Technology & Engineering Design II (Semester)
Grade 8, Career & Technical Education

Developed By: Mrs. Michelle Milner & Mr. Vincent Vicchiariello
Effective Date: Fall 2022
Scope and Sequence

Month	Unit	Activities
September	Blink!	- The Brain - What to Do - How to Do It - Crush the Bug - The Blinking Message
October	The Ins and Outs	- Need Input - Responding Output - Get Connected - Secrets and Safes
November	Program the Physical World	- Clean Up Your Code - Interactions
December	City Planning	Sketchup Basics
January	City Planning	City Planning Designing
February	Blink!	- The Brain - What to Do - How to Do It - Crush the Bug - The Blinking Message
March	The Ins and Outs	- Need Input - Responding Output - Get Connected - Secrets and Safes
April	Program the Physical World	- Clean Up Your Code - Interactions
May	City Planning	Sketchup Basics
June	City Planning	City Planning Designing

Unit 1
Blink!
Summary and Rationale
In this unit, 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 and download 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.
Recommended Pacing
15 days
Standards

Computing Systems	
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.
Algorithms & Programming	
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.
Career Awareness and Planning	
9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.

9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
Creativity and Innovation	
9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.
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).
Global and Cultural Awareness	
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
Interdisciplinary Connections	
8.1.8.CS.4	Systematically apply troubleshooting strategies to identify and resolve hardware and software problems in computing systems.
Science	
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Social Studies: Civics, Government, and Human Rights	
6.3.8.CivicsPR.3	Take a position on an issue in which fundamental ideals and principles are in conflict (e.g., liberty, equality).

Instructional Focus

Enduring Understandings:	Essential Questions:
● Computer science solutions have global impacts in the economy, environment, and society.	● How do we use computer science in our everyday lives? ● How is a design process used to develop physical computing systems? ● What do programming best practices look like? ● How can algorithmic thinking skills be used across multiple disciplines? ● How can computer programs solve problems?

Evidence of Learning (Assessments)

- Blink Project
- Blinking Message Project
- Debugging Project

Objectives (SLO)

Students will know:	Students will be able to:
- Flowcharts - Programming basics - Code tracing	- Create a flowchart to outline the process of a given program. - Create a program using basic code blocks involving LEDs. - Debug programs using a code tracing chart.

Suggested Resources/Technology Tools

- Microsoft MakeCode
- Micro:bit

Modifications

Special Education/IEP/504 - Modifications and accommodations must be aligned to the stated plan and uphold expectations of the plan lawfully. Every student requires a different set of accommodations based upon need. Examples specific to CTE include, but are not limited to:
- Follow individual IEP/504 plans for specific modifications.
- Preferential seating
- Extended/Additional time for assessments
- Behavior management support
- Assignments/resources in electronic and physical format
- Break down assignments with oral directions, written directions, and visuals.
- Provide frequent reminders to stay on task and reinforce on-task behavior
- Work on organizational skills
- Provide visual supports
- Word banks
- Partnering/Grouping of students
- Peer learning
- Coding diagrams
- Re-teaching and review
- Multi-media approach to accommodate various learning styles
- Decrease/Modify number of project requirements
- Teacher/Aide/Para assistance
- Demonstrations of techniques on an individual level

ELL - Teachers identify the modifications that they will use in the unit as related to the needs of their student population. Examples specific to CTE include, but are not limited to:
- Work with district language specialist.
- Allow the use of Google Translate where appropriate.

- Provide alternate ways for the student to respond (verbal/pictographic answers instead of written)
- Substitute a hands-on activity or use of different media in projects for a written activity
- Prepare and distribute advance notes
- Provide model sentence frames and sentence starters for both oral responses and written responses
- Provide additional time to complete assessments and assignments
- Model and use gestures to aid in understanding
- Model tasks by giving one or two examples before releasing students to work independently
- Present instructions both verbally and visually
- Simplify written and verbal instructions
- Speak clearly and naturally, and try to enunciate words, especially their ending sounds.
- Provide Visual, Graphic, Interactive, and/or Sensory Supports
- Simplify the language, format, and directions of the assessment
- Allow for alternate seating for proximity to peer helper or teacher as necessary
- When showing videos, use Closed Captioning.
- Support use of student's primary language by translating key words in directions, or key vocabulary terms or giving students opportunities to communicate in their primary language (written or orally)

