7th and 8th Grade Computer Science for Innovators and Makers (PLTW) Curriculum

This curricula and accompanying instructional materials have been developed to align with the NJSLS and in accordance with the NJ Department of Education's guidelines to include: Curriculum designed to meet grade level expectations, integrated accommodations and modifications for students with IEPs, 504s, ELLs, and gifted and talented students, assessments including benchmarks, formative, summative, and alternative assessments, a list of core instructional and supplemental materials, pacing guide, interdisciplinary connections, integration of 21st century skills, integration of technology, and integration of 21st Century Life and Career standards.

About the Standards

In 1996, the New Jersey State Board of Education adopted the state's first set of academic standards called the Core Curriculum Content Standards. The standards described what students should know and be able to do upon completion of a thirteen-year public school education. Over the last twenty years, New Jersey's academic standards have laid the foundation for local district curricula that is used by teachers in their daily lesson plans.

Revised every five years, the standards provide local school districts with clear and specific benchmarks for student achievement in nine content areas. Developed and reviewed by panels of teachers, administrators, parents, students, and representatives from higher education, business, and the community, the standards are influenced by national standards, research-based practice, and student needs. The standards define a "Thorough and Efficient Education" as guaranteed in 1875 by the New Jersey Constitution. Currently the standards are designed to prepare our students for college and careers by emphasizing high-level skills needed for tomorrow's world.

The New Jersey Student Learning Standards include Preschool Teaching and Learning Standards, as well as nine K-12 standards for the following content areas: **21st Century Life and Careers, Comprehensive Health and Physical Education, English Language Arts, Mathematics, Science, Social Studies, Technology, Visual and Performing Arts, World Languages**

Lower Cape May Regional School District 7th and 8th Grade Computer Science Curriculum	
Content Area: Computer Science	
Course Title: Computer Science for Innovators	**Grade level: 7 and 8**
Unit 1: Blink	**6 weeks**
Unit 2: The Ins and Outs	**6 weeks**
Unit 3: Program the Physical World	**6 weeks**
Date Created: 11/16/21	**Board Approved: 2021**

Lower Cape May Regional School District 7th and 8th Grade Computer Science Curriculum
Unit 1 Overview

Content Area: Computer Science

Unit Title: Blink!

Target Course/Grade Level: 7th and 8th Grade

Unit Summary:
Students begin to explore the capabilities of physical computing systems with The Digital Dive game, an engaging, live-action activity where students "become" computer parts and transmit commands. They learn to use algorithmic thinking as they prepare to code. Students use block-based coding to create, download, and upload programs to the microbit microcontroller. They learn processes and gain skills to debug programs starting with pre-bugged programs. They apply these skills to their own project where they code a blinking message that includes text, images such as emojis, and animation.

Interdisciplinary Connections:
- Life Literacies and Key Skills (Critical Thinking and Problem Solving)

• 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.
9.1.8.CR.2: Compare various ways to give back through strengths, passions, goals, and other personal factors
9.1.2.CAP.2: Explain why employers are willing to pay individuals to work
9.1.2.CAP.3: Define entrepreneurship and social entrepreneurship.
9.1.2.CAP.4: List the potential rewards and risks to starting a business
9.2.8.CAP.1: Identify offerings such as high school and county career and technical school courses, apprenticeships, military programs, and dual enrollment courses that support career or occupational areas of interest
9.2.8.CAP.2: Develop a plan that includes information about career areas of interest.
9.2.8.CAP.3: Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
9.2.8.CAP.4: Explain how an individual's online behavior (e.g., social networking, photo exchanges, video postings) may impact opportunities for employment or advancement

21st Century Themes, Skills, and Standards:

- 21st Century Life and Career Standard 9.1, including critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding and interpersonal communication and science.

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
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 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.
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.9	Document programs in order to make them easier to follow, test, and debug.

