive computational products. When engaging in this practice, students<br>• Include the unique perspectives of others and reflect on one's own perspectives when designing and developing computational product;<br>• Address the needs of diverse end users during the design process to produce artifacts with broad accessibility and usability;<br>• Employ self- and peer-advocacy to address bias in interactions, product design, and development methods. |
| **Collaborating Around Computing and Design** | Collaborative computing is the process of performing a computational task by working on pairs in teams. Because it involves asking for the contributions and feedback of others, effective collaboration can lead to better outcomes than working independently. Collaboration requires individuals to navigate and incorporate diverse perspectives, conflicting ideas, disparate skills, and distinct personalities. Students should use collaborative tools to effectively work together and to create complex artifacts. When engaging in this practice, students<br>• Cultivate working relationships with individuals possessing diverse perspectives, skills, and personalities;<br>• Create team norms, expectations, and equitable workloads to increase efficiency and effectiveness;<br>• Solicit and incorporate feedback from, and provide constructive feedback to, team members and other stakeholders. Evaluate and select technological tools that can be used to collaborate on a project |
| **Recognizing and Defining Computational Problems** | The ability to recognize appropriate and worthwhile opportunities to apply computation is a skill that develops over time and is central to computing. Solving a problem with a computational approach requires defining the problem, breaking it down into parts, and evaluating each part to determine whether a computational solution is appropriate. When engaging in this practice, students<br>• Identify complex, interdisciplinary, real-world problems that can be solved computationally;<br>• Decompose complex real-world problems into manageable sub-problems that could integrate existing solutions or procedures;<br>• Evaluate whether it is appropriate and feasible to solve a problem computationally. |
| **Developing and** | Abstractions are formed by identifying patterns and extracting common features from specific examples in order to create |

| | |
|---|---|
| **Using Abstractions** | generalizations. Using generalized solutions and parts of solutions designed for broad reuse simplifies the development process by managing complexity. When engaging in this practice, students<br>• Extract common features from a set of interrelated processes or complex phenomena;<br>• Evaluate existing technological functionalities and incorporate them into new designs;<br>• Create modules and develop points of interaction that can apply to multiple situations and reduce complexity;<br>• Model phenomena and processes and simulate systems to understand and evaluate potential outcomes. |
| **Creating Computational Artifacts** | The process of developing computational artifacts embraces both creative expression and the exploration of ideas to create prototypes and solve computational problems. Students create artifacts that are personally relevant or beneficial to their community and beyond. Computational artifacts can be created by combining and modifying existing artifacts or by developing new artifacts. Examples of computational artifacts include programs, simulations, visualizations, digital animations, robotic systems, and apps. When engaging in this practice, students<br>• 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;<br>• Create a computational artifact for practical intent, personal expression, or to address a societal issue;<br>• Modify an existing artifact to improve or customize it. |
| **Testing and Refining Computational Artifacts** | Testing and refinement is the deliberate and iterative process of improving a computational artifact. This process includes debugging (identifying and fixing errors) and comparing actual outcomes to intended outcomes. Students also respond to the changing needs and expectations of end users and improve the performance, reliability, usability, and accessibility of artifacts. When engaging in this practice, students<br>• Systematically test computational artifacts by considering all scenarios and using test cases;<br>• Identify and fix errors using a systematic process;<br>• Evaluate and refine a computational artifact, multiple times, to enhance its performance, reliability, usability, and accessibility. |
| **Communicating About Computing and Design** | Communication involves personal expression and exchanging ideas with others. In computer science, students communicate with diverse audiences about the use and effects of computation and the appropriateness of computational choices. Students write clear comments, document their work, and communicate their ideas through multiple forms of media. Clear communication includes using precise language and carefully considering possible audiences. When engaging in this practice, students<br>• Select, organize, and interpret large data sets from multiple sources to support a claim;<br>• Describe, justify, and document computational and/or design processes and solutions using appropriate terminology consistent with the intended audience and purpose;<br>• Articulate ideas responsibly by observing intellectual property rights and giving appropriate attribution. |

**Disciplinary Concepts and Core Ideas by the end of Grade 2**

| | |
|---|---|
| **Computing Systems** | • Individuals use computing devices to perform a variety of tasks accurately and quickly. Computing devices interpret and follow the instructions they are given literally.<br>• A computing system is composed of software and hardware.<br>• Describing a problem is the first step toward finding a solution when computing systems do not work as expected. |
| **Networks and the Internet** | • Computer networks can be used to connect individuals to other individuals, places, information, and ideas. The Internet enables individuals to connect with others worldwide.<br>• Connecting devices to a network or the Internet provides great benefits, but care must be taken to use authentication measures, such as strong passwords, to protect devices and information from unauthorized access. |
| **Impacts of Computing** | Computing technology has positively and negatively changed the way individuals live and work (e.g., entertainment, communication, productivity tools). |
| **Data and Analysis** | • Individuals collect, use, and display data about individuals and the world around them.<br>• Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved.<br>• Data can be used to make predictions about the world. |
| **Algorithms & Programming** | • Individuals develop and follow directions as part of daily life.<br>• A sequence of steps can be expressed as an algorithm that a computer can process.<br>• Real world information can be stored and manipulated in programs as data (e.g., numbers, words, colors, images).<br>• Computers follow precise sequences of steps that automate tasks.<br>• Complex tasks can be broken down into simpler instructions, some of which can be broken down even further.<br>• People work together to develop programs for a purpose, such as expressing ideas or addressing problems.<br>• The development of a program involves identifying a sequence of events, goals, and expected outcomes, and addressing errors (when necessary). |
| **Engineering Design** | • Engineering design is a creative process for meeting human needs or wants that can result in multiple solutions.<br>• Limitations (constraints) must be considered when engineering designs. |
| **Interactions of Technology and Humans** | • Human needs and desires determine which new tools are developed.<br>• Technology has changed the way people live and work.<br>• Various tools can improve daily tasks and quality of life. |
| **Nature of Technology** | Innovation and the improvement of existing technology involves creative thinking. |

| | |
|---|---|
| **Effects of Technology on the Natural World** | • The use of technology developed for the human designed world can affect the environment, including land, water, air, plants, and animals.<br>• Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants.<br>• Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment. |
| **Ethics & Culture** | The availability of technology for essential tasks varies in different parts of the world. |

