Boonton School District

Course Title:	Computer Language Programing I	**Grade Level(s):**	10-12		
Curriculum Area / Level:	Technology	**Credits:**	5		
Course prerequisites and/or co-requisites:	None				
Course Description:	This course is aimed at students with little or no programming experience. It aims to provide students with an understanding of the role computation can play in solving problems. Students will learn the fundamentals of multiple programming languages. Specific languages will be at the discretion of the teacher and will be based on student interest and market need, but may include: Java, html, the C family, php, and python.				
Created by:	Daniel Matarazzo	**Date:**	8/2/16	**BOE Approval:**	9/26/16
District Equity Statement:	As required by state law, it is the policy of Boonton School District not to discriminate on the basis of race, color, creed, religion, sex, ancestry, national origin, social or economic status, pregnancy, or physical handicap in its educational programs or activities and to maintain a learning environment that is free from sexual harassment. Courses of study and instructional materials shall be designed and selected in order to eliminate discrimination and promote understanding, sex equity, and mutual respect among people. No course offering, including but not limited to physical education, health, technology education, vocational, home economics, music and adult education, shall be limited on the basis of race, color, creed, religion, sex, ancestry, national origin, social or economic status, pregnancy, or physical handicap. Furthermore, there shall be no discrimination against students as to any educational activity or program because of pregnancy, childbirth, pregnancy-related disabilities, actual or potential parenthood, or family or marital status. If a student requests to be excluded or a physician certifies that such is necessary for her physical, mental, or emotional well-being, she must be provided with adequate and timely opportunity for instruction to continue or make up her schoolwork without prejudice or penalty.				

Division of Umbrella & Mini Units	
Umbrella Unit 1 Topic / Name: Fundamentals of Programming	**Mini Unit(s)** ***(Add to the list of mini units as necessary)*** **1A. If / Then: Programming Basics** **1B. Building Blocks w/ EV3 Robots** **1C. Advanced EV3 Programming and Problem Solving**
Umbrella Unit 2 Topic / Name: App Design and Development	**Mini Unit(s)** ***(Add to the list of mini units as necessary)*** **2A. Research, Planning, and Problem Solving** **2B. Coding and Testing** **2C. UX Design** **2D. Gaming Design**
Umbrella Unit 3 Topic / Name: Programming and Controlling an Arduino Micro Controller	**Mini Unit(s)** ***(Add to the list of mini units as necessary)*** **3A. C++ and Arduino IDE Basics** **3B. Sensing and Controlling the World Around You** **3C. Solving Real World Problems Through Programming**
Umbrella Unit 4 Topic / Name: Programming and Machine Use in the Real World	**Mini Unit(s)** ***(Add to the list of mini units as necessary)*** **4A. How It's Made: Programming and Machinery** **4B. 3D Modeling, Printing, and G-Code** **4C. Solving Problems Through 3D Printing**

UMBRELLA UNIT 1	
Title:	Fundamentals of Programming
Duration:	1 Marking Period (9 Weeks)
Essential Questions:	What is “If / Then Programming”? How do robots understand commands? How can robotics and programming be used to solve real-world problems?
Summative Assessments: **(Assessment at the end the learning period)**	Performance-Based Assessment after Each Mini-Unit. Students will perform an EV3 Robotics task or procedure to demonstrate their understanding.
Formative Assessments: **(Ongoing assessments during the learning period)**	Weekly Robotics Challenges and Programming Quizzes
Differentiation:	All quizzes and coursework will be modified or adapted to fit individual student needs. Assignments will be modified to meet individual needs and expectations. Quizzes or tests will be modified in accordance with an IEP. This may include substituting questions or removing a choice from a multiple choice question. Students may choose to apply a project’s method or steps to a different subject matter if they feel uncomfortable with the original subject matter.
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.

