PLTW INNOVATORS AND MAKERS	
CURRICULUM/CONTENT AREA	**COURSE LENGTH**
IT/ENTREPRENEURSHIP	*45 days*
GRADE LEVEL	**DATE LAST REVIEWED**
6	*2022*
PREREQUISITE(s) ***if applicable***	**BOARD APPROVAL DATE**
	11/15/2022
PRIMARY RESOURCE ***if applicable***	
PLTW Computer Science for Innovators and Makers	

DESIRED RESULTS

COURSE DESCRIPTION AND PURPOSE

Programming goes beyond the virtual world into the physical world. Students are challenged to creatively use sensors and actuators to develop systems that interact with their environment. While designing algorithms and using computational thinking practices, students code and upload programs to microcontrollers that perform a variety of authentic tasks.

ENDURING UNDERSTANDINGS *Students will understand that...*	**ESSENTIAL QUESTIONS** *Students will keep considering...*
Creativity, innovation, and critical thinking are essential for success in a technologically advanced world.	Why is creativity and innovation important? How is creativity and innovation used in STEM career pathways?
	How do teams efficiently and effectively solve problems in an increasingly complex world?
	What strategies and processes can I use to become a more effective creator, thinker and problem solver?
The ability to communicate and collaborate with people with diverse backgrounds and perspectives is key to participation in a global economic society.	Why is communication and collaboration important? How do positive work behaviors and personal qualities impact communication and collaboration?
	What is effective teamwork? What strategies can I use/teams use to work better together? How can perspectives and experiences of a diverse group develop innovative solutions to a given problem?
Career and technical education provides pathways to high-demand, high-wage career opportunities, and personal fulfillment.	Why is career and life readiness important? What jobs and careers are available to meet individual and societal needs locally, regionally, and nationally?
	How might technical knowledge and skills influence one's employability and advancement opportunities within various work settings?
	What are employability skills? How do I prepare myself for a career that is in demand now and in 5, 10, or 20 years from now?

PRIORITY CAREER & TECHNICAL STANDARDS
Students will be skilled at...

Creativity, Critical Thinking, Communication and Collaboration
4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.
a: I develop effective resolutions for a given problem, decision or opportunity using available information.
b: I develop and implement a resolution for a new situation using personal knowledge and experience.

Career Development
CD4: Students will identify and apply employability skills.
a: I identify and demonstrate positive work behaviors and personal qualities needed to be employable.
b: I demonstrate skills related to seeking and applying for employment to find and obtain a desired job.
c: I identify and exhibit traits for retaining employment.
d: I develop positive relationships with others.

Information, Media, Technology

IMT1: Students will access, interpret and evaluate information from a variety of sources in order to inform and support premises, arguments, decisions, ideas and initiatives.

a: I choose appropriate sources of data and information for a given purpose.
b: I determine the relevance, validity and timeliness of data and information.
c: I select relevant information necessary for making decisions and solving problems
d: I apply data and information to communicate ideas and create new opportunities.

PRIORITY CONTENT STANDARDS

Students will know...

Standard AP2: Students will create computational artifacts using algorithms and programming

Lesson 1 - Blink

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 micro:bit 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.