## 8.1 Computer Science - End of Grade 2

### Computing Systems - End of Grade 2

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals use computing devices to perform a variety of tasks accurately and quickly. Computing devices interpret and follow the instructions they are given literally.'**<br>8.1.2.CS.1: Select and operate computing devices that perform a variety of tasks accurately and quickly based on user needs and preferences. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: A computing system is composed of software and hardware.**<br>8.1.2.CS.2: Explain the functions of common software and hardware components of computing systems. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Describing a problem is the first step toward finding a solution when computing systems do not work as expected.**<br>8.1.2.CS.3: Describe basic hardware and software problems using accurate terminology. |

### Networks and the Internet - End of Grade 2

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Computer networks can be used to connect individuals to other individuals, places, information, and ideas. The Internet enables individuals to connect with others worldwide.**<br>• 8.1.2.NI.1: Model and describe how individuals use computers to connect to other individuals, places, information, and ideas through a network.<br>• 8.1.2.NI.2: Describe how the Internet enables individuals to connect with others worldwide. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Connecting devices to a network or the Internet provides great benefits, but care must be taken to use authentication measures, such as strong passwords, to protect devices and information from unauthorized access.**<br>• 8.1.2.NI.3: Create a password that secures access to a device. Explain why it is important to create unique passwords that are not shared with others.<br>• 8.1.2.NI.4: Explain why access to devices need to be secured |

**Impacts of Computing - End of Grade 2**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Computing technology has positively and negatively changed the way individuals live and work (e.g., entertainment, communication, productivity tools).**<br>8.1.2.IC.1: Compare how individuals live and work before and after the implementation of new computing technology. |

**Data and Analysis - End of Grade 2**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals collect, use, and display data about individuals and the world around them.**<br>8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Computers store data that can be retrieved later. Data can be copied, stored in multiple locations, and retrieved.**<br>8.1.2.DA.2: Store, copy, search, retrieve, modify, and delete data using a computing device. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Data can be used to make predictions about the world.**<br>• 8.1.2.DA.3: Identify and describe patterns in data visualizations.<br>• 8.1.2.DA.4: Make predictions based on data using charts or graphs. |

**Algorithms & Programming - End of Grade 2**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals develop and follow directions as part of daily life. A sequence of steps can be expressed as an algorithm that a computer can process.**<br>8.1.2.AP.1: Model daily processes by creating and following algorithms to complete tasks. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Real-world information can be stored and manipulated in programs as data (e.g., numbers, words, colors, images).**<br>8.1.2.AP.2: Model the way programs store and manipulate data by using numbers or other symbols to represent information. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Computers follow precise sequences of steps that automate tasks.**<br>8.1.2.AP.3: Create programs with sequences and simple loops to accomplish tasks. |

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Complex tasks can be broken down into simpler instructions, some of which can be broken down even further.**<br>8.1.2.AP.4: Break down a task into a sequence of steps |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: People work together to develop programs for a purpose, such as expressing ideas or addressing problems. The development of a program involves identifying a sequence of events, goals, and expected outcomes, and addressing errors (when necessary).**<br>• 8.1.2.AP.5: Describe a program's sequence of events, goals, and expected outcomes.<br>• 8.1.2.AP.6: Debug errors in an algorithm or program that includes sequences and simple loops. |

**8.2 Design Thinking - End of Grade 2**

**Engineering Design - End of Grade 2**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Engineering design is a creative process for meeting human needs or wants that can result in multiple solutions.**<br>• 8.2.2.ED.1: Communicate the function of a product or device.<br>• 8.2.2.ED.2: Collaborate to solve a simple problem or to illustrate how to build a product using the design process.<br>• 8.2.2.ED.3: Select and use appropriate tools and materials to build a product using the design process. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Limitations (constraints) must be considered when engineering designs.**<br>8.2.2.ED.4: Identify constraints and their role in the engineering design process. |

**Interactions of Technology and Humans - End of Grade 2**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Human needs and desires determine which new tools are developed.**<br>• 8.2.2.ITH.1: Identify products that are designed to meet human wants or needs.<br>• 8.2.2.ITH.2: Explain the purpose of a product and its value. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technology has changed the way people live and work. Various tools can improve daily tasks and quality of life.**<br>• 8.2.2.ITH.3: Identify how technology impacts or improves life.<br>• 8.2.2.ITH.4: Identify how various tools reduce work and improve daily tasks.<br>• 8.2.2.ITH.5: Design a solution to a problem affecting the community in a collaborative team and explain the intended impact of the solution. |

## Nature of Technology - End of Grade 2

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technology has changed the way people live and work. Various tools can improve daily tasks and quality of life.**<br>• 8.2.2.NT.1: Model and explain how a product works after taking it apart, identifying the relationship of each part, and putting it back together.<br>• 8.2.2.NT.2: Brainstorm how to build a product, improve a designed product, fix a product that has stopped working, or solve a simple problem |

## Effects of Technology on the Natural World - End of Grade 2

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The use of technology developed for the human-designed world can affect the environment, including land, water, air, plants, and animals. Technologies that use natural sources can have negative effects on the environment, its quality, and inhabitants. Reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment.**<br>• 8.2.2.ETW.1: Classify products as resulting from nature or produced as a result of technology.<br>• 8.2.2.ETW.2: Identify the natural resources needed to create a product.<br>• 8.2.2.ETW.3: Describe or model the system used for recycling technology.<br>• 8.2.2.ETW.4: Explain how the disposal of or reusing a product affects the local and global environment. |

## Ethics & Culture - End of Grade 2

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The availability of technology for essential tasks varies in different parts of the world.**<br>8.2.2.EC.1: Identify and compare technology used in different schools, communities, regions, and parts of the world. |

## By the end of Grade 2

| **CLKS** | **Interdisciplinary** |
|---|---|
| 9.1.2.RM.1 Describe how valuable items might be damaged or lost and ways to protect them.<br>91.2.CI.1 Demonstrate openness to new ideas and perspectives<br>9.1.2.CI.2 Demonstrate originality and inventiveness in work<br>9.4.2.CT.1 Gather information about an issue, such as climate change, and collaboratively brainstorm ways to solve the problem<br>9.4.2.CT.3 Use a variety of types of thinking to solve problems | Soc<br>6.1.2.Geo.GI.2: Use technology to understand the culture and physical characteristics of regions.<br>6.1.2.EconET.1: Explain the difference between needs and wants |

| | |
|---|---|
| 9.4.2.DC.1 Explain differences between ownership and sharing of<br>9.4.2.DC.3 Explain how to be safe online and follow safe practices when using the internet<br>9.4.2.DC.4 Compare information that should be kept private to information that might be made public<br>9.4.2.DC.5 Explain what a digital footprint is and how it is created.<br>9.4.2.DC.6 Identify respectful and responsible ways to communicate in digital environments.<br>9.4.2.IML.1 Identify a simple search term to find information in a search engine or digital resource.<br>9.4.2.TL.1 Identify the basic features of a digital tool and explain the purpose of the tool<br>9.4.2.TL.23 Create a document using a word processing application. | |

