Computational and Design Thinking (K-5)

Ewing Public Schools
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Course Description and Rationale

Computer science and design thinking education prepares students to succeed in today's knowledge-based economy by providing equitable and expanded access to high-quality, standards-based computer science and technological design education.

Students receive computer science and design thinking instruction. The study of these disciplines focuses on deep understanding of concepts that enable students to think critically and systematically about leveraging technology to solve local and global issues. Authentic learning experiences that enable students to apply content knowledge, integrate concepts across disciplines, develop computational thinking skills, acquire and incorporate varied perspectives, and communicate with diverse audiences about the use and effects of computing prepares New Jersey students for college and careers.

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.

Unit 1: Computing Systems
Grade Levels: K–2

Why Is This Unit Important?

People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form. Computing systems are present in all areas of life in the 21st Century. Because students are immersed in technology in their daily lives, they need to be able to use a computer in an effective and expedient manner.

Enduring Understandings:

- Individuals use computing devices to perform a variety of tasks accurately and quickly.
- Computing devices interpret and follow the instructions they are given literally.
- A computing system is composed of software and hardware.
- Describing a problem is the first step toward finding a solution when computing systems do not work as expected.

Essential Questions:

- How do individuals use computing devices to perform tasks accurately and quickly?
- How do computing devices interpret and follow verbal directions?
- What is hardware?
- What is software?
- What steps would you take to troubleshoot a computer problem?

Acquired Knowledge:

- Logging in to their school device
- Accessing information online
- Computing systems are everywhere

Acquired Skills:

- Analyze how things work.
- Identify and use everyday symbols.
- Describe qualities of everyday life.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Discussions about computing systems in everyday life
- At-home computing systems family scavenger hunt

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

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.

8.1.2.CS.2: Explain the functions of common software and hardware components of computing systems.

8.1.2.CS.3: Describe basic hardware and software problems using accurate terminology.

Unit 1: Computing Systems
Grade Levels: 3-5

Why Is This Unit Important?

People interact with a wide variety of computing devices that collect, store, analyze, and act upon information in ways that can affect human capabilities both positively and negatively. The physical components (hardware) and instructions (software) that make up a computing system communicate and process information in digital form. Computing systems are present in all areas of life in the 21st Century. Because students are immersed in technology in their daily lives, they need to be able to use a computer in an effective and expedient manner.

Enduring Understandings:

- Computing devices may be connected to other devices to form a system as a way to extend their capabilities.
- Software and hardware work together as a system to accomplish tasks (e.g., sending, receiving, processing, and storing units of information).
- Shared features allow for common troubleshooting strategies that can be effective for many systems.

Essential Questions:

- What can computing devices be used for?
- How does hardware and software work together to accomplish a task?
- What are some troubleshooting strategies?

Acquired Knowledge:

- Accessing information online.
- Computing systems are everywhere.
- Anyone can troubleshoot.

Acquired Skills:

- Follow directions to complete a technological task.
- Use appropriate symbols, numbers, and words to communicate key ideas about technological products and systems.
- Identify why a product or system is not working properly.
- Examine information to assess the trade-offs of using a product or system.

Assessments:

Formative
- Do Nows

- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Discussions about computing systems in everyday life
- At-home computing systems family scavenger hunt

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.5.CS.1: Model how computing devices connect to other components to form a system.

8.1.5.CS.2: Model how computer software and hardware work together as a system to accomplish tasks.

8.1.5.CS.3: Identify potential solutions for simple hardware and software problems using common troubleshooting strategies.

Unit 2: Networks and the Internet
Grade Levels: K-2

Why Is This Unit Important?

In our technology-rich world, there are basic understandings that all students need to have to be able to navigate their digital lives. Students need to have an understanding of general technology vocabulary so that they may communicate effectively in their digital environment. A large part of their digital world is accessing online information. Though they search for information very quickly using search terms, they are missing the background knowledge on what they are actually accessing, which are URLs. This unit is designed to fill in some of the missing essential general understandings of the contents of their digital lives.

Enduring Understandings:

- Computer networks can be used to connect individuals to other individuals, places, information, and ideas.
- The Internet enables individuals to connect with others worldwide.
- 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.
- Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world.

Essential Questions:

- How are computer networks used to connect individuals to other individuals, places, information, and ideas?
- How can the Internet help individuals to connect with others worldwide?
- How are passwords used to protect devices and information from unauthorized access?
- How has computing technology positively and negatively changed the way individuals live and work?