Unit Enduring Questions: ● **Why is computer science important to study?** ● **What impacts do computers have on our daily lives?** ● **How can one protect themselves and use computers with caution?** ● **How can we apply computer science skills to other areas in life?** ● **What relevant problems does computer science assist with?**	**Unit Enduring Understandings:** ● **Programming goes beyond the virtual world and into the physical world** ● **Microcontrollers perform a variety of tasks** ● **Algorithms and computational practices are key components involved in coding** ● **Computer science can have many applications**

Unit Objectives: ***Students will know….*** ● **About basic computer parts** ● **How computers transmit code** ● **Basic computer algorithms** ● **How to code** ● **How to apply computer skills**	**Unit Objectives:** ***Students will be able to…...*** ● **Explore the capabilities of physical computing** ● **Apply skills to create their own project** ● **Code a blinking message** ● **Code text** ● **Code emojis** ● **Code animations**

Lower Cape May Regional School District 7th and 8th Grade Computer Science Curriculum
Unit 2 Overview

Content Area: Computer Science

Unit Title: The Ins and Outs

Target Course/Grade Level: 7th and 8th Grade

Unit Summary:
In this lesson, students explore a variety of sensors and actuators to use as inputs and outputs in physical computing projects. Using different materials to transfer electrical signals, such as conductive thread, alligator clips, conductive paint, and copper tape, students create their own input device—a sensor or switch—to interact with a program they develop on the microcontroller. They use these skills in the lesson's project to design, develop, and program a system to protect safes and secrets.

Interdisciplinary Connections:

- Life Literacies and Key Skills (Creativity and Innovation):
  • 9.4.8.CI.2: Repurpose an existing resource in an innovative way (e.g., 8.2.8.NT.3).
  • 9.4.8.CI.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.CI.4: Explore the role of creativity and innovation in career pathways and industries
  9.2.5.CAP.1: Evaluate personal likes and dislikes and identify careers that might be suited to personal likes.
  9.2.5.CAP.2: Identify how you might like to earn an income.
  9.2.5.CAP.3: Identify qualifications needed to pursue traditional and non-traditional careers and occupations.
  9.2.5.CAP.4: Explain the reasons why some jobs and careers require specific training, skills, and certification
  9.2.5.CAP.6: Compare the characteristics of a successful entrepreneur with the traits of

successful employees.
9.2.5.CAP.7: Identify factors to consider before starting a business.

21st Century Themes, Skills, and Standards:

- 21st Century Life and Career Standard 9.1, including critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding and interpersonal communication and science.

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
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.4	Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems.
8.1.8.AP.3	Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
9.4.8.TL.6	Collaborate to develop and publish work that provides perspectives on a real-world problem.
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 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.DA.5	Test, analyze, and refine computational models.

Unit Enduring Questions: ● **What is the purpose of a sensor?** ● **What are inputs and outputs?** ● **What is a microcontroller?** ● **How are microcontrollers used?** ● **What are different materials that can be used to transfer signals?**	**Unit Enduring Understandings:** ● **Physical computing projects require inputs and outputs** ● **Different materials can be used to transfer signals** ● **How can a system be created to protect safes and secrets?** ● **Sensor switches can interact with programs**
Unit Objectives: ***Students will know….*** ● **About sensors** ● **About actuators** ● **The difference between inputs and outputs** ● **About different materials used to transfer electrical signals** ● **How to plan**	**Unit Objectives:** ***Students will be able to…...*** ● **Identify inputs and outputs** ● **Use different materials to transfer electrical signals** ● **Apply skills to create their own project (Sensor switch)** ● **Students will be able to make their project interact with a microcontroller**