**By the end of Grade 2**

| MATERIALS and RESOURCES: | INSTRUCTIONAL STRATEGIES | ELL Modifications |
|---|---|---|
| ● Video Tools: YouTube, QR Codes: QR Code Generator Game-based<br>● Communicative Tools: SeeSaw<br>● Authentic listening and reading sources that provides data<br>● ESGI<br>● Let's Find Out<br>● Science materials (not restricted to)<br>  ○ Scales<br>  ○ Measuring tools<br>  ○ Weights<br>  ○ Magnets | ● Reinforcing effort<br>● Provide recognition<br>● Cooperative learning<br>● Cues, Questions, Organizers<br>● Orally Summarizing<br>● Generating & testing hypotheses<br>● Student practice<br>● Individualized instruction<br>● Effective feedback<br>● Presenting learning goals/ objectives<br>● Authentic learning<br>● Adapting to learning styles<br>● Conferencing<br>● Activating prior knowledge<br>● Flexible classrooms<br>● Identifying similarities and differences<br>● Learning centers<br>● Modeling<br>● Music/ songs<br>● Peer teaching<br>● Sharing opinions<br>● Student choice<br>● Rubrics | ● Seat student near teacher<br>● Print clearly<br>● Do not use cursive<br>● Give directions in print & orally<br>● Print keywords, page numbers, homework, deadlines on the board<br>● Incorporate visuals<br>● Avoid slang or colloquial sayings,<br>● Avoid complex sentence structure<br>● Use questions that need one-word answers<br>● Be ready to give additional instructions on complex tasks<br>● Adjust assignments so student writes less<br>● Provide simpler questions to answer<br>● Expect fewer spelling words<br>● Provide extra time as necessary<br>● Provide graphic organizers<br>● Provide an ELL dictionary<br>● Provide books on tape or CD<br>● Provide wall charts of key<br>● concepts<br>● Provide a word wall |

| | | |
|---|---|---|
| | | • Provide models of docs such as Homework, projects |

**By the end of Grade 2**

| MODIFICATIONS -SPECIAL NEEDS, 504 | STUDENTS AT RISK OF FAILURE | GIFTED AND TALENTED |
|---|---|---|
| • Pair visual prompts with verbal presentations<br>• Ask students to restate information, directions, and assignments.<br>• Provide opportunities for repetition and practice<br>• Model skills / techniques to be mastered.<br>• Provide extended time to complete class work<br>• Provide preferential seating to be mutually determined by the student and teacher<br>• Accommodate student requests to use a computer to complete assignments.<br>• Establish expectations for completing assignments, routine, and behavior<br>• Provide extra resources to be sent home as available | • Ask students to restate information, directions, and assignments.<br>• Provide opportunities for repetition and practice<br>• Model skills / techniques to be mastered.<br>• Provide extended time to complete class work<br>• Provide preferential seating to be mutually determined by the student and teacher<br>• Provide extra books/ materials for home.<br>• Assign a peer helper in the class setting<br>• Provide oral reminders and check student work during independent work time<br>• Encourage student to look over work<br>• Provide regular parent/ school communication<br>• Establish expectations for routine, behavior, academics | • Use advanced supplementary / reading materials<br>• Use authentic resources to promote a deeper understanding of culture.<br>• Provide opportunities for open-ended, self-directed activities<br>• Encourage the use of creativity<br>• Provide opportunities to develop depth and breadth of knowledge in the subject area (examples: create drawings/illustrations, use of music, create poems/songs, write opinion letters, create videos/stories/comic strips, etc.) Conduct research and provide presentations of cultural topics.<br>• Provide tiered reading materials |

**Disciplinary Concepts and Core Ideas by the end of Grade 5**

| | |
|---|---|
| **Computing Systems** | • Computing devices may be connected to other devices to form a system that extends/ expands their capabilities.<br>• Software and hardware work together as a system to accomplish tasks (e.g., sending, receiving, processing, and storing units of information).<br>• Shared features allow for common troubleshooting strategies that can be effective for many systems. |
| **Networks and the Internet** | • Information needs a physical or wireless path to in order to be sent and received.<br>• Distinguishing between public and private information is important for safe and secure online interactions.<br>• Information can be protected using various security measures (i.e., physical and digital). |
| **Impacts of Computing** | The development and modification of computing technology is driven by people's needs and wants and can affect individuals differently. |
| **Data and Analysis** | • Data can be organized, displayed, and presented to highlight relationships<br>• The type of data being stored affects the storage requirements.<br>• Individuals can select, organize, and transform data into different visual representations and communicate insights gained from the data.<br>• Many factors influence the accuracy of inferences and predictions. |
| **Algorithms & Programming** | • Different algorithms can achieve the same result.<br>• Some algorithms are more appropriate for a specific use than others.<br>• Programming languages provide variables, which are used to store and modify data.<br>• A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).<br>• Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist.<br>• Individuals develop programs using an iterative process involving design, implementation, testing, and review. |
| **Engineering Design** | • Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.<br>• Often, several design solutions exist, each better in some way than the others.<br>• Engineering design requirements include desired features and limitations that need to be considered. |
| **Interactions of Technology and** | • Societal needs and wants determine which new tools are developed to address real-world problems. |

| | |
|---|---|
| **Humans** | • A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.<br>• Technology spurs new businesses and careers. |
| **Nature of Technology** | • Technology innovation and improvement may be influenced by a variety of factors.<br>• Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world. |
| **Effects of Technology on the Natural World** | • The technology developed for the human designed world can have unintended consequences for the environment.<br>• Technology must be continually developed and made more efficient to reduce the need for nonrenewable resources. |
| **Ethics & Culture** | Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values. |

**8.1 Computer Science - End of Grade 5**

**Computing Systems - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Computing devices may be connected to other devices to form a system that extends/ expands their capabilities.**<br>8.1.5.CS.1: Model how computing devices connect to other components to form a system. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Software and hardware work together as a system to accomplish tasks (e.g., sending, receiving, processing, and storing units of information).**<br>8.1.5.CS.2: Model how computer software and hardware work together as a system to accomplish tasks. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Shared features allow for common troubleshooting strategies that can be effective for many systems.**<br>8.1.5.CS.3: Identify potential solutions for simple hardware and software problems using common troubleshooting strategies. |