Acquired Knowledge:

- The Internet connects us globally.

Acquired Skills:

- Logging in to district's required websites

Assessments:

Formative
- ● Do Nows
- ● Classwork / Homework
- ● Exit Tickets

Summative
- ● Projects

Accommodations and Modifications
- ● Peer to peer assistance
- ● Extra time to complete task
- ● Additional guidance by teacher
- ● Rephrase directions
- ● Provide log in information
- ● Preferential seating

Suggested Learning Experiences and Instructional Activities:

- ● Collaborate on digital file or discussion

Instructional Materials (including, but not limited to):

- ● Individual student Chromebooks
- ● Canvas Learning Management System
- ● Google Workspace

Standards:

8.1.2.NI.1: Model and describe how individuals use computers to connect to other individuals, places, information, and ideas through a network.

8.1.2.NI.2: Describe how the Internet enables individuals to connect with others worldwide.

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.

Unit 2: Networks and the Internet
Grade Levels: 3-5

Why Is This Unit Important?

In our technology-rich world, there are basic understandings that all students need to have to be able to navigate their digital lives. Students need to have an understanding of general technology vocabulary so that they may communicate effectively in their digital environment. A large part of their digital world is accessing online information. Though they search for information very quickly using search terms, they are missing the background knowledge on what they are actually accessing, which are URLs. This unit is designed to fill in some of the missing essential general understandings of the contents of their digital lives.

Enduring Understandings:

- Information needs a physical or wireless path to travel to be sent and received.
- 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).
- Computing devices typically do not operate in isolation. Networks connect computing devices to share information and resources and are an increasingly integral part of computing. Networks and communication systems provide greater connectivity in the computing world.

Essential Questions:

- How does the Internet work?
- What is private information?
- What is public information?
- How can one keep their information secure while using the Internet?

Acquired Knowledge:

- The Internet connects us globally.
- We must protect our information online.

Acquired Skills:

- Students build networks and customize their learning environments in ways that support the learning process.
- Students manage their personal data to maintain digital privacy and security and are aware of data-collection technology used to track their navigation online.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Public vs. private info online game
- Collaborate on digital file or discussion

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.5.NI.1: Develop models that successfully transmit and receive information using both wired and wireless methods.

8.1.5.NI.2: Describe physical and digital security measures for protecting sensitive personal information.

Unit 3: Impacts of Computing
Grade Levels: K-2

Why Is This Unit Important?

Computing affects many aspects of the world in both positive and negative ways at local, national, and global levels. Individuals and communities influence computing through their behaviors and cultural and social interactions, and, in turn, computing influences new cultural practices.

Enduring Understandings:

- Computing technology has positively and negatively changed the way individuals live and work (e.g., entertainment, communication, productivity tools).

Essential Questions:

- How does computing affect your life?

Acquired Knowledge:

- Computing has had positive and negative impacts on individuals and society.

Acquired Skills:

- Explain ways that technology helps with everyday tasks.
- Illustrate helpful and harmful effects of technology.
- Compare simple technologies to evaluate their impacts.
- Select ways to reduce, reuse, and recycle resources in daily life.
- Design new technologies that could improve their daily lives.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions

- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Compare our experience with computing to other cultures
- Compare and contrast computing technologies now versus when teachers/ parents/ guardians were the same age group

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.2.IC.1: Compare how individuals live and work before and after the implementation of new computing technology.

Unit 3: Impacts of Computing
Grade Levels: 3-5

Why Is This Unit Important?

Computing affects many aspects of the world in both positive and negative ways at local, national, and global levels. Individuals and communities influence computing through their behaviors and cultural and social interactions, and, in turn, computing influences new cultural practices.

Enduring Understandings:

- The development and modification of computing technology is driven by individuals' needs and wants and can affect individuals differently.

Essential Questions:

- How have technologies advanced to solve human needs and wants?

Acquired Knowledge:

- Computing has had positive and negative impacts on individuals and society.

Acquired Skills:

- Describe the helpful and harmful effects of technology.
- Judge technologies to determine the best one to use to complete a given task or meet a need.
- Classify resources used to create technologies as either renewable or non-renewable.
- Explain why responsible use of technology requires sustainable management of resources.
- Predict how certain aspects of their daily lives would be different without given technologies.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance

- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Compare our experience with computing to other cultures
- Compare and contrast computing technologies now versus when teachers/ parents/ guardians were the same age group

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.5.IC.1: Identify computing technologies that have impacted how individuals live and work and describe the factors that influenced the changes.

