GREEN TOWNSHIP SCHOOL DISTRICT



Content Area: Computer Science and Design Thinking

Course/Grade Level: K-8

Curriculum Committee Members:

Principal:

Jon Paul Bollette

Board Approval Date:

{Fill in when known}



Mission:

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.

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.



Key Performance and Benchmark Tasks/Assessments

Resources for help in creating assessments

Formative assessments:

- Used to gauge student understanding and progress throughout the unit.
- Not necessarily graded
- Provide feedback for students to use to reflect, revise and refine their work.

Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.

Benchmark Assessments:

• Teacher-created benchmark assessments to be given periodically during the year.

Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.
- Accommodation and modification ideas may be found here:
 - o Modifications & Accommodations Menu
 - Assessments other than paper & pencil tests See link for more info: <u>http://education.gmu.edu/assets/docs/forms/mirs/assessment_brochure.pdf</u>

Integrated Accommodations & Modifications



Please utilize the link below for ideas and strategies to use with *ELL*, *Students with IEPS & 504s*, *At-Risk Students and Gifted & Talented Students*.

The attached worksheets can be printed ahead of each unit during the planning phase to help the teacher plan for the needs of particular students in each class, allowing for differentiation per unit and per year. The worksheets contain suggested accommodations and modifications for Content & Material, Student Organization, Instructional Strategies, Assessments, Attention/Focus, Written Language, and Social/Behavioral.



Computer Science Grade K-2

Computing Systems and Networks	Pacing: Students meet 1x weekly throughout K-2	
Unit Summary: Students will learn how computer systems, networks and the internet are used in everyday life.		
Essential Questions: 1. What role do computers play in the lives of people? 2. How have computers impacted humans?	Enduring Understandings:	

New Jersey Student Learning Standards	Student Learning Objectives	Practices
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 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. 8.1.2.NI.4: Explain why access to devices need to be secured.	Students will: Define hardware and software Describe problems that arise with basic computer hardware and software Model how humans use computers including the internet in their daily lives Create passwords that are unique and safe	Fostering an Inclusive Computing and Design Culture Collaborating Around Computing and Design



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

Interdisciplinary Connections

Career Readiness, Life Literacies and Key Skills:

- 9.4.2.Cl.1: Demonstrate openness to new ideas and perspectives (e.g., 1.1.2.CR1a, 2.1.2.EH.1, 6.1.2.CivicsCM.2).
- 9.4.2.Cl.2: Demonstrate originality and inventiveness in work (e.g., 1.3A.2CR1a).
- 9.4.2.DC.1: Explain differences between ownership and sharing of information.
- 9.4.2.DC.2: Explain the importance of respecting digital content of others
- 9.4.2.DC.3: Explain how to be safe online and follow safe practices when using the internet (e.g., 8.1.2.NI.3, 8.1.2.NI.4).
- 9.4.2.DC.4: Compare information that should be kept private to information that might be made public.
- 9.4.2.DC.5: Explain what a digital footprint is and how it is created.
- 9.4.2.DC.6: Identify respectful and responsible ways to communicate in digital environments
- 9.4.2.DC.7: Describe actions peers can take to positively impact climate change (e.g., 6.3.2.CivicsPD.1).

Unit 1: Assessments

Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.

Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.

Unit 1: Accommodations & Modifications



Please utilize the link below for ideas and strategies to use with ELL, Students with IEPS & 504s, At-Risk Students and Gifted & Talented Students. Note possible accommodations or modifications for this unit below.

Modifications & Accommodations Menu

Computer Science Grade K-2

Data and Programming	Pacing: Students meet 1x weekly throughout K-2	
Unit Summary: Students will learn how data is used and stored through technology, as well as the basic components of computer programming and algorithms.		
Essential Questions: 1. What can computers do and how do they work? 2. How do programs tell a computer what to do?	 Enduring Understandings: Computers store data that can be retrieved later. Individuals develop and follow directions as a part of everyday live. Computers follow precise sequences of steps to complete tasks. 	

New Jersey Student Learning Standards	Student Learning Objectives	Practices
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	Students will:	Recognizing and Defining Computational Problems



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
- 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.

- Use algorithms to make predictions
- Create algorithms for daily processes and make connections to how algorithms are used in technology

Developing and Using Abstractions

Creating Computational Artifacts

Testing and Refining Computational Artifacts

Communicating About Computing and Design

Interdisciplinary Connections

Career Readiness, Life Literacies and Key Skills:

- 9.4.2.TL.1: Identify the basic features of a digital tool and explain the purpose of the tool (e.g., 8.2.2.ED.1).
- 9.4.2.TL.2: Create a document using a word processing application.
- 9.4.2.TL.3: Enter information into a spreadsheet and sort the information.
- 9.4.2.TL.4: Navigate a virtual space to build context and describe the visual content.
- 9.4.2.TL.5: Describe the difference between real and virtual experiences.
- 9.4.2.TL.6: Illustrate and communicate ideas and stories using multiple digital tools (e.g., SL.2.5.).
- 9.4.2.TL.7: Describe the benefits of collaborating with others to complete digital tasks or develop digital artifacts (e.g., W.2.6., 8.2.2.ED.2).