**Networks and the Internet - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Information needs a physical or wireless path to travel to be sent and received.**<br>8.1.5.NI.1: Develop models that successfully transmit and receive information using both wired and wireless methods |

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Distinguishing between public and private information is important for safe and secure online interactions. Information can be protected using various security measures (i.e., physical and digital).**<br>8.1.5.NI.2: Describe physical and digital security measures for protecting sensitive personal information. |

**Impacts of Computing - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The development and modification of computing technology is driven by individual needs and wants and can affect individuals differently.**<br>• 8.1.5.IC.1: Identify computing technologies that have impacted how individuals live and work and describe the factors that influenced the changes.<br>• 8.1.5.IC.2: Identify possible ways to improve the accessibility and usability of computing technologies to address the diverse needs and wants of users. |

**Data and Analysis - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Data can be organized, displayed, and presented to highlight relationships.**<br>8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The type of data being stored affects the storage requirements.**<br>8.1.5.DA.2: Compare the amount of storage space required for different types of data. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals can select, organize, and transform data into different visual representations and communicate insights gained from the data.**<br>• 8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.<br>• 8.1.5.DA.4: Organize and present climate change data visually to highlight relationships or support a claim |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Many factors influence the accuracy of inferences and predictions.**<br>8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data. |

## Algorithms & Programming - End of Grade 5

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Different algorithms can achieve the same result. Some algorithms are more appropriate for a specific use than others.**<br>8.1.5.AP.1: Compare and refine multiple algorithms for the same task and determine which is the most appropriate. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Programming languages provide variables, which are used to store and modify data.**<br>8.1.5.AP.2: Create programs that use clearly-named variables to store and modify data |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).**<br>8.1.5.AP.3: Create programs that include sequences, events, loops, and conditionals. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist.**<br>• 8.1.5.AP.4: Break down problems into smaller, manageable sub-problems to facilitate program development.<br>• 8.1.5.AP.5: Modify, remix, or incorporate pieces of existing programs into one's own work to add additional features or create a new program. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals develop programs using an iterative process involving design, implementation, testing, and review.**<br>8.1.5.AP.6: Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended. |

## 8.2 Design Thinking - End of Grade 5

### Engineering Design - End of Grade 5

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge. Often, several design solutions exist, each better in some way than the others.**<br>• 8.2.5.ED.1: Explain the functions of a system and its subsystems.<br>• 8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models. |

| | |
|---|---|
| | • 8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Engineering design requirements include desired features and limitations that need to be considered.**<br>• 8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).<br>• 8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.<br>• 8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and tradeoffs identified in the design process. |

**Interactions of Technology and Humans - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Societal needs and wants determine which new tools are developed to address real-world problems.**<br>8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: A new tool may have favorable or unfavorable results as well as both positive and negative effects on society. Technology spurs new businesses and careers.**<br>• 8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.<br>• 8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.<br>• 8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career. |

**Nature of Technology - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technology innovation and improvement may be influenced by a variety of factors. Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.**<br>• 8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.<br>• 8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.<br>• 8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team. |

| | |
|---|---|
| | • 8.2.5.NT.4: Identify how improvement in the understanding of materials impacts technologies. |

**Effects of Technology on the Natural World - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The technology developed for the human designed world can have unintended consequences for the environment. Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.**<br>• 8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.<br>• 8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.<br>• 8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.<br>• 8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.<br>• 8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change. |

**Ethics & Culture - End of Grade 5**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.**<br>8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects. |

**By the end of Grade 5**

| **CLKS** | **Interdisciplinary** |
|---|---|
| 9.1.5.CAP.4 Explain the reasons why some jobs and careers require specific training, skills, and certification<br>9.1.5.CI.1 Use appropriate communication technologies to collaborate with individuals with diverse perspectives about a local and/or global climate change issue and deliberate about possible solutions<br>9.1.5.CT.1 Identify and gather relevant data that will aid in the problem-solving process<br>9.1.5.CT.3 Describe how digital tools and technology may be used to solve problems.<br>9.1.5.DC.2 Provide attribution according to intellectual property rights<br>9.1.5.DC.3 Distinguish between digital images that can be reused freely and those that have copyright restrictions.<br>9.1.5.DC.4 Model safe, legal, and ethical behavior when using online or offline technology<br>9.1.5.DC.5 Identify the characteristics of a positive and negative online identity and the lasting implications of online activity.<br>9.1.5.DC.7 Explain how posting and commenting in social spaces can have positive or negative consequences.<br>9.1.5.IML.1 Evaluate digital sources for accuracy, perspective, credibility and relevance<br>9.1.5.IML.2 Create a visual representation to organize information about a problem or issue<br>9..1.5.IML.6 Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions<br>9.1.5.TL.3 Format a document using a word processing application to enhance text, change page formatting, and include appropriate images, graphics, or symbols. | Soc<br>6.1.5.EconET.1: Identify positive and negative incentives that influence the decisions people make.<br>6.1.5.EconET.2: Use quantitative data to engage in cost benefit analyses of decisions that impact the individual and/or community.<br>6.1.5.EconGE.1: Explain how the development of communication systems has led to increased collaboration and the spread of ideas throughout the United States and the world.<br>6.3.5.GeoGI.1: Use technology to collaborate with others who have different perspectives to examine global issues, including climate change and propose possible solutions. |