STAGE 1: Desired Unit Results What will students understand as a result of the unit?		**STAGE 2: Assessment Evidence** By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?
ESSENTIAL QUESTION (s) What thought-provoking questions will foster inquiry, understanding, and transfer of learning?		**Success Criteria with Standards** The criteria for evaluating performance on standards is constant.
Why is creativity and innovation important? How is creativity and innovation used in STEM career pathways?		CTE standards-based Rubric: Throughout the course, students and teachers use the rubric for communication of success criteria, reflection, goal setting, and feedback.
How might technical knowledge and skills influence one's employability and advancement opportunities within various work settings?		In their portfolio/evidence journal, students will reflect on the essential questions through a quick write, constructed response.
PRIORITY CAREER & TECHNICAL STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** Students may be given options to show their learning in varied ways.
Creativity, Critical Thinking, Communication and Collaboration **4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.**		In their portfolio/evidence journal, students will describe opportunities or problems that lead to successful endeavors using the MakeCode - Microbit online platform. Students will have the option to use quick writes or constructed responses for responses.
a: I develop effective resolutions for a given problem, decision or opportunity using available information.	4C2.a.5.m: I can analyze symptoms to identify the root cause of a problem.	
Information, Media, Technology **IMT1: Students will access, interpret and evaluate information from a variety of sources in order to inform and support premises, arguments, decisions, ideas and initiatives.**		Through conferring and pair share opportunities, students will share evidence of multiple sources of data found in their coding project.
d: I apply data and information to communicate ideas and create new opportunities.	IMT1.d.4.m: I can incorporate information from multiple sources to communicate a new idea or support an argument.	
PRIORITY CONTENT STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** Students may be given options to show their learning in varied ways.
Standard AP2: Students will create computational artifacts using algorithms and programming	I can develop programs, both independently and collaboratively, which include sequencing with nested loops and multiple branches [Clarification At this level, students may use block-based and/or textbased languages].	Through various creative tasks, students will demonstrate how computers receive, process, and send information and examine the parts of a microcontroller.
	I can produce computational artifacts with broad accessibility and usability through careful consideration of diverse needs and wants of the community	
	I can design, develop, and implement a computing artifact that responds to an event (e.g., robot that responds to a sensor, mobile app that responds to a text message, sprite that responds to a broadcast).	
	I can create variables that represent different types of data and manipulate their values.	

Stage 3: Learning Activities

A brief summary of the key learning activities- How will students build knowledge & develop skills? How will learning be relevant, accessible, and engaging? How will the learning unforld in a natural flow?

GUIDING UNIT QUESTIONS Using Costas Level of Thinking, what questions will hook and hold students so that they develop a deep understanding of the desired results? The guiding questions are more topic-specific to the particular unit. They guide the exploration of the essential questions and rigor of the standards. This may include questions that guide project based/ problem based learning	**STRATEGIES/ACTIVITIES** What learning strategies and experiences will authentically engage students so that they gain understanding the desired results? This includes strategies and activities that help learners acquire targeted knowledge and skills, make meaning of important ideas, and transfer their learning to new situations. Consider how the learning will be tailored and flexible to address the interests and learning styles of all students.	**RESOURCES/MATERIALS** This includes an applicable textbooks, software, industry recognized certification software/tools, subcriptions (such asPLTW), etc.
Why is the Makecode Programming Environment organized into "drawers"?	Scavenger Hunt	PLTW website Microsoft Makecode
Why is planning an important step before doing?	Creating your Own Flowchart	PLTW website Graphic Organizer Online Flowchart Maker
How is debugging a critical element in the creation and execution of programming?	Debug Activity with Partners	PLTW Website Microsoft Makecode Debug Chart
How can programming be used to express your individual interests?	Blink Project	PLTW website Microsoft Makecode
how can algorithmic thinking skills be used across multiple disciplines?	Explicit instruction in the L.A.U.N.C.H. Design process	Defined Learning/Defined Careers
How do you express yourself and your creativity through computer science?		

Lesson 2 - The Ins & Outs

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.