Unit 2: Assessments



Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.

Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.

Unit 2: Accommodations & Modifications

Please utilize the link below for ideas and strategies to use with ELL, Students with IEPS & 504s, At-Risk Students and Gifted & Talented Students. Note possible accommodations or modifications for this unit below.



Computer Science Grade 3-5

Computing Systems and Networks	Pacing: Students meet 1x weekly throughout K-2	
Unit Summary: Students will identify the systems in place, troubleshoot problems with hardware and software and identify the impact that technology has had on individual.		
Essential Questions: 1. How is information shared through computer technology? 2. What impact has computer technology had on the lives of individuals? 3. How has the needs of individuals impacted the changes in computer technology?	Computers operate through systems that communicate with each other to complete tasks. Information needs a physical or wireless path to travel to be sent and received. The development and modification of computing technology is driven by individual's needs and wants and can affect individuals differently.	

New Jersey Student Learning Standards	Student Learning Objectives	Practices
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. 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. 8.1.5.IC.1: Identify computing technologies that have	Students will: Define systems as it applies to computers and computing devices. Distinguish between wired and wireless Identify problems and solutions for hardware and software problems. Define troubleshooting. Determine how computers have impacted everyday life, including work Discuss and identify the need for security measures in terms of personal information	Fostering an Inclusive Computing and Design Culture Collaborating Around Computing and Design



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.		
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Interdisciplinary Connections

Career Readiness, Life Literacies and Key Skills:

- 9.4.5.DC.1: Explain the need for and use of copyrights.
- 9.4.5.DC.2: Provide attribution according to intellectual property rights guidelines using public domain or creative commons media.
- 9.4.5.DC.3: Distinguish between digital images that can be reused freely and those that have copyright restrictions.
- 9.4.5.DC.4: Model safe, legal, and ethical behavior when using online or offline technology (e.g., 8.1.5.NI.2).
- 9.4.5.DC.5: Identify the characteristics of a positive and negative online identity and the lasting implications of online activity.
- 9.4.5.DC.6: Compare and contrast how digital tools have changed social interactions (e.g., 8.1.5.IC.1).
- 9.4.5.DC.7: Explain how posting and commenting in social spaces can have positive or negative consequences.
- 9.4.5.DC.8: Propose ways local and global communities can engage digitally to participate in and promote climate action (e.g., 6.3.5.GeoHE.1).
- 9.4.5.TL.1: Compare the common uses of at least two different digital tools and identify the advantages and disadvantages of using each.
- $9.4.5.TL.2\colon Sort$ and filter data in a spreadsheet to analyze findings.
- 9.4.5.TL.3: Format a document using a word processing application to enhance text, change page formatting, and include appropriate images graphics, or symbols.
- 9.4.5.CT.2: Identify a problem and list the types of individuals and resources (e.g., school, community agencies, governmental, online) that can aid in solving the problem (e.g., 2.1.5.CHSS.1, 4-ESS3-1)

Unit 1: Assessments

Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.



Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.

Unit 1: Accommodations & Modifications

Please utilize the link below for ideas and strategies to use with ELL, Students with IEPS & 504s, At-Risk Students and Gifted & Talented Students. Note possible accommodations or modifications for this unit below.

Modifications & Accommodations Menu

Computer Science Grade 3-5

Data and Programming	Pacing: Students meet 1x weekly throughout K-2	
Unit Summary: Students will analyze how data is organized and presented and create programs that involve simple algorithms.		
Essential Questions: 1. How do computers work? 2. What does a computer programmer do?	Computers store, organize and display data in a variety of ways. Computers use algorithms to complete tasks. Different algorithms can achieve the same result.	

New Jersey Student Learning Standards	Student Learning Objectives	Practices
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- 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.
- 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.

Students will:

- Collect, organize and present data to draw conclusions about a variety of viewpoints.
- Define cause and effect, variables, and other key terminology in relationship to algorithms
- Create simple programs that follow an algorithm

Recognizing and Defining Computational Problems

Developing and Using Abstractions

Creating Computational Artifacts

Testing and Refining Computational Artifacts

Communicating About Computing and Design

Interdisciplinary Connections

Career Readiness, Life Literacies and Key Skills:

- 9.4.5.IML.1: Evaluate digital sources for accuracy, perspective, credibility and relevance (e.g., Social Studies Practice Gathering and Evaluating Sources).
- 9.4.5.IML.2: Create a visual representation to organize information about a problem or issue (e.g., 4.MD.B.4, 8.1.5.DA.3).
- 9.4.5.IML.3: Represent the same data in multiple visual formats in order to tell a story about the data.
- 9.4.5.IML.4: Determine the impact of implicit and explicit media messages on individuals, groups, and society as a whole.
- 9.4.5.IML.5: Distinguish how media are used by individuals, groups, and organizations for varying purposes. (e.g., 1.3A.5.R1a).