**By the end of Grade 5**

| MATERIALS and RESOURCES: | INSTRUCTIONAL STRATEGIES | ELL Modifications |
|---|---|---|
| ● Video Tools: YouTube, QR Codes: QR Code Generator Game-based<br>● Communicative Tools: SeeSaw<br>● Authentic listening and reading sources that provides data<br>● ESGI<br>● Let's Find Out<br>● Science materials (not restricted to)<br>  ○ Scales<br>  ○ Measuring tools<br>  ○ Weights<br>  ○ Magnets | ● Reinforcing effort<br>● Provide recognition<br>● Cooperative learning<br>● Cues, Questions, Organizers<br>● Orally Summarizing<br>● Generating & testing hypotheses<br>● Student practice<br>● Individualized instruction<br>● Effective feedback<br>● Presenting learning goals/ objectives<br>● Authentic learning<br>● Adapting to learning styles<br>● Conferencing<br>● Activating prior knowledge<br>● Flexible classrooms<br>● Identifying similarities and differences<br>● Learning centers<br>● Modeling<br>● Music/ songs<br>● Peer teaching<br>● Sharing opinions<br>● Student choice<br>● Rubrics<br>● Sharing opinions<br>● Student choice<br>● Rubrics | ● Seat student near teacher<br>● Print clearly<br>● Do not use cursive<br>● Give directions in print & orally<br>● Print keywords, page numbers, homework, deadlines on the board<br>● Incorporate visuals<br>● Avoid slang or colloquial sayings,<br>● Avoid complex sentence structure<br>● Use questions that need one word answers<br>● Be ready to give additional instructions on complex tasks<br>● Adjust assignments so student writes less<br>● Provide simpler questions to answer<br>● Expect fewer spelling words<br>● Provide extra time as necessary<br>● Provide graphic organizers<br>● Provide an ELL dictionary<br>● Provide books on tape or CD<br>● Provide wall charts of key concepts<br>● Provide a word wall<br>● Provide models of docs such as Homework, projects |

**By the end of Grade 5**

| MODIFICATIONS -SPECIAL NEEDS, 504 | STUDENTS AT RISK OF FAILURE | GIFTED AND TALENTED |
|---|---|---|
| ● Pair visual prompts with verbal presentations<br>● Ask students to restate information, directions, and assignments.<br>● Provide opportunities for repetition and practice<br>● Model skills / techniques to be mastered.<br>● Provide extended time to complete class work<br>● Provide preferential seating to be mutually determined by the student and teacher<br>● Accommodate student requests to use a computer to complete assignments.<br>● Establish expectations for completing assignments, routine, and behavior<br>● Provide extra resources to be sent home as available | ● Ask students to restate information, directions, and assignments.<br>● Provide opportunities for repetition and practice<br>● Model skills / techniques to be mastered.<br>● Provide extended time to complete class work<br>● Provide preferential seating to be mutually determined by the student and teacher<br>● Provide extra books/ materials for home.<br>● Assign a peer helper in the class setting<br>● Provide oral reminders and check student work during independent work time<br>● Encourage student to look over work<br>● Provide regular parent/ school communication<br>● Establish expectations for routine, behavior, academics | ● Use advanced supplementary / reading materials<br>● Use authentic resources to promote a deeper understanding of culture.<br>● Provide opportunities for open-ended, self-directed activities<br>● Encourage the use of creativity<br>● Provide opportunities to develop depth and breadth of knowledge in the subject area (examples: create drawings/illustrations, use of music, create poems/songs, write opinion letters, create videos/stories/comic strips, etc.) Conduct research and provide presentations of cultural topics.<br>● Provide tiered reading materials |

**Disciplinary Concepts and Core Ideas by the end of Grade 8**

| | |
|---|---|
| **Computing Systems** | • The study of human-computer interaction can improve the design of devices and extend the abilities of humans.<br>• Software and hardware determine a computing system's capability to store and process information. The design or selection of a computing system involves multiple considerations and potential trade-offs.<br>• Troubleshooting a problem is more effective when knowledge of the specific device along with a systematic process is used to identify the source of a problem. |
| **Networks and the Internet** | • Protocols, packets and addressing are the key components for reliable delivery of information across networks.<br>• The information sent and received across networks can be protected from unauthorized access and modification in a variety of ways.<br>• The evolution of malware leads to understanding the key security measures and best practices needed to proactively address the threat to digital data. |
| **Impacts of Computing** | • Advancements in computing technology can change individuals' behaviors.<br>• Society is faced with trade-offs due to the increasing globalization and automation that computing brings |
| **Data and Analysis** | • People use digital devices and tools to automate the collection, use, and transformation of data.<br>• The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data.<br>• Data is represented in many formats. Software tools translate the low-level representation of bits into a form understandable by individuals. Data is organized and accessible based on the application used to store it.<br>• The purpose of cleaning data is to remove errors and make it easier for computers to process.<br>• Computer models can be used to simulate events, examine theories and inferences, or make predictions. |
| **Algorithms & Programming** | • Individuals design algorithms that are reusable in many situations.<br>• Algorithms that are readable are easier to follow, test, and debug.<br>• Programmers create variables to store data values of different types and perform appropriate operations on their values.<br>• Control structures are selected and combined in programs to solve more complex problems.<br>• Programs use procedures to organize code and hide implementation details. Procedures can be repurposed in new programs. Defining parameters for procedures can generalize behavior and increase reusability.<br>• Individuals design and test solutions to identify problems taking into consideration the diverse needs of the |

| | |
|---|---|
| | users and the community. |
| **Engineering Design** | • Engineering design is a systematic, creative and iterative process used to address local and global problems.<br>• The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.<br>• Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features. |
| **Interactions of Technology and Humans** | • Economic, political, social, and cultural aspects of society drive development of new technological products, processes, and systems.<br>• Technology interacts with society, sometimes bringing about changes in a society's economy, politics, and culture, and often leading to the creation of new needs and wants.<br>• New needs and wants may create strains on local economies and workforces.<br>• Improvements in technology are intended to make the completion of tasks easier, safer, and/or more efficient. |
| **Nature of Technology** | • Technology advances through the processes of innovation and invention which relies upon the imaginative and inventive nature of people.<br>• Sometimes a technology developed for one purpose is adapted to serve other purposes.<br>• Engineers use a systematic process of creating or modifying technologies that is fueled and constrained by physical laws, cultural norms, and economic resources. Scientists use systematic investigation to understand the natural world. |
| **Effects of Technology on the Natural World** | • Resources need to be utilized wisely to have positive effects on the environment and society.<br>• Some technological decisions involve trade-offs between environmental and economic needs, while others have positive effects for both the economy and environment. |
| **Ethics and Culture** | Technological disparities have consequences for public health and prosperity. |

## 8.1 Computer Science - End of Grade 8

### Computing Systems - End of Grade 8

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The study of human–computer interaction can improve the design of devices and extend the abilities of humans.**<br>8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Software and hardware determine a computing system's capability to store and process information. The design or selection of a computing system involves multiple considerations and potential trade-offs.**<br>• 8.1.8.CS.2: Design a system that combines hardware and software components to process data.<br>• 8.1.8.CS.3: Justify design decisions and explain potential system trade-offs. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Troubleshooting a problem is more effective when knowledge of the specific device, along with a systematic process, is used to identify the source of a problem.**<br>8.1.8.CS.4: Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems. |