STAGE 1: Desired Unit Results *What will students understand as a result of the unit?*		**STAGE 2: Assessment Evidence** *By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?*
ESSENTIAL QUESTION (s) *What thought-provoking questions will foster inquiry, understanding, and transfer of learning?*		**Success Criteria with Standards** *The criteria for evaluating performance on standards is constant.*
How do teams efficiently and effectively solve problems in an increasingly complex world?		CTE standards-based Rubric: Throughout the course, students and teachers use the rubric for communication of success criteria, reflection, goal setting, and feedback.
What is effective teamwork? What strategies can I use/teams use to work better together? How can perspectives and experiences of a diverse group develop innovative solutions to a given problem?		In their portfolio/evidence journal, students will reflect on the essential questions through a quick write, constructed response.
PRIORITY CAREER & TECHNICAL STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** *Students may be given options to show their learning in varied ways.*
Creativity, Critical Thinking, Communication and Collaboration **4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.**		Utilizing the 30-second expert strategy, students will explain the differences between an input / output and software / hardware.
a: I develop effective resolutions for a given problem, decision or opportunity using available information.	4C2.a.10.m: I can explain the process for choosing an action or making a decision.	
Career Development **CD4: Students will identify and apply employability skills.**		Students will respectfully engage in peer review of small integrative collaborative coding projects while prvoding feedback around goals and tasks.
a: I identify and demonstrate positive work behaviors and personal qualities needed to be employable.	CD4.a.4.m: I can demonstrate flexibility and willingness to learn new knowledge and skills.	
d: I develop positive relationships with others.	CD4.d.4.m: I can use cooperative behavior in helping peers accomplish goals and tasks.	
Information, Media, Technology **IMT1: Students will access, interpret and evaluate information from a variety of sources in order to inform and support premises, arguments, decisions, ideas and initiatives.**		Students will analyze multiple sources of information through the focused note taking process to orally defend their coding project.
d: I apply data and information to communicate ideas and create new opportunities.	IMT1.d.4.m: I can incorporate information from multiple sources to communicate a new idea or support an argument.	
PRIORITY CONTENT STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** *Students may be given options to show their learning in varied ways.*
Standard AP2: Students will create computational artifacts using algorithms and programming	I can develop programs, both independently and collaboratively, which include sequencing with nested loops and multiple branches [Clarification At this level, students may use block-based and/or textbased languages].	Through various creative tasks, students will demonstrate ability to work with others to create and modify programs that use input devices, to use pair programming to collaborate, to build a physical computing device, to explore wireless technology, develop and modify algorithms that use variables, and to follow a design process to effectively develop a physical computing solution.
	I can produce computational artifacts with broad accessibility and usability through careful consideration of diverse needs and wants of the community	
	I can design, develop, and implement a computing artifact that responds to an event (e.g., robot that responds to a sensor, mobile app that responds to a text message, sprite that responds to a broadcast).	
	I can create variables that represent different types of data and manipulate their values.	

Stage 3: Learning Activities

A brief summary of the key learning activities- How will students build knowledge & develop skills? How will learning be relevant, accessible, and engaging? How will the learning unforld in a natural flow?

GUIDING UNIT QUESTIONS *Using Costas Level of Thinking, what questions will hook and hold students so that they develop a deep understanding of the desired results? The guiding questions are more topic-specific to the particular unit. They guide the exploration of the essential questions and rigor of the standards. This may include questions that guide project based/ problem based learning*	**STRATEGIES/ACTIVITIES** *What learning strategies and experiences will authentically engage students so that they gain understanding the desired results? This includes strategies and activities that help learners acquire targeted knowledge and skills, make meaning of important ideas, and transfer their learning to new situations. Consider how the learning will be tailored and flexible to address the interests and learning styles of all students.*	**RESOURCES/MATERIALS** *This includes an applicable textbooks, software, industry recognized certification software/tools, subcriptions (such asPLTW), etc.*
What is the difference between input and output?	Matching activity	PLTW website Microsoft Makecode
What is the difference between analog and digital and how does this apply to the different sensors?	Small Group work	Video Worksheet
How does hardware interact with software to create an integrated outcome?	Small Integrative Collaborative Coding Projects	PLTW website Microsoft Makecode Microbit Input and Output Sensors

Identify the roles / expecations for the Driver / Navigator within each group?	Videos explaining roles / responsibilities	PLTW website Microsoft Makecode
What do programming best practices look like?	Explicit instruction in the L.A.U.N.C.H. design process	Defined Learning/Defined Careers
How is a design process used to develop physical computing systems?		

Lesson 3 - Micriobit Challenge

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.