9.4.5.IML.6: Use appropriate sources of information from diverse sources, contexts, disciplines, and cultures to answer questions (e.g., RI.5.7,

6.1.5. History CC.7, 7.1. NM. IPRET.5).

9.4.5.IML.7: Evaluate the degree to which information meets a need including social emotional learning, academic, and social (e.g., 2.2.5. PF.5).

9.4.5.TL.4: Compare and contrast artifacts produced individually to those developed collaboratively (e.g., 1.5.5.CR3a).

9.4.5.TL.5: Collaborate digitally to produce an artifact (e.g., 1.2.5CR1d).

Unit 2: Assessments

Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.

Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.

Unit 2: Accommodations & Modifications

Please utilize the link below for ideas and strategies to use with ELL, Students with IEPS & 504s, At-Risk Students and Gifted & Talented Students. Note possible accommodations or modifications for this unit below.



Computer Science Grade 6-8

Computing Systems and Networks	Pacing: Students meet for 30 day rotations in grades 6-8	
Unit Summary: Students will analyze the impacts of computers on human behavior and identify safety and reliability of technology in everyday life.		
Essential Questions: 1. How can computer technology be improved to suit the needs of humans? 2. Why does information shared on a network need to be protected?	Advancements in computing technology can change individuals' behaviors. Information that is sent and received across networks can be protected in a variety of ways.	

New Jersey Student Learning Standards	Student Learning Objectives	Practices
8.1.8.CS.1: Recommend improvements to computing devices in order to improve the ways users interact with the devices. 8.1.8.CS.2: Design a system that combines hardware and software components to process data. 8.1.8.CS.3: Justify design decisions and explain potential system trade-offs. 8.1.8.CS.4: Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems. 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. 8.1.8.NI.2: Model the role of protocols in transmitting data	Students will: Design programs that complete a variety of tasks Identify the systems that are used to design computer programs and networks. Discuss the safety and security measures in place for transmission of information online and why they are necessary Analyze and describe how individuals have been impacted by networks and computer technology.	Fostering an Inclusive Computing and Design Culture Collaborating Around Computing and Design



across networks and the Internet and how they enable secure and errorless communication

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.

8.1.8.NI.4: Explain how new security measures have been created in response to key malware events

8.1.8.IC.1: Compare the trade-offs associated with computing technologies that affect individual's everyday activities and career options.

8.1.8.IC.2: Describe issues of bias and accessibility in the design of existing technologies

Interdisciplinary Connections

Career Readiness, Life Literacies and Key Skills:

- 9.4.8.DC.3: Describe tradeoffs between allowing information to be public (e.g., within online games) versus keeping information private and secure.
- 9.4.8.DC.4: Explain how information shared digitally is public and can be searched, copied, and potentially seen by public audiences.
- 9.4.8.DC.5: Manage digital identity and practice positive online behavior to avoid inappropriate forms of self-disclosure.
- 9.4.8.DC.6: Analyze online information to distinguish whether it is helpful or harmful to reputation
- 9.4.8.DC.7: Collaborate within a digital community to create a digital artifact using strategies such as crowdsourcing or digital surveys.
- 9.4.8.DC.8: Explain how communities use data and technology to develop measures to respond to effects of climate change (e.g., smart cities).
- 9.4.8.IML.1: Critically curate multiple resources to assess the credibility of sources when searching for information.
- 9.4.8.IML.2: Identify specific examples of distortion, exaggeration, or misrepresentation of information
- 9.4.8.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 (e.g., 6.SP.B.4, 7.SP.B.8b).
- 9.4.8.IML.4: Ask insightful questions to organize different types of data and create meaningful visualizations.
- 9.4.8.IML.5: Analyze and interpret local or public data sets to summarize and effectively communicate the data
- 9.4.8.IML.6: Identify subtle and overt messages based on the method of communication.
- 9.4.8.IML.8: Apply deliberate and thoughtful search strategies to access high-quality information on climate change (e.g., 1.1.8.C1b).
- 9.4.8.IML.9: Distinguish between ethical and unethical uses of information and media (e.g., 1.5.8.CR3b, 8.2.8.EC.2).



9.4.8.IML.10: Examine the consequences of the uses of media (e.g., RI.8.7).

Unit 1: Assessments

Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.

Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.