8.2.12.E.2	Analyze the relationships between internal and external computer components.
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
9.3.IT-PRG.5	Apply an appropriate software development process to design a software application.
9.3.IT-PRG.6	Program a computer application using the appropriate programming language.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
9.3.ST-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

MINI UNIT 1A		
Title:	If / Then: Programming Basics	
Duration:	2 Weeks	
Overview:	Students will engage in the most basic form of programming, “If / Then”. Students will utilize a mix of tactile and digital resources to gain an understanding of how to successfully write and execute a basic program.	
Essential Outcomes - Upon completion of this course students will know (declarative):		**Alignment to Standards**

What “If / Then Programming” is.	8.2.12.E.3 9.3.IT-PRG.5
How robots understand commands.	8.2.12.E.2 9.3.IT-PRG.5 9.3.IT-PRG.6
How robotics and programming be used to solve real-world problems.	8.2.12.E.1 8.2.12.E.3 8.2.12.E.4 9.3.ST-ET.1 9.3.ST-ET.5 9.3.ST-ET.6
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to utilize “If / Then Programming”.	8.2.12.E.3 9.3.IT-PRG.5
How to program a robot.	8.2.12.E.2 9.3.IT-PRG.5 9.3.IT-PRG.6
How to utilize robotics and programming to solve real-world problems.	8.2.12.E.1 8.2.12.E.3 8.2.12.E.4 9.3.ST-ET.1 9.3.ST-ET.5 9.3.ST-ET.6
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
Why “If / Then Programming” is considered the foundation of programming..	8.2.12.E.3 9.3.IT-PRG.5

How to successfully write a robotics program.	8.2.12.E.2 9.3.IT-PRG.5 9.3.IT-PRG.6
How to use robotics and programming in real-world applications.	8.2.12.E.1 8.2.12.E.3 8.2.12.E.4 9.3.ST-ET.1 9.3.ST-ET.5 9.3.ST-ET.6
Resources Mini Unit 1A:	Lego EV3 Robotics Kits, EV3 Instructions, and Digital Resources

MINI UNIT 1B	
Title:	Building Blocks w/ EV3 Robots
Duration:	3 Weeks
Overview:	Students will build upon the previous Mini Unit and explore how to program EV3 Robots. They will work with the EV3 software to develop functional programs to solve simple and complex tasks.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How does a Robot understand a program?	8.2.12.E.3 9.3.IT-PRG.5 9.3.IT-PRG.6
How can you check a program for functionality?	8.2.12.E.4 9.3.IT-PRG.6

How can robotics and programming be used to solve real-world problems?	8.2.12.E.1 8.2.12.E.3 9.3.ST-ET.5
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to program a robot.	8.2.12.E.3 9.3.IT-PRG.5 9.3.IT-PRG.6
How to check the functionality of a program.	8.2.12.E.4 9.3.IT-PRG.6
How to solve real-world problems with robotics and programming.	8.2.12.E.1 8.2.12.E.3 9.3.ST-ET.5
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How robots can be programmed.	8.2.12.E.3 9.3.IT-PRG.5 9.3.IT-PRG.6
How to check and inspect a program.	8.2.12.E.4 9.3.IT-PRG.6
How to leverage the advantages and disadvantages of certain robots to solve a prolem.	8.2.12.E.1 8.2.12.E.3 9.3.ST-ET.5
Resources Mini Unit 1B:	Lego EV3 Robotics Kits, EV3 Instructions, and Digital Resources

MINI UNIT 1C

Title:	Advanced EV3 Programming and Problem Solving
Duration:	4 Weeks
Overview:	Students will build upon the previous Mini Unit and explore how to solve real-world problems via EV3 Robotics and Programming. Students will solve unique and complex tasks through challenges.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How can robotics and programming be used to solve real-world problems?	8.2.12.E.1 8.2.12.E.3 9.3.ST-ET.5
How can you create a complex program?	9.3.IT-PRG.5 9.3.IT-PRG.6
How can you describe/ breakdown a task for programming?	8.2.12.E.1 8.2.12.E.2 8.2.12.E.4
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to solve real-world problems with robotics and programming.	8.2.12.E.1 8.2.12.E.3 9.3.ST-ET.5
How to create a complex program.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to describe and breakdown a task for robotics programming.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.4
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**

How to utilize robotics and programming to solve real-world problems.	8.2.12.E.1 8.2.12.E.3 9.3.ST-ET.5
How to create and check complex programs.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to describe and explain the programming process.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.4
Resources Mini Unit 1C:	Lego EV3 Robotics Kits, EV3 Instructions, and Digital Resources

UMBRELLA UNIT 2	
Title:	App Design and Development
Duration:	10 Weeks
Essential Questions:	What is an App? How can an App be used to solve a real-world problem? Why are Apps useful? What need does an App fulfill? How does user interface (UX) affect an App?
Summative Assessments: **(Assessment at the end the learning period)**	Performance-Based Assessment after Each Mini-Unit. Students will perform an App task or procedure to demonstrate their understanding.
Formative Assessments: **(Ongoing assessments during the learning period)**	App Challenges, App Development Progress/Deliverables, and Programming Quizzes
Differentiation:	All quizzes and coursework will be modified or adapted to fit individual student needs. Assignments will be modified to meet individual needs and expectations. Quizzes or tests will be modified in accordance with an IEP. This may include substituting questions or removing a choice from a multiple choice question. Students may choose to apply a project's method or steps to a different subject matter if they feel uncomfortable with the original subject matter.
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**

8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.