Lower Cape May Regional School District 7th and 8th Grade Computer Science Curriculum Unit 3 Overview
Content Area: Computer Science
Unit Title: Program the Physical World
Target Course/Grade Level: 7th and 8th Grade
Unit Summary: Within teams, students become innovators and makers. Teams apply their physical computing knowledge and skills as they design and create one of three problem options: • A wearable safety device someone might use when completing a physical activity outside at night • An engaging art installation to help improve a community space • A useful mechanical dispenser for a person or animal who needs assistance to retrieve an object Teams collaborate and learn that solving authentic problems involves the unit content knowledge, as well as skills from other disciplines, such as communications, mathematics, and science
Interdisciplinary Connections:

Career Readiness Life Literacies and Key Skills (Digital Citizenship)
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)
Career Readiness Life Literacies and Key Skills (Global and Cultural Awareness)
9.4.8.GCA.1: Model how to navigate cultural differences with sensitivity and respect (e.g., 1.5.8.C1a).
9.4.8.GCA.2: Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

21st Century Themes, Skills, and Standards:

- (State 21st century themes here). Link http://www.state.nj.us/education/cccs/2014/career/
- Example: Technology utilization in the form of ……
- 21st Century Life and Career Standard 9.1, including critical thinking, problem solving, creativity, innovation, collaboration, teamwork and leadership, cross-cultural understanding and interpersonal communication and science.

Learning Targets

CPI #	Cumulative Progress Indicators (CPI) for Unit
8.1.8.AP.6	Refine a solution that meets users' needs by incorporating feedback from team members and users.
8.1.8.AP.7	Design programs, incorporating existing code, media, and libraries, and give attribution.
8.1.8.AP.8	Systematically test and refine programs using a range of test cases and users.
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.7	Use information from a variety of sources, contexts, disciplines, and cultures for a specific purpose
9.4.8.IML.11	Predict the personal and community impact of online and social media activities.
9.4.8.IML.12	Use relevant tools to produce, publish, and deliver information supported with evidence for an authentic audience.
9.4.8.IML.13	Identify the impact of the creator on the content, production, and delivery of information
9.4.8.TL.2:	Gather data and digitally represent information to communicate a real-world problem
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

Unit Enduring Questions: ● **Why does the world need innovators and makers?** ● **How can computer science knowledge be applied in a real world setting?** ● **Why is team collaboration important?** ● **Why is computer science a cross-curricular course?**	**Unit Enduring Understandings:** ● **Innovation is needed in the modern business world** ● **Why is physical computer knowledge necessary in computer science?** ● **How are collaborative teams effective?** ● **Computer science can solve authentic real world problems**
Unit Objectives: ***Students will know….*** ● **How to work in teams** ● **How to apply knowledge related to inputs and outputs** ● **How to apply knowledge related to microcontrollers** ● **Why computer science is a relevant and important field** ● **How to work with deadlines in mind**	**Unit Objectives:** ***Students will be able to…...*** ● **Work collaboratively in teams** ● **Apply knowledge of physical computing** ● **Apply knowledge of how to solve a problem** ● **Use interdisciplinary skills to solve a problem**

Lower Cape May Regional School District Computer Science Curriculum
Evidence of Learning

Specific Formative Assessments Utilized in Daily Lessons:

- List examples of specific formative assessments to be utilized daily to gauge student comprehension and drive instruction here. Link here for ideas. More ideas and here.
- If you utilization Kahoot, Socrative, quizlet or other online assessment platforms list those here as well.

Summative Assessment Utilized throughout Units:

- QBA's
- Benchmarks

Modifications for ELL's, Special Education, 504, and Gifted and Talented Students:

- Teacher tutoring
- Peer tutoring
- Cooperative Learning Groups
- Modified Assignments
- Differentiated Instruction
- Response to Intervention (www.help4teachers.com)
- Follow all IEP and 504 modifications

Teacher Notes:

- As required by the NJ Department of Education, teachers in all content areas will integrate the 21st Century Life and Careers Standards. As the NJDOE indicates, "Providing New Jersey students with the life and career skills needed to function optimally within this dynamic context is a critical focus and organizing principle of K-12 public education. New Jersey has both an obligation to prepare its young people to thrive in this environment, and a vested economic interest in grooming an engaged citizenry made up of productive members of a global workforce that rewards innovation, creativity, and adaptation to change." The links below indicate the CPIs for grade ranges and need to be addressed throughout the units of study:
  Life and Career Standards
- As indicated in the NJSLS, standards and interdisciplinary connections will be integrated throughout content area curriculum.