STAGE 1: Desired Unit Results What will students understand as a result of the unit?		**STAGE 2: Assessment Evidence** By what criteria will performances of understanding be assessed? Through what authentic performance tasks will students demonstrate the desired unit results?
ESSENTIAL QUESTION (s) What thought-provoking questions will foster inquiry, understanding, and transfer of learning?		**Success Criteria with Standards** The criteria for evaluating performance on standards is constant.
How do teams efficiently and effectively solve problems in an increasingly complex world?		CTE standards-based Rubric: Throughout the course, students and teachers use the rubric for communication of success criteria, reflection, goal setting, and feedback.
How might technical knowledge and skills influence one's employability and advancement opportunities within various work settings?		In their portfolio/evidence journal, students will reflect on the essential questions through a quick write, constructed response.
Why is creativity and innovation important? How is creativity and innovation used in STEM career pathways?		
PRIORITY CAREER & TECHNICAL STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** Students may be given options to show their learning in varied ways.
Creativity, Critical Thinking, Communication and Collaboration **4C2: Students will formulate and defend judgments and decisions by employing critical thinking skills.**		Students will create a final project using the design requirements below: Design Process Define the Problem Generate Concepts Design Solution Build and Test Evaluate your Solution Present your Solution
a: I develop effective resolutions for a given problem, decision or opportunity using available information.	4C2.a.5.m: I can analyze symptoms to identify the root cause of a problem.	
b: I develop and implement a resolution for a new situation using personal knowledge and experience.		
Career Development **CD4: Students will identify and apply employability skills.**		Through a personal feedback cycle, students will reflect on their ability to maintain a positive attitude and demonstrate employability skills of self discipline, flexibility and willingness to learn. In their portfolio/evidenced based journal, students will reflect on: "Think about what you have learned so far and what it means to be a computer scientist. How could you see yourself using computer science in the future?"
d: I develop positive relationships with others.	CD4.d.3.m: I can interact with others in a respectful and non-judgmental manner.	
Information, Media, Technology **IMT1: Students will access, interpret and evaluate information from a variety of sources in order to inform and support premises, arguments, decisions, ideas and initiatives.**		Students will analyze multiple sources of information through the focused note taking process to orally defend their final project.
a: I choose appropriate sources of data and information for a given purpose.	IMT1.a.5.m: I can use information sources to support an argument, idea or initiative.	
PRIORITY CONTENT STANDARDS & Learning Targets		**Performance Tasks Options/ Assessment Strategies by Standard** Students may be given options to show their learning in varied ways.
Standard AP2: Students will create computational artifacts using algorithms and programming	I can develop programs, both independently and collaboratively, which include sequencing with nested loops and multiple branches [Clarification At this level, students may use block-based and/or textbased languages].	Through various creative tasks, students will demonstrate the following: Simplify code to make it easier to read. Follow a design process to effectively develop a physical computing solution.
	I can produce computational artifacts with broad accessibility and usability through careful consideration of diverse needs and wants of the community	
	I can design, develop, and implement a computing artifact that responds to an event (e.g., robot that responds to a sensor, mobile app that responds to a text message, sprite that responds to a broadcast).	
	I can create variables that represent different types of data and manipulate their values.	

Stage 3: Learning Activities

A brief summary of the key learning activities- How will students build knowledge & develop skills? How will learning be relevant, accessible, and engaging? How will the learning unforld in a natural flow?

GUIDING UNIT QUESTIONS	**STRATEGIES/ACTIVITIES**	**RESOURCES/MATERIALS**
Using Costas Level of Thinking, what questions will hook and hold students so that they develop a deep understanding of the desired results? The guiding questions are more topic-specific to the particular unit. They guide the exploration of the essential questions and rigor of the standards. This may include questions that guide project based/ problem based learning	What learning strategies and experiences will authentically engage students so that they gain understanding the desired results? This includes strategies and activities that help learners acquire targeted knowledge and skills, make meaning of important ideas, and transfer their learning to new situations. Consider how the learning will be tailored and flexible to address the interests and learning styles of all students.	This includes an applicable textbooks, software, industry recognized certification software/tools, subcriptions (such asPLTW), etc.

How can I use prior knowledge and skills to create a solution to a problem?	Design Requirements Design Process Define the Problem Generate Concepts Design Solution Build and Test Evaluate your Solution Present your Solution	Microsoft Makecode Peripheral Devices/Sensors Online Flowchart Maker Supplermentary materials from students
How can I work cooperatively to complete the final project?	Small Group Conferences Conflict Resolution Cycle	Roles and Responsibilities from PLTW website Gallery Walk
Do all professions need computer science?	explicit instruction on L.A.U.N.C.H. design process	PLTW curriculum materials
Does society need computer science and physical computing projects?		Defined Learning/Defined Careers
How are ethics, safety, and computing projects related?		