### Networks and the Internet - End of Grade 8

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Protocols, packets, and addressing are the key components for reliable delivery of information across networks.**<br>• 8.1.8.NI.1: Model how information is broken down into smaller pieces, transmitted as addressed packets through multiple devices over networks and the Internet, and reassembled at the destination.<br>• 8.1.8.NI.2: Model the role of protocols in transmitting data across networks and the Internet and how they enable secure and errorless communication. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The information sent and received across networks can be protected from unauthorized access and modification in a variety of ways. The evolution of malware leads to understanding the key security measures and best practices needed to proactively address the threat to digital data.**<br>• 8.1.8.NI.3: Explain how network security depends on a combination of hardware, software, and practices that control access to data and systems.<br>• 8.1.8.NI.4: Explain how new security measures have been created in response to key malware events. |

## Impacts of Computing - End of Grade 8

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Advancements in computing technology can change individuals' behaviors. Society is faced with trade-offs due to the increasing globalization and automation that computing brings.**<br>• 8.1.8.IC.1: Compare the trade-offs associated with computing technologies that affect an individual's everyday activities and career options.<br>• 8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies. |

## Data and Analysis - End of Grade 8

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: People use digital devices and tools to automate the collection, use, and transformation of data. The manner in which data is collected and transformed is influenced by the type of digital device(s) available and the intended use of the data.**<br>8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Data is represented in many formats. Software tools translate the low-level representation of bits into a form understandable by individuals. Data is organized and accessible based on the application used to store it.**<br>• 8.1.8.DA.2: Explain the difference between how the computer stores data as bits and how the data is displayed.<br>• 8.1.8.DA.3: Identify the appropriate tool to access data based on its file format. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: The purpose of cleaning data is to remove errors and make it easier for computers to process.**<br>• 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Computer models can be used to simulate events, examine theories and inferences, or make predictions.**<br>• 8.1.8.DA.5: Test, analyze, and refine computational models.<br>• 8.1.8.DA.6: Analyze climate change computational models and propose refinements. |

## Algorithms & Programming - End of Grade 8

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals design algorithms that are reusable in many situations. Algorithms that are readable are easier to follow, test, and debug.**<br>8.1.8.AP.1: Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Programmers create variables to store data values of different types and perform appropriate operations on their values.**<br>8.1.8.AP.2: Create clearly named variables that represent different data types and perform operations on their values. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Control structures are selected and combined in programs to solve more complex problems.**<br>8.1.8.AP.3: Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Programs use procedures to organize code and hide implementation details. Procedures can be repurposed in new programs. Defining parameters for procedures can generalize behavior and increase reusability.**<br>• 8.1.8.AP.4: Decompose problems and subproblems into parts to facilitate the design, implementation, and review of programs.<br>• 8.1.8.AP.5: Create procedures with parameters to organize code and make it easier to reuse. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Individuals design and test solutions to identify problems taking into consideration the diverse needs of the users and the community.**<br>• 8.1.8.AP.6: Refine a solution that meets users' needs by incorporating feedback from team members and users.<br>• 8.1.8.AP.7: Design programs, incorporating existing code, media, and libraries, and give attribution. •<br>8.1.8.AP.8: Systematically test and refine programs using a range of test cases and users.<br>• 8.1.8.AP.9: Document programs in order to make them easier to follow, test, and debug. |

## 8.2 Design Thinking - End of Grade 8

### Engineering Design - End of Grade 8

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Engineering design is a systematic, creative, and iterative process used to address local and global problems. The process includes generating ideas, choosing the best solution, and making, testing, and redesigning models or prototypes.** |

| | |
|---|---|
| | • 8.2.8.ED.1: Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.<br>• 8.2.8.ED.2: Identify the steps in the design process that could be used to solve a problem.<br>• 8.2.8.ED.3: Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).<br>• 8.2.8.ED.4: Investigate a malfunctioning system, identify its impact, and explain the step-by-step process u |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Engineering design requirements and specifications involve making trade-offs between competing requirements and desired design features.**<br>• 8.2.8.ED.5: Explain the need for optimization in the design process.<br>• 8.2.8.ED.6: Analyze how trade-offs can impact the design of a product.<br>• 8.2.8.ED.7: Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches). |

**Interactions of Technology and Humans - End of Grade 8**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Economic, political, social and cultural aspects of society drive development of new technological products, processes, and systems.**<br>8.2.8.ITH.1: Explain how the development and use of technology influences economic, political, social, and cultural issues. |
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technology interacts with society, sometimes bringing about changes in a society's economy, politics, and culture, and often leading to the creation of new needs and wants. New needs and wants may create strains on local economies and workforces. Improvements in technology are intended to make the completion of tasks easier, safer, and/or more efficient.**<br>• 8.2.8.ITH.2: Compare how technologies have influenced society over time.<br>• 8.2.8.ITH.3: Evaluate the impact of sustainability on the development of a designed product or system.<br>• 8.2.8.ITH.4: Identify technologies that have been designed to reduce the negative consequences of other technologies and explain the change in impact.<br>• 8.2.8.ITH.5: Compare the impacts of a given technology on different societies, noting factors that may make a technology appropriate and sustainable in one society but not in another. |

**Nature of Technology - End of Grade 8**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technology advances through the processes of innovation and invention which relies upon the imaginative and inventive nature of people. Sometimes a technology developed for one purpose is adapted to serve other purposes. Engineers use a systematic process of creating or modifying technologies that is fueled and constrained by physical laws, cultural norms, and economic resources. Scientists use systematic investigation to understand the natural world.**<br>• 8.2.8.NT.1: Examine a malfunctioning tool, product, or system and propose solutions to the problem.<br>• 8.2.8.NT.2: Analyze an existing technological product that has been repurposed for a different function.<br>• 8.2.8.NT.3: Examine a system, consider how each part relates to other parts, and redesign it for another purpose.<br>• 8.2.8.NT.4: Explain how a product designed for a specific demand was modified to meet a new demand and led to a new product. |

**Effects of Technology on the Natural World - End of Grade 8**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Resources need to be utilized wisely to have positive effects on the environment and society. Some technological decisions involve tradeoffs between environmental and economic needs, while others have positive effects for both the economy and environment.**<br>• 8.2.8.ETW.1: Illustrate how a product is upcycled into a new product and analyze the short- and long-term benefits and costs.<br>• 8.2.8.ETW.2: Analyze the impact of modifying resources in a product or system (e.g., materials, energy, information, time, tools, people, capital).<br>• 8.2.8.ETW.3: Analyze the design of a product that negatively impacts the environment or society and develop possible solutions to lessen its impact.<br>• 8.2.8.ETW.4: Compare the environmental effects of two alternative technologies devised to address climate change issues and use data to justify which choice is best. |