Gifted and Talented/Enrichment - Utilize differentiation in the areas of acceleration, enrichment, and grouping.
Examples specific to CTE include, but are not limited to:
- Complex, in-depth research assignments
- Independent study where applicable
- Provide a variety of individualized work centers or student choice
- Lead demonstrations for class
- Create additional project(s) in a different medium, exploring a different technique, style, or subject.
- Individual presentation
- Multiple mediums in project

Career Readiness, Life Literacies, and Key Skills Practices (June 2020)

- ❏ Act as a responsible and contributing citizen and employee.
- ❏ Apply appropriate academic and technical skills.
- ❏ Attend to personal health and financial well being.
- ❏ Communicate clearly and effectively and with reason.
- ❏ Consider the environmental, social and economic impacts of decisions.
- ❏ Demonstrate creativity and innovation.
- ❏ Employ valid and reliable research strategies.
- ❏ Utilize critical thinking to make sense of problems and persevere in solving them.
- ❏ Model integrity, ethical leadership, and effective management.
- ❏ Plan education and career paths aligned to personal goals.
- ❏ Use technology to enhance productivity.
- ❏ Work productively in teams while using cultural global competence.

Unit 2
The Ins & Outs
Summary and Rationale
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, 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.
Recommended Pacing
17 days
Standards

Networks and the Internet	
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.
Impacts of Computing	
8.1.8.IC.1	Compare the trade-offs associated with computing technologies that affect an individual's everyday activities and career options.
Algorithms & Programming	
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.9	Document programs in order to make them easier to follow, test, and debug.
Career Awareness and Planning	
9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior

	affect income.
9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
Creativity and Innovation	
9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.
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).
Global and Cultural Awareness	
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
Interdisciplinary Connections	
Science	
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Social Studies: Civics, Government, and Human Rights	
6.3.8.CivicsPR.3	Take a position on an issue in which fundamental ideals and principles are in conflict (e.g., liberty, equality).
English Language Arts	
RST.6-8.2	Determine the central ideas or conclusions of a text; provide an accurate summary of the text distinct from prior knowledge or opinions.
NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
Mathematics	
6.SP.B.4	Summarize numerical data sets in relation to their context.
Instructional Focus	

Enduring Understandings:	Essential Questions:
● Ethics, analytical thinking, creativity, persistence, and the positive role of failure are important mindsets and habits of programming.	● How can we use technology to keep us safe?

Evidence of Learning (Assessments)

● Input/Output Program
● Secrets and Safes Project

Objectives (SLO)

Students will know:	Students will be able to:
● Inputs ● Outputs ● Variables	● Wire inputs and outputs onto a micro:bit device. ● Program given inputs and outputs to solve a problem. ● Create a program with variables to solve a given problem more efficiently.

Suggested Resources/Technology Tools

● Microsoft MakeCode
● Micro:bit

Modifications

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● Work on organizational skills
● Provide visual supports
● Word banks
● Partnering/Grouping of students
● Peer learning
● Coding diagrams
● Re-teaching and review
● Multi-media approach to accommodate various learning styles

- Decrease/Modify number of project requirements
- Teacher/Aide/Para assistance
- Demonstrations of techniques on an individual level

ELL - Teachers identify the modifications that they will use in the unit as related to the needs of their student population. Examples specific to CTE include, but are not limited to:
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Gifted and Talented/Enrichment - Utilize differentiation in the areas of acceleration, enrichment, and grouping. Examples specific to CTE include, but are not limited to:
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- Individual presentation
- Multiple mediums in project

Career Readiness, Life Literacies, and Key Skills Practices (June 2020)

- ❏ Act as a responsible and contributing citizen and employee.
- ❏ Apply appropriate academic and technical skills.
- ❏ Attend to personal health and financial well being.
- ❏ Communicate clearly and effectively and with reason.
- ❏ Consider the environmental, social and economic impacts of decisions.
- ❏ Demonstrate creativity and innovation.
- ❏ Employ valid and reliable research strategies.
- ❏ Utilize critical thinking to make sense of problems and persevere in solving them.
- ❏ Model integrity, ethical leadership, and effective management.
- ❏ Plan education and career paths aligned to personal goals.

❏ Use technology to enhance productivity.
❏ Work productively in teams while using cultural global competence.

Unit 3
Program the Physical World
Summary and Rationale
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, or 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 unit content knowledge, as well as skills from other disciplines, such as communications, mathematics, and science.
Recommended Pacing
13 days
Standards

Networks and the Internet	
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.

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

Algorithms & Programming	
8.1.8.AP.1	Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode.
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8.1.8.AP.3	Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
8.1.8.AP.9	Document programs in order to make them easier to follow, test, and debug.