8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
8.2.12.E.2	Analyze the relationships between internal and external computer components.
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).

21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
9.3.IT-PRG.5	Apply an appropriate software development process to design a software application.
9.3.IT-PRG.6	Program a computer application using the appropriate programming language.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.4	Apply the elements of the design process.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.

MINI UNIT 2A	
Title:	Research, Planning, and Problem Solving
Duration:	2 Weeks
Overview:	Students will use the Engineering Design Process (EDP) to identify a problem that can be solved via an App. They will use this time to perform research and develop a viable solution. A key element of this Mini Unit will be planning out the next phases of the project. Students will be responsible for planning their App progress, setting development goals, and maintaining an activity log.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
What an Computer Application or App is.	9.3.IT-PRG.5 9.3.IT-PRG.6
How an App be used to solve a real-world problem.	8.1.12.C.1 8.2.12.E.1
How to utilize the EDP to solve a problem.	9.3.ST-ET.4
How to set goals and maintain progress.	8.2.12.E.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to solve a real-world problem by using an App.	8.1.12.C.1 8.2.12.E.1
How to utilize the EDP to solve a problem.	9.3.ST-ET.4
How to set and maintain production goals.	8.2.12.E.1
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
What constitutes a useful App.	9.3.IT-PRG.5

	9.3.IT-PRG.6
Why troubleshooting and diagnosis are necessary to prevent App failure.	8.2.12.E.4
What types of problems can and cannot be solved via Apps.	8.1.12.C.1 8.2.12.E.1
How the EDP can be used to solve a problem.	9.3.ST-ET.4
Why setting and maintaining progress goals is important.	8.2.12.E.1
Why feedback and research is important when developing and/or promoting a new app.	9.3.MK-SAL.2 9.3.ST-SM.4
Resources Mini Unit 2A:	PC, Internet Access, and Online App Development Tools (Scratch or MIT App Inventor)

MINI UNIT 2B	
Title:	Coding and Testing
Duration:	3 Weeks
Overview:	Students will utilize an assortment of programming and coding tools to design and develop an App. Students will follow their progress and development goals to meet their self-created deadlines. Throughout the Mini Unit students will test their code periodically and make adjustments as needed.
Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How to set goals and maintain progress.	8.2.12.E.1
What a Computer Application or App is.	9.3.IT-PRG.5 9.3.IT-PRG.6

How an App be used to solve a real-world problem.	8.1.12.C.1 8.2.12.E.1
How to troubleshoot an App.	9.3.IT-PRG.5 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to solve a real-world problem by using an App.	8.1.12.C.1 8.2.12.E.1
How to utilize the EDP to solve a problem.	9.3.ST-ET.4
How to set and maintain production goals.	8.2.12.E.1
How to troubleshoot an App.	9.3.IT-PRG.5 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How the EDP can be used to solve a problem.	9.3.ST-ET.4
Why setting and maintaining progress goals is important.	8.2.12.E.1
How to set up a troubleshooting procedure.	9.3.IT-PRG.5 9.3.IT-PRG.6
Resources Mini Unit 2B:	PC, Internet Access, Online App Development Tools (Scratch or MIT App Inventor), and Progress Management Tools (Google Drive)

MINI UNIT 2C	
Title:	UX Design
Duration:	3 Weeks
Overview:	Students will continue to develop and code their app with a focus on the user experience or UX. A strong and intuitive UX is vital for an app. The main goal of this Mini Unit is to create an easy to use and well thought out app experience.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
Why Apps are useful.	8.2.12.E.1 8.2.12.E.3
How an App be used to solve a real-world problem.	8.1.12.C.1 8.2.12.E.1
How a user interface (UX) affects an App.	8.1.12.C.19.3 .IT-PRG.5 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to determine the usability of an App.	8.2.12.E.1 8.2.12.E.3
How to solve real-world problems by utilizing an App.	