**Ethics & Culture - End of Grade 8**

| | |
|---|---|
| **PERFORMANCE EXPECTATIONS** | **Core Idea: Technological disparities have consequences for public health and prosperity.**<br>• 8.2.8.EC.1: Explain ethical issues that may arise from the use of new technologies.<br>• 8.2.8.EC.2: Examine the effects of ethical and unethical practices in product design and development. |

**By the end of Grade 8**

| **CLKS** | **Interdisciplinary** |
|---|---|
| 9.1.8.CI.1 Assess data gathered on varying perspectives and determine how the data can best be used to design multiple, potential solutions<br>9.1.8.DC.1 Analyze the resource citations in online materials for proper use.<br>9.1.8.DC.2 Provide appropriate citation and attribution elements when creating media products<br>9.1.8.DC.3 Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure.<br>9.1.8.DC.4 Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences.<br>9.1.8.DC.5 Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.<br>9.1.8.DC.6 Analyze online information to distinguish whether it is helpful or harmful to reputation.<br>9.1.8.DC.7Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.<br>9.1.8.DC.8 Explain how communities use data and technology to develop measures to respond to effects of climate change<br>9.1.8.IML.1 Critically curate multiple resources to assess the credibility of sources when searching for information.<br>9.1.8.IML.3 Create a digital visualization that effectively communicates a data set using formatting techniques such as form, position, size, color, movement, and spatial grouping<br>9.1.8.IML.5 Analyze and interpret local or public data sets to summarize and effectively communicate the data<br>9.1.8.IML.6 Identify subtle and overt messages based on the method of communication.<br>9.1.8.IML.12 Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.<br>9.1.8.TL.1 Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.<br>9.1.8.TL.2 Gather data and digitally represent information to communicate a real-world problem<br>9.1.8.TL.3 Select appropriate tools to organize and present information digitally.<br>9.1.8.TL.4 Synthesize and publish information about a local or global issue or event | Soc<br>6.3.8.EconET.1: Using quantitative data, evaluate the opportunity cost of a proposed economic action, and take a position and support it<br><br>The diffusion of ideas and cultural practices are impacted by the movement of people and advancements in transportation, communication, and technology. |

**By the end of Grade 8**

| MATERIALS and RESOURCES: | INSTRUCTIONAL STRATEGIES | ELL Modifications |
|---|---|---|
| ● Artist | ● Reinforcing effort<br>● Provide recognition<br>● Cooperative learning<br>● Cues, Questions, Organizers<br>● Orally Summarizing<br>● Generating & testing hypotheses<br>● Student practice<br>● Individualized instruction<br>● Effective feedback<br>● Presenting learning goals/ objectives<br>● Authentic learning<br>● Adapting to learning styles<br>● Conferencing<br>● Activate prior knowledge<br>● Investigations<br>● Flexible classrooms<br>● Graphic organizers<br>● Identifying similarities and differences<br>● Learning centers<br>● Modeling<br>● Music/ songs<br>● Peer teaching<br>● Project -based learning<br>● Reading aloud<br>● Sharing opinions<br>● Student choice<br>● Think- Pair- Share | ● Seat student near teacher<br>● Print clearly<br>● Do not use cursive<br>● Give directions in print & orally<br>● Print keywords, page numbers, homework, deadlines on the board<br>● Incorporate visuals<br>● Avoid slang or colloquial sayings,<br>● Avoid complex sentence structure<br>● Use questions that need one-word answers<br>● Be ready to give additional instructions on complex tasks<br>● Adjust assignments so student writes less<br>● Provide simpler questions to answer<br>● Expect fewer spelling words<br>● Provide extra time as necessary<br>● Provide graphic organizers<br>● Provide an ELL dictionary<br>● Provide books on tape or CD<br>● Provide wall charts of key concepts<br>● Provide a word wall<br>● Provide models of docs such as Homework, projects |

| | | |
|---|---|---|
| | • Rubrics<br>• Varied texts | |

**By the end of Grade 8**

| MODIFICATIONS -SPECIAL NEEDS, 504 | STUDENTS AT RISK OF FAILURE | GIFTED AND TALENTED |
|---|---|---|
| • Pair visual prompts with verbal presentations<br>• Ask students to restate information, directions, and assignments.<br>• Provide for repetition and practice<br>• Model skills / techniques to be mastered.<br>• Provide extended time to complete class work<br>• Provide preferential seating to be mutually determined by the student and teacher<br>• Accommodate student requests to use a computer to complete assignments.<br>• Establish expectations for completing assignments, routine, and behavior<br>• Provide extra resources to be sent home as available | • Ask students to restate information, directions, and assignments.<br>• Repetition and practice<br>• Model skills / techniques to be mastered.<br>• Provide extended time to complete class work<br>• Provide preferential seating to be mutually determined by the student and teacher<br>• Provide extra books/ materials for home.<br>• Assign a peer helper in the class setting<br>• Provide oral reminders and check student work during independent work time<br>• Encourage student to look over work<br>• Provide regular parent/ school communication<br>• Establish expectations for routine, behavior, academics | • Use advanced supplementary / reading materials<br>• Use authentic resources to promote a deeper understanding of culture.<br>• Provide opportunities for open-ended, self-directed activities<br>• Encourage the use of creativity<br>• Provide opportunities to develop depth and breadth of knowledge in the subject area (examples: create drawings/illustrations, use of music, create poems/songs, write opinion letters, create videos/stories/comic strips, etc.) Conduct research and provide presentations of cultural topics.<br>• Provide tiered reading materials |

**RESOURCES**

Materials & Resources, Interdisciplinary Connections, Technology, Pacing - Included at each grade level

GLOSSARY - Link  Assure that terms outlined in the State curriculum are covered.

**SEL Competencies**

**NJDOE SEL**

**Amistad**

**Holocaust**

**Italian American Heritage**

**NJ Model Curriculum Health / Physical Education**

**Diversity and Inclusion**

**Asian American /Pacific Islander Commission**

**Climate Change Standards Support**

**REFERENCES**

ELL, Instructional Strategies, Differentiation, Students at Risk, Modifications - Included at each grade level

Bilingual/ESL Education: This website provides resources to help educators understand and implement effective instructional strategies for bilingual/ESL students.

Gifted & Talented: This website provides resources to help educators understand and implement effective instructional strategies for Gifted and Talented students.