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.

Unit 4: Data & Analysis
Grade Levels: K-2

Why Is This Unit Important?

Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.

Enduring Understandings:

- Individuals collect, use, and display data about individuals and the world around them.
- Computers store data that can be retrieved later.
- Data can be copied, stored in multiple locations, and retrieved.
- Data can be used to make predictions about the world.

Essential Questions:

- How do individuals collect, use, and display data about individuals and the world around them?
- How do computers store data that can be retrieved later?
- How is data copied and stored in multiple locations, and retrieved?
- How can data be used to make predictions about the world?

Acquired Knowledge:

- Data communicates information

Acquired Skills:

- Apply concepts and skills from technology and engineering activities that reinforce concepts and skills across multiple content areas
- Draw connections between technology and human experiences

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications

- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Create a chart digitally and interpret information

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.2.DA.1: Collect and present data, including climate change data, in various visual formats.

8.1.2.DA.2: Store, copy, search, retrieve, modify, and delete data using a computing device.

8.1.2.DA.3: Identify and describe patterns in data visualizations.

8.1.2.DA.4: Make predictions based on data using charts or graphs.

Unit 4: Data & Analysis
Grade Levels: 3-5

Why Is This Unit Important?

Computing systems exist to process data. The amount of digital data generated in the world is rapidly expanding, so the need to process data effectively is increasingly important. Data is collected and stored so that it can be analyzed to better understand the world and make more accurate predictions.

Enduring Understandings:

- Data can be organized, displayed, and presented to highlight relationships.
- The type of data being stored affects the storage requirements.
- Individuals can select, organize, and transform data into different visual representations and communicate insights gained from the data.
- Many factors influence the accuracy of inferences and predictions.

Essential Questions:

- How can data be organized, displayed and presented to clearly explain what it means?
- What types of storage requirements are needed for different files?
- How can a person select, organize and transform data into different representations?
- What factors influence the accuracy, inference, and prediction of certain data sets?

Acquired Knowledge:

- Data communicates information.

Acquired Skills:

- Students choose the appropriate platforms and tools for meeting the desired objectives of their creation or communication.
- Students create original works or responsibly repurpose or remix digital resources into new creations.
- Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.
- Students publish or present content that customizes the message and medium for their intended audiences.

Assessments:

Formative

- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Create charts to display information digitally

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.5.DA.1: Collect, organize, and display data in order to highlight relationships or support a claim.

8.1.5.DA.2: Compare the amount of storage space required for different types of data.

8.1.5.DA.3: Organize and present collected data visually to communicate insights gained from different views of the data.

8.1.5.DA.4: Organize and present climate change data visually to highlight relationships or support a claim.

8.1.5.DA.5: Propose cause and effect relationships, predict outcomes, or communicate ideas using data.

Unit 5: Algorithms & Programming
Grade Levels: K-2

Why Is This Unit Important?

An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems.

Enduring Understandings:

- 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.
- Real world information can be stored and manipulated in programs as data (e.g., numbers, words, colors, images).
- Computers follow precise sequences of steps that automate tasks.
- Complex tasks can be broken down into simpler instructions, some of which can be broken down even further.
- 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).

Essential Questions:

- How do individuals develop and follow directions as part of daily life?
- What are the sequence of steps expressed as an algorithm that a computer can process?
- How can real world information be stored and manipulated in programs as data (e.g., numbers, words, colors, images)?
- How can computers follow precise sequences of steps that automate tasks?
- How are complex tasks broken down into simpler instructions?
- How do people work together to develop programs for a purpose, such as expressing ideas or addressing problems?
- How do you debug a program?

Acquired Knowledge:

- Computers follow specific steps.
- Coding is using a set of instructions to communicate with computers.

Acquired Skills:

- Sequencing

- Following directions

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Computerless coding activities (create and complete a maze, for example)
- Code.org, Scratch, etc.

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.2.AP.1: Model daily processes by creating and following algorithms to complete tasks.

8.1.2.AP.2: Model the way programs store and manipulate data by using numbers or other symbols to represent information.

8.1.2.AP.3: Create programs with sequences and simple loops to accomplish tasks.

8.1.2.AP.4: Break down a task into a sequence of steps.