Career Awareness and Planning	

9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
Creativity and Innovation	
9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.
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).
Global and Cultural Awareness	
9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.
Interdisciplinary Connections	
Science	
MS-ETS1-2	Evaluate competing design solutions using a systematic process to determine how well they meet the criteria and constraints of the problem.
Social Studies: Civics, Government, and Human Rights	
6.3.8.CivicsPR.3	Take a position on an issue in which fundamental ideals and principles are in conflict (e.g., liberty, equality).
English Language Arts	
SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.
Mathematics	
MP.4	Model with mathematics.

Instructional Focus

Enduring Understandings:	Essential Questions:
● Ethics, analytical thinking, creativity, persistence, iteration, and the positive role of failure are important mindsets and habits of action.	● How do you express yourself and your creativity through computer science? ● How can algorithmic thinking skills be used across multiple disciplines?

Evidence of Learning (Assessments)

● Code Clean-Up
● Problem Challenge

Objectives (SLO)

Students will know: ● Variables ● Code efficiency	Students will be able to: ● Program using an efficient code with carefully named variables. ● Solve a real life problem using programming.

Suggested Resources/Technology Tools

● Microsoft MakeCode
● Micro:bit

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- Re-teaching and review
- Multi-media approach to accommodate various learning styles
- Decrease/Modify number of project requirements
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- ❏ Model integrity, ethical leadership, and effective management.
- ❏ Plan education and career paths aligned to personal goals.
- ❏ Use technology to enhance productivity.
- ❏ Work productively in teams while using cultural global competence.

Unit 4

City Planning

Summary and Rationale

In this unit students will work together to construct a city of their design. Students will explore the digital tool Sketchup to make 3D models online. Each student will make a building for the residential zone, the commercial zone, and one building of their choosing. Students will choose a city goal like being eco conscious and must represent that goal in their buildings. Students will explore what a city needs to function and will also provide input on what would make a city enjoyable. Students will discover different careers that are needed for city management and planning. Students will use peer review to get feedback on their building designs.

Recommended Pacing

8 weeks

Standards

Engineering Design	
8.2.8.ED.1	Evaluate the function, value, and aesthetics of a technological product or system, from the perspective of the user and the producer.
8.2.8.ED.3	Develop a proposal for a solution to a real-world problem that includes a model (e.g., physical prototype, graphical/technical sketch).
8.2.8.ED.7	Design a product to address a real-world problem and document the iterative design process, including decisions made as a result of specific constraints and trade-offs (e.g., annotated sketches).
Interaction of Technology and Humans	
8.2.8.ITH.2	Compare how technologies have influenced society over time.
Career Awareness and Planning	
9.2.8.CAP.3	Explain how career choices, educational choices, skills, economic conditions, and personal behavior affect income.
9.2.8.CAP.10	Evaluate how careers have evolved regionally, nationally, and globally.
Creativity and Innovation	

9.4.8.CI.4	Explore the role of creativity and innovation in career pathways and industries.

Critical Thinking and Problem - Solving

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Global and Cultural Awareness

9.4.8.GCA.2	Demonstrate openness to diverse ideas and perspectives through active discussions to achieve a group goal.

Interdisciplinary Connections

Science

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SL.8.5	Integrate multimedia and visual displays into presentations to clarify information, strengthen claims and evidence, and add interest.
NJSLSA.W6	Use technology, including the Internet, to produce and publish writing and to interact and collaborate with others.

Instructional Focus

Enduring Understandings:	Essential Questions:
● Different people and perspectives are essential to have a thriving society.	● What things do we as a society need to function in our daily lives? What are the most important things in our lives? ● What things do you think would make society more enjoyable for everyone if we had? ● What goal would your perfect city accomplish?

Evidence of Learning (Assessments)

- Sketchup Quiz 1
- Sketchup Quiz 2
- Residential Project
- Commercial Project
- Choice Project

Objectives (SLO)

Students will know:
- How using abbreviations for measuring is important.
- 3D modeling is an efficient way to construct a blueprint and share information.

Students will be able to:
- Identify key icons on Sketchup.
- Write measurements using symbols such as ' and "
- Identify the key things that help make a city function and a nice place to live.
- Describe the importance of a building for the satisfaction of city residents.

Suggested Resources/Technology Tools

- Sketchup Program

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- ❏ Utilize critical thinking to make sense of problems and persevere in solving them.
- ❏ Model integrity, ethical leadership, and effective management.
- ❏ Plan education and career paths aligned to personal goals.
- ❏ Use technology to enhance productivity.
- ❏ Work productively in teams while using cultural global competence.