Special Education: This website provides resources to help educators understand and implement effective instructional strategies for students with high frequency learning challenges.

**APPENDIX**

**New Jersey Statutes and Regulations**

**Hamburg School Policies and Regulations**

**Administrative Code[1]**

**New Jersey Administrative Code Summary and Statutes Curriculum Development:**
**Integration of 21st Century Skills and Themes and Interdisciplinary Connections**

- District boards of education shall be responsible for the review and continuous improvement of curriculum and instruction based upon changes in knowledge, technology, assessment results, and modifications to the NJSLS, according to N.J.A.C. 6A:8-2. 1.
- District boards of education shall include interdisciplinary connections throughout the K–12 curriculum. 2. District boards of education shall integrate into the curriculum 21st century themes and skills (N.J.A.C. 6A:8-3.1(c)2).

**Twenty-first century themes and skills integrated into all content standards areas (N.J.A.C. 6A:8-1.1(a)3).**
"Twenty-first century themes and skills" means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility.

[1] https://www.nj.gov/education/cccs/2020/NJSLS-Science.pdf

From NJDOE : Please note that Administrative Code requires that the local curriculum include, but is not limited to:

1. A pacing guide;
2. A list of core instructional materials, including various levels of texts at each grade level;
3. Benchmark assessments; and
4. Modifications for special education students, for ELLs in accordance with N.J.A.C. 6A:15, for students at risk of school failure, and for gifted students.

**Dissection Law**

N.J.S.A. 18A:35-4.25 and N.J.S.A. 18A:35-4.24 authorizes parents or guardians to assert the right of their children to refuse to dissect, vivisect, incubate, capture or otherwise harm or destroy animals or any parts thereof as part of a course of instruction.

**Amistad Law**: N.J.S.A. 18A 52:16A-88

Every board of education shall incorporate the information regarding the contributions of AfricanAmericans to our country in an appropriate place in the curriculum of elementary and secondary school students.

**Holocaust Law**: N.J.S.A. 18A:35-28

Every board of education shall include instruction on the Holocaust and genocides in an appropriate place in the curriculum of all elementary and secondary school pupils. The instruction shall further emphasize the personal responsibility that each citizen bears to fight racism and hatred whenever and wherever it happens.

**LGBT and Disabilities Law:** N.J.S.A. 18A:35-4.35

A board of education shall include instruction on the political, economic, and social contributions of persons with disabilities and lesbian, gay, bisexual, and transgender people, in an appropriate place in the curriculum of middle school and high school students as part of the district's implementation of the New Jersey Student Learning Standards (N.J.S.A.18A:35-4.36). A board of education shall have policies and procedures in place pertaining to the selection of instructional materials to implement the requirements of N.J.S.A. 18A:35-4.35.

**African American History** N.J.S.A. 18A:35-1 Requires 2 years of US History in high schools including history of New Jersey and of African-Americans

**Asian American Pacific Islander** :

**S3764** that will ensure that the contributions, history, and heritage of Asian Americans and Pacific Islanders (AAPI) are included in the New Jersey Student Learning Standards for Social Studies for students in kindergarten through Grade 12.

**S4021** will create an AAPI curriculum requirement for schools and S3764 will establish the Commission for Asian American Heritage within the Department of Education.

**Dating Violence** N.J.S.A. 35-4.23
**Sexual Assault** N.J.S.A. 35-4.3 National Sexual Assault Resource Center
**Dangers of Sexting** N.J.S.A. 35-4.33 Common Sense Education
**Deaf Students Bill of Rights** N.J.S.A. 46-2.7
**Digital Citizenship/ Social Media** N.J.S.A. 35-4.27 Digital Citizenship Social Media

**Climate Change**

**Standards in Action: Climate Change**

Although the future of work is unclear, thought leaders assert that artificial intelligence, the Internet of Things, robotics, and machine learning will be ubiquitous in tomorrow's workplaces (Malyn-Smith et al, 2018). This vision of the future includes a new machine age, where humans will shape technology, technology will shape human interaction, and where technologies and humans will collaborate to discover and innovate (Mervis, 2016; Van Opstal, Evans, Bates, & Knuckles, 2008). At the core of computer science and design thinking education, is the goal to prepare students with the essential knowledge and skills to make their local and global communities a better place to live. Learning experiences that enable students to apply content knowledge and employ computational thinking skills prepare students for the work of tomorrow by proposing solutions concerning the balancing of societal, environmental, and economic needs for a sustainable future. Further, leveraging topics such as computational sustainability and clean technology (Cleantech), technologies that either reduce or optimize the use of natural resources while reducing the negative effect that technology has on the planet and its ecosystems, is essential for developing a populace with the knowledge and skills necessary to mitigate the effects of climate change.

**New Jersey Legislative Statutes Curriculum Development: Integration of 21st Century Skills and Themes and Interdisciplinary Connections**

District boards of education shall be responsible for the review and continuous improvement of curriculum and instruction based upon changes in knowledge, technology, assessment results, and modifications to the NJSLS, according to N.J.A.C. 6A:8-2.

1. District boards of education shall include interdisciplinary connections throughout the K–12 curriculum.
2. District boards of education shall integrate into the curriculum 21st century themes and skills (N.J.A.C. 6A:8-3.1(c). New Jersey Department of Education June 2020 19

**Twenty-first century themes and skills integrated into all content standards areas**

(N.J.A.C. 6A:8-1.1(a)3).

"Twenty-first century themes and skills" means themes such as global awareness; financial, economic, business, and entrepreneurial literacy; civic literacy; health literacy; learning and innovation skills, including creativity and innovation, critical thinking and problem solving, and communication and collaboration; information, media, and technology skills; and life and career skills, including flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility.

The 2020 NJSLS-CHPE continue to incorporate New Jersey Legislative Statutes related to the health and well-being of students in New Jersey public schools, including those enacted from 2019:

**Sexting**

(N.J.S.A. 18A:35-4.33) A Board of education shall include instruction on the social, emotional, and legal consequences of distributing and soliciting sexually explicit images through electronic means once during middle school in an appropriate place in the curriculum as part as of the school district's implementation of the New Jersey Student Learning Standards in Comprehensive Health and Physical Education. The Commissioner of Education shall provide school districts with age-appropriate sample learning activities and resources designed to implement this requirement.

**2020 New Jersey Student Learning Standards Kindergarten through Grade 12**

**NJ Model Curriculum Health / Physical Education**

**New Jersey Statutes and Regulations**