8.1.2.AP.5: Describe a program's sequence of events, goals, and expected outcomes.

8.1.2.AP.6: Debug errors in an algorithm or program that includes sequences and simple loops.

Unit 5: Algorithms & Programming
Grade Levels: 3-5

Why Is This Unit Important?

An algorithm is a sequence of steps designed to accomplish a specific task. Algorithms are translated into programs, or code, to provide instructions for computing devices. Algorithms and programming control all computing systems, empowering people to communicate with the world in new ways and solve compelling problems.

Enduring Understandings:

- Different algorithms can achieve the same result.
- Some algorithms are more appropriate for a specific use than others.
- Programming languages provide variables, which are used to store and modify data.
- A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).
- 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.
- Individuals develop programs using an iterative process involving design, implementation, testing, and review.

Essential Questions:

- What are some examples of programming languages?
- What are some control structures that can be added to a program to make it work better?
- How can programs be broken down into smaller parts?

Acquired Knowledge:

- Computers follow specific steps.
- Coding is using a set of instructions to communicate with computers.

Acquired Skills:

- Students formulate problem definitions suited for technology-assisted methods such as data analysis, abstract models and algorithmic thinking in exploring and finding solutions.
- Students collect data or identify relevant data sets, use digital tools to analyze them, and represent data in various ways to facilitate problem-solving and decision-making.

- Students break problems into component parts, extract key information, and develop descriptive models to understand complex systems or facilitate problem-solving.
- Students understand how automation works and use algorithmic thinking to develop a sequence of steps to create and test automated solutions.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Computerless coding activities (create and complete a maze, for example)
- Code.org, Scratch, etc.

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.1.5.AP.1: Compare and refine multiple algorithms for the same task and determine which is the most appropriate.

8.1.5.AP.2: Create programs that use clearly named variables to store and modify data.

8.1.5.AP.3: Create programs that include sequences, events, loops, and conditionals.

8.1.5.AP.4: Break down problems into smaller, manageable sub-problems to facilitate program development.

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.

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.

Unit 6: Engineering Design
Grade Levels: K-2

Why Is This Unit Important?

People design for enjoyment and to solve problems, extend human capabilities, satisfy needs and wants, and improve the human condition. Engineering Design, a systematic approach to creating solutions to technological problems and finding ways to meet people's needs and desires, allows for the effective and efficient development of products and systems.

Enduring Understandings:

- Engineering design is a creative process for meeting human needs or wants that can result in multiple solutions.
- Limitations (constraints) must be considered when engineering designs.

Essential Questions:

- How is engineering design a creative process for meeting human needs or wants that can result in multiple solutions?
- What limitations (constraints) must be considered when engineering designs?

Acquired Knowledge:

- We often have to repeat the design process to complete a project.

Acquired Skills:

- Apply design concepts, principles, and processes through play and exploration
- Demonstrate that designs have requirements
- Explain that design is a response to wants and needs
- Discuss that all designs have different characteristics that can be described
- Illustrate that there are different solutions to a design and that none are perfect.
- Differentiate essential skills of the technology and engineering design process.
- Apply skills necessary for making in design.

Assessments:

Formative
- Do Nows
- Classwork / Homework

- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- STEM Challenges

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.2.ED.1: Communicate the function of a product or device.

8.2.2.ED.2: Collaborate to solve a simple problem, or to illustrate how to build a product using the design process.

8.2.2.ED.3: Select and use appropriate tools and materials to build a product using the design process.

8.2.2.ED.4: Identify constraints and their role in the engineering design process.

Unit 6: Engineering Design
Grade Levels: 3-5

Why Is This Unit Important?

People design for enjoyment and to solve problems, extend human capabilities, satisfy needs and wants, and improve the human condition. Engineering Design, a systematic approach to creating solutions to technological problems and finding ways to meet people's needs and desires, allows for the effective and efficient development of products and systems.

Enduring Understandings:

- 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.
- Engineering design requirements include desired features and limitations that need to be considered.

Essential Questions:

- How is the Engineering Design Process used to solve real world problems?
- What does criteria mean?
- What is a constraint/limitation?

Acquired Knowledge:

- We often have to repeat the design process to complete a project.