Project-based Learning Tasks:

- Team Project as reference above in unit 3.

Vocabulary:

- In-text vocabulary should be incorporated into every unit. Word journals, vocabulary walls, and/or various other activities should be utilized by the instructor to teach vocabulary.

The Research Process:

- The research process must be integrated within each course curriculum. Student will be provided with opportunities to investigate issues from thematic units of study. As the NJSLS indicate, students will develop proficiency with MLA or APA format as applicable.
- Link Research resources here.

Technology:

- Students must engage in technology applications integrated throughout the curriculum. Applicable technology utilized in this curricula are included below:
- Microcontrollers, physical computing systems, input devices, etc.

Resources:

- Ancillary resources and materials used to deliver instruction are included below:
  Project Lead the Way curriculum and activities as available through personal accounts

Differentiation Strategies

Differentiation strategies can require varied amounts of preparation time. High-prep strategies often require a teacher to both create multiple pathways to process information/demonstrate learning and to assign students to those pathways. Hence, more ongoing monitoring and assessment is often required. In contrast, low-prep strategies might require a teacher to strategically create process and product choices for students, but students are allowed to choose which option to pursue given their learning profile or readiness level. Also, a low-prep strategy might be focused on a discrete skill (such as vocabulary words), so there are fewer details to consider. Most teachers find that integration of one to two new low-prep strategies and one high-prep strategy each quarter is a reasonable goal.

Low Prep Strategies	
Varied journal prompts, spelling or vocabulary lists	Students are given a choice of different journal prompts, spelling lists or vocabulary lists depending on level of proficiency/assessment results.
Anchor activities	Anchor activities provide meaningful options for students when they are not actively engaged in classroom activities (e.g., when they

	finish early, are waiting for further directions, are stumped, first enter class, or when the teacher is working with other students). Anchors should be directly related to the current learning goals.
Choices of books	Different textbooks or novels (often at different levels) that students are allowed to choose from for content study or for literature circles.
Choices of review activities	Different review or extension activities are made available to students during a specific section of the class (such as at the beginning or end of the period).
Homework options	Students are provided with choices about the assignments they complete as homework. Or, students are directed to specific homework based on student needs.
Student-teacher goal setting	The teacher and student work together to develop individual learning goals for the student.
Flexible grouping	Students might be instructed as a whole group, in small groups of various permutations (homogeneous or heterogeneous by skill or interest), in pairs or individual. Any small groups or pairs change over time based on assessment data.
Varied computer programs	The computer is used as an additional center in the classroom, and students are directed to specific websites or software that allows them to work on skills at their level.
Multiple Intelligence or Learning Style options	Students select activities or are assigned an activity that is designed for learning a specific area of content through their strong intelligence (verbal-linguistic, interpersonal, musical, etc.)
Varying scaffolding of same organizer	Provide graphic organizers that require students to complete various amounts of information. Some will be more filled out (by the teacher) than others.
Think-Pair-Share by readiness, interest, and/or learning profile	Students are placed in predetermined pairs, asked to think about a question for a specific amount of time, then are asked to share their answers first with their partner and then with the whole group.
Mini workshops to re-teach or extend skills	A short, specific lesson with a student or group of students that focuses on one area of interest or reinforcement of a specific skill.
Orbitals	Students conduct independent investigations generally lasting 3-6 weeks. The investigations “orbit” or revolve around some facet of the curriculum.