Unit 1: Accommodations & Modifications

Please utilize the link below for ideas and strategies to use with ELL, Students with IEPS & 504s, At-Risk Students and Gifted & Talented Students. Note possible accommodations or modifications for this unit below.

Modifications & Accommodations Menu

Computer Science Grade 6-8

Data and Programming

Pacing: Students meet for 30 day rotations in grades 6-8

Unit Summary: Students will analyze how data is represented in different formats through technology. They will design algorithms to solve complex problems.



Essential Questions:

- 1. How do program designers create programs?
- 2. How is information stored on a computer and what problems are there with computer storage?

Enduring Understandings:

- Data is represented in many formats.
- Computer models can be used to simulate events, examine theories and inferences, or make predictions.
- Algorithms can be reused in many situations.

New Jersey Student Learning Standards	Student Learning Objectives	Practices
8.1.8.DA.1: Organize and transform data collected using computational tools to make it usable for a specific purpose. 8.1.8.DA.2: Explain the difference between how the computer stores data as bits and how the data is displayed. 8.1.8.DA.3: Identify the appropriate tool to access data based on its file format 8.1.8.DA.4: Transform data to remove errors and improve the accuracy of the data for analysis. 8.1.8.DA.5: Test, analyze, and refine computational models. 8.1.8.DA.6: Analyze climate change computational models and propose refinements. 8.1.8.AP.1: Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode. 8.1.8.AP.2: Create clearly named variables that represent different data types and perform operations on their values 8.1.8.AP.3: Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals. 8.1.8.AP.4: Decompose problems and sub-problems into parts to facilitate the design, implementation, and review of programs. 8.1.8.AP.5: Create procedures with parameters to organize code and make it easier to reuse. 8.1.8.AP.6: Refine a solution that meets users' needs by incorporating feedback from team members and users.	Students will: Create systems that organize and present data for specific purposes. Choose from a variety of options the best tools to access data Design programs that use algorithms and code to complete a task. Define vocabulary specific to computer coding and design, including loops, parameters, pseudocode, conditionals.	Recognizing and Defining Computational Problems Developing and Using Abstractions Creating Computational Artifacts Testing and Refining Computational Artifacts Communicating About Computing and Design



easier to follow, test, and debug.

Interdisciplinary Connections

Career Readiness, Life Literacies and Key Skills:

- 9.4.8.Cl.1: Assess data gathered on varying perspectives on causes of climate change (e.g., crosscultural, gender-specific, generational), and determine how the data can best be used to design multiple potential solutions (e.g., RI.7.9, 6.SP.B.5, 7.1.NH.IPERS.6, 8.2.8.ETW.4).
- 9.4.8.Cl.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).
- 9.4.8.Cl.3: Examine challenges that may exist in the adoption of new ideas (e.g., 2.1.8.SSH, 6.1.8.CivicsPD.2).
- 9.4.8.Cl.4: Explore the role of creativity and innovation in career pathways and industries
- 9.4.8.CT.1: Evaluate diverse solutions proposed by a variety of individuals, organizations, and/or agencies to a local or global problem, such as climate change, and use critical thinking skills to predict which one(s) are likely to be effective (e.g., MS-ETS1-2).
- 9.4.8.CT.2: Develop multiple solutions to a problem and evaluate short- and long-term effects to determine the most plausible option (e.g., MS-ETS1-4, 6.1.8.CivicsDP.1).
- 9.4.8.CT.3: Compare past problem-solving solutions to local, national, or global issues and analyze the factors that led to a positive or negative outcome.
- 9.4.8.TL.1: Construct a spreadsheet in order to analyze multiple data sets, identify relationships, and facilitate data-based decision-making.
- 9.4.8.TL.2: Gather data and digitally represent information to communicate a real-world problem (e.g., MS-ESS3-4, 6.1.8.EconET.1, 6.1.8.CivicsPR.4).
- 9.4.8.TL.3: Select appropriate tools to organize and present information digitally.
- 9.4.8.TL.4: Synthesize and publish information about a local or global issue or event (e.g., MSLS4-5, 6.1.8.CivicsPl.3).
- 9.4.8.TL.5: Compare the process and effectiveness of synchronous collaboration and asynchronous collaboration.
- 9.4.8.TL.6: Collaborate to develop and publish work that provides perspectives on a real-world problem.

Unit 2: Assessments



Summative Assessments:

• Final projects or assessments to determine what students have learned over the course of the project or unit.

Alternative Assessments:

- Teacher modifies assignments and activities based on student needs.
- Oral assessments administered in place of written when necessary.

Unit 2: Accommodations & Modifications

Please utilize the link below for ideas and strategies to use with ELL, Students with IEPS & 504s, At-Risk Students and Gifted & Talented Students. Note possible accommodations or modifications for this unit below.