Acquired Skills:

- Illustrate that there are multiple approaches to design.
- Apply the technology and engineering design process.
- Evaluate designs based on criteria, constraints, and standards.
- Interpret how good design improves the human condition.
- Apply universal principles and elements of design.
- Evaluate the strengths and weaknesses of existing design solutions, including their own solutions.
- Practice successful design skills.
- Apply tools, techniques, and materials in a safe manner as part of the design process.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- STEM Challenges

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.5.ED.1: Explain the functions of a system and its subsystems.

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.

8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).

8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.

8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.

Unit 7: Interaction of Technology and Humans
Grade Levels: K-2

Why Is This Unit Important?

Societies influence technological development. Societies are characterized by common elements such as shared values, differentiated roles, and cultural norms, as well as by entities such as community institutions, organizations, and businesses. Interaction of Technology and Humans concerns the ways society drives the improvement and creation of new technologies, and how technologies both serve and change society.

Enduring Understandings:

- Human needs and desires determine which new tools are developed.
- Technology has changed the way people live and work.
- Various tools can improve daily tasks and quality of life.

Essential Questions:

- How do human needs and desires determine which new tools are developed?
- How has technology changed the way people live and work?
- How do various tools improve daily tasks and quality of life?"

Acquired Knowledge:

- Technology changed the way we live.

Acquired Skills:

- Compare the natural world and human-made world.
- Explain the tools and techniques that people use to help them do things.
- Demonstrate that creating can be done by anyone.
- Discuss the roles of scientists, engineers, technologists, and others who work with technology.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Compare and contrast how technology has changed how we live and work.

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.2.ITH.1: Identify products that are designed to meet human wants or needs.

8.2.2.ITH.2: Explain the purpose of a product and its value.

8.2.2.ITH.3: Identify how technology impacts or improves life.

8.2.2.ITH.4: Identify how various tools reduce work and improve daily tasks.

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.

Unit 7: Interaction of Technology and Humans
Grade Levels: 3-5

Why Is This Unit Important?

Societies influence technological development. Societies are characterized by common elements such as shared values, differentiated roles, and cultural norms, as well as by entities such as community institutions, organizations, and businesses. Interaction of Technology and Humans concerns the ways society drives the improvement and creation of new technologies, and how technologies both serve and change society.

Enduring Understandings:

- Societal needs and wants determine which new tools are developed to address real-world problems.
- 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.

Essential Questions:

- How do societal needs and wants determine which new tools are developed to solve real world problems?
- What are some examples of intended and unintended consequences on society and the environment that a new technology can have?
- What kinds of technological/STEM jobs are there?

Acquired Knowledge:

- Technology changed the way we live.
- There are many careers in STEM fields.

Acquired Skills:

- Compare how things found in nature differ from things that are human-made, noting differences and similarities in how they are produced and used.
- Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation.
- Differentiate between the roles of scientists, engineers, technologists, and others in creating and maintaining technological systems.
- Design solutions by safely using tools, materials, and skills.
- Explain how solutions to problems are shaped by economic, political, and cultural forces.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Compare and contrast how technology has changed how we live and work.
- STEM Career Fair

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.

8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.

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.

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.

Unit 8: Nature of Technology
Grade Levels: K-2

Why Is This Unit Important?

Human population, patterns and movement focus on the size, composition, distribution, and movement of human populations and how they are fundamental and active features on Earth's surface. This includes understanding that the expansion and redistribution of the human population affects patterns of settlement, environmental changes, and resource use. Patterns and movements of population also relate to physical phenomena including climate variability, landforms, and locations of various natural hazards and their effects on population size, composition, and distribution.

Enduring Understandings:

- Innovation and the improvement of existing technology involves creative thinking.

Essential Questions:

- How does creative thinking improve innovation and the improvement of existing technology?

Acquired Knowledge:

- Sometimes a technology developed for one purpose is adapted to serve other purposes
- Creative thinking is necessary to improve and innovate.

Acquired Skills:

- Compare the natural world and human-made world.
- Explain the tools and techniques that people use to help them do things.
- Demonstrate that creating can be done by anyone.
- Discuss the roles of scientists, engineers, technologists, and others who work with technology.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Brainstorm how to improve an existing product

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

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.

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.

Unit 8: Nature of Technology
Grade Levels: 3-5

Why Is This Unit Important?

Human population, patterns and movement focus on the size, composition, distribution, and movement of human populations and how they are fundamental and active features on Earth's surface. This includes understanding that the expansion and redistribution of the human population affects patterns of settlement, environmental changes, and resource use. Patterns and movements of population also relate to physical phenomena including climate variability, landforms, and locations of various natural hazards and their effects on population size, composition, and distribution.