Games to practice mastery of information and skill	Use games as a way to review and reinforce concepts. Include questions and tasks that are on a variety of cognitive levels.
Multiple levels of questions	Teachers vary the sorts of questions posed to different students based on their ability to handle them. Varying questions is an excellent way to build the confidence (and motivation) of students who are reluctant to contribute to class discourse. Note: Most teachers would probably admit that without even thinking about it they tend to address particular types of questions to particular students. In some cases, such tendencies may need to be corrected. (For example, a teacher may be unknowingly addressing all of the more challenging questions to one student, thereby inhibiting other students' learning and fostering class resentment of that student.)
High Prep Strategies	
Cubing	Designed to help students think about a topic or idea from many different angles or perspectives. The tasks are placed on the six sides of a cube and use commands that help support thinking (justify, describe, evaluate, connect, etc.). The students complete the task on the side that ends face up, either independently or in homogenous groups.
Tiered assignment/ product	The content and objective are the same, but the process and/or the products that students must create to demonstrate mastery are varied according to the students' readiness level.
Independent studies	Students choose a topic of interest that they are curious about and wants to discover new information on. Research is done from questions developed by the student and/or teacher. The researcher produces a product to share learning with classmates.
4MAT	Teachers plan instruction for each of four learning preferences over the course of several days on a given topic. Some lessons focus on mastery, some on understanding, some on personal involvement, and some on synthesis. Each learner has a chance to approach the topic through preferred modes and to strengthen weaker areas
Jigsaw	Students are grouped based on their reading proficiency and each group is given an appropriate text on a specific aspect of a topic (the economic, political and social impact of the Civil War, for example). Students later get into heterogeneous groups to share their findings with their peers, who have read about different areas of study from

	source texts on their own reading levels. The jigsaw technique allows you to tackle the same subject with all of your students while discreetly providing them the different tools they need to get there.
Multiple texts	The teacher obtains or creates a variety of texts at different reading levels to assign strategically to students.
Alternative assessments	After completing a learning experience via the same content or process, the student may have a choice of products to show what has been learned. This differentiation creates possibilities for students who excel in different modalities over others (verbal versus visual).
Modified Assessments	Assessments can be modified in a variety of ways – for example by formatting the document differently (e.g. more space between questions) or by using different types of questions (matching vs. open ended) or by asking only the truly essential questions.
Learning contracts or Personal Agendas	A contract is a negotiated agreement between teacher and student that may have a mix of requirements and choice based on skills and understandings considered important by the teacher. A personal agenda could be quite similar, as it would list the tasks the teacher wants each student to accomplish in a given day/lesson/unit. Both Learning contracts and personal agendas will likely vary between students within a classroom.
Compacting	This strategy begins with a student assessment to determine level of knowledge or skill already attained (i.e. pretest). Students who demonstrate proficiency before the unit even begins are given the opportunity to work at a higher level (either independently or in a group).
Literature circles	Flexible grouping of students who engage in different studies of a piece of literature. Groups can be heterogeneous and homogeneous.
Learning Centers	A station (or simply a collection of materials) that students might use independently to explore topics or practice skills. Centers allow individual or groups of students to work at their own pace. Students are constantly reassessed to determine which centers are appropriate for students at a particular time, and to plan activities at those centers to build the most pressing skills.
Tic-Tac-Toe Choice Board (sometimes called "Think-Tac-Toe"	The tic-tac-toe choice board is a strategy that enables students to choose multiple tasks to practice a skill, or demonstrate and extend understanding of a process or concept. From the board, students choose (or teacher assigns) three adjacent or diagonal. To design a

	tic-tac-toe board: - Identify the outcomes and instructional focus - Design 9 different tasks - Use assessment data to determine student levels - Arrange the tasks on a tic-tac-toe board either randomly, in rows according to level of difficulty, or you may want to select one critical task to place in the center of the board for all students to complete.
Curriculum development Resources/Instructional Materials:	
• Projectleadtheway.com	
Board of Education Approved Text(s)	
• Project Lead the Way online materials	