Enduring Understandings:

- 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

Essential Questions:

- What factors influence technology innovations and improvements?
- What does an engineer do?
- What does a scientist do?

Acquired Knowledge:

- Sometimes a technology developed for one purpose is adapted to serve other purposes
- Creative thinking is necessary to improve and innovate.

Acquired Skills:

- Discuss the roles of scientists, engineers, technologists, and others who work with technology.
- Compare how things found in nature differ from things that are human-made, noting differences and similarities in how they are produced and used.
- Describe the unique relationship between science and technology, and how the natural world can contribute to the human-made world to foster innovation.
- Differentiate between the roles of scientists, engineers, technologists, and others in creating and maintaining technological systems.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Brainstorm how to improve an existing product

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.

8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.

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 science impacts technologies.

Unit 9: Effects of Technology on the Natural World
Grade Levels: K-2

Why Is This Unit Important?

Many of engineering and technology's impacts on society and the environment are widely regarded as desirable. However, other impacts are regarded as less desirable. Effects of Technology on the Natural World concerns the positive and negative ways that technologies affect the natural world.

Enduring Understandings:

- 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.

Essential Questions:

- How has the use of technology developed for the human designed world affect the environment, including land, water, air, plants, and animals?
- How do technologies that use natural sources create negative effects on the environment, its quality, and inhabitants?
- How does reusing and recycling materials can save money while preserving natural resources and avoiding damage to the environment?

Acquired Knowledge:

- Resources need to be utilized wisely to have positive effects on the environment and society

Acquired Skills:

- Critical thinking
- Discussion

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Discussion about how technology negatively impacts the environment and brainstorming how to limit it

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.2.ETW.1: Classify products as resulting from nature or produced as a result of technology.

8.2.2.ETW.2: Identify the natural resources needed to create a product.

8.2.2.ETW.3: Describe or model the system used for recycling technology.

8.2.2.ETW.4: Explain how the disposal of or reusing a product affects the local and global environment.

Unit 9: Effects of Technology on the Natural World
Grade Levels: 3-5

Why Is This Unit Important?

Many of engineering and technology's impacts on society and the environment are widely regarded as desirable. However, other impacts are regarded as less desirable. Effects of Technology on the Natural World concerns the positive and negative ways that technologies affect the natural world.

Enduring Understandings:

- 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.

Essential Questions:

- What are some unintended consequences that technologies and humans have done to the environment?
- Why does technology need to be continually developed in order to be more efficient?
- What are renewable and non-renewable resources?

Acquired Knowledge:

- Resources need to be utilized wisely to have positive effects on the environment and society

Acquired Skills:

- Determine factors that influence changes in a society's technological systems or infrastructure.
- Explain how technologies are developed or adapted when individual or societal needs and wants change.
- Identify what renewable and nonrenewable resources are.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Discussion about how technology negatively impacts the environment and brainstorming how to limit it

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.

8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.

8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.

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.

Unit 10: Ethics & Culture
Grade Levels: K-2

Why Is This Unit Important?

Ethics and Culture concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions.

Enduring Understandings:

- The availability of technology for essential tasks varies in different parts of the world.

Essential Questions:

- How does the availability of technology for essential tasks vary in different parts of the world?

Acquired Knowledge:

- Use of technology affects humans and the environment.

Acquired Skills:

- Critical thinking
- Discussion

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Discussion about how the role and access to technology varies in different places and cultures.

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

8.2.2.EC.1: Identify and compare technology used in different schools, communities, regions, and parts of the world.

Unit 10: Ethics & Culture
Grade Levels: 3-5

Why Is This Unit Important?

Ethics and Culture concerns the profound effects that technologies have on people, how those effects can widen or narrow disparities, and the responsibility that people have for the societal consequences of their technological decisions.

Enduring Understandings:

- Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Essential Questions:

- How do technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values?

Acquired Knowledge:

- Use of technology affects humans and the environment.

Acquired Skills:

- Explains ethical dilemmas involving technology, such as trade-offs.

Assessments:

Formative
- Do Nows
- Classwork / Homework
- Exit Tickets

Summative
- Projects

Accommodations and Modifications
- Peer to peer assistance
- Extra time to complete task
- Additional guidance by teacher
- Rephrase directions
- Provide log in information
- Preferential seating

Suggested Learning Experiences and Instructional Activities:

- Discussion about how the role and access to technology varies in different places and cultures.

Instructional Materials (including, but not limited to):

- Individual student Chromebooks
- Canvas Learning Management System
- Google Workspace

Standards:

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.

Suggested Pacing

Cycle #	K	1	2	3	4	5
1	Class Expectations & Login Procedures & Canvas Review	Class Expectations & Login Procedures & Canvas Review	Class Expectations & Login Procedures & Canvas Review	Class Expectations & Login Procedures & Canvas Review	Class Expectations & Login Procedures & Canvas Review	Class Expectations & Login Procedures & Canvas Review
2	Computing Systems	Computing Systems	Computing Systems	Computing Systems	Computing Systems	Computing Systems
3	Computing Systems	Computing Systems	Computing Systems	Computing Systems	Computing Systems	Computing Systems
4	Computing Systems	Computing Systems	Computing Systems	Networks and the Internet	Networks and the Internet	Networks and the Internet
5	Networks and the Internet	Networks and the Internet	Networks and the Internet	Networks and the Internet	Networks and the Internet	Networks and the Internet
6	Networks and the Internet	Networks and the Internet	Networks and the Internet	Networks and the Internet	Networks and the Internet	Networks and the Internet
7	Networks and the Internet	Networks and the Internet	Networks and the Internet	Impacts of Computing	Impacts of Computing	Impacts of Computing
8	Impacts of Computing	Impacts of Computing	Impacts of Computing	Impacts of Computing	Impacts of Computing	Impacts of Computing
9	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis
10	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis
11	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis	Data & Analysis
12	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Data & Analysis	Data & Analysis	Data & Analysis
13	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming
14	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming
15	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming
16	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming
17	Engineering Design	Engineering Design	Engineering Design	Algorithms & Programming	Algorithms & Programming	Algorithms & Programming
18	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design
19	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design

20	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design
21	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design	Engineering Design
22	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Engineering Design	Engineering Design	Engineering Design
23	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans
24	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans	Interaction of Technology and Humans
25	Nature of Technology	Nature of Technology	Nature of Technology	Nature of Technology	Nature of Technology	Nature of Technology
26	Nature of Technology	Nature of Technology	Nature of Technology	Nature of Technology	Nature of Technology	Nature of Technology
27	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World
28	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World
29	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World
30	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World	Effects of Technology on the Natural World
31	Ethics & Culture	Ethics & Culture	Ethics & Culture	Ethics & Culture	Ethics & Culture	Ethics & Culture

Sample Standards Integration

During this course, in addition to the New Jersey Student Learning Standards for Computer Science and Design Thinking, students will work on developing, to an age appropriate level, standards across content areas, including:

Career Readiness, Life Literacies, and Key Skills
9.4.8.CI.4: Explore the role of creativity and innovation in career pathways and industries.
Students will connect the concepts and skills in this course to potential future careers.

Social Studies
6.1.12.EconNE.16.b: Evaluate the economic, political, and social impact of new and emerging technologies on individuals and nations.
Students will discuss the positive and negative impacts of technological advancements.

Science
MS-PS1-6: Undertake a design project, engaging in the design cycle, to construct and/or implement a solution that meets specific design criteria and constraints.
Students will employ the design cycle to complete projects based on specific guidelines.

Mathematics
NJSLS-M.8.SP.A.2: Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit (e.g. line of best fit) by judging the closeness of the data points to the line.
Students will interpret, analyze, and discuss data on diversity in technology careers and education.

English Language Arts
NJSLSA.W6: Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
Students will engage in written discussion utilizing the district's digital learning environment.

Diversity, Equity & Inclusion

All students deserve equitable access (N.J.A.C. 6A:7) to a high-quality education that is inclusive and reflective of the rich diversity of our state. This curriculum will include learning activities that meet the legislative requirements of the 2019 History and Contributions of Individuals with Disabilities and LGBT (N.J.S.A. 18A:35-4.35-6) and Diversity and Inclusion statutes (N.J.S.A. 18A:35-4.36a) that may include:
- Students work in groups to develop a slide deck highlighting LGBTQ+ pioneers of computer science, such as Alan Turing, Edith Windsor, etc.
- Students will interpret, analyze, evaluate, and discuss data involving diversity in STEM fields (this may include the number of women enrolled in technology education programs, representation of people with disabilities in video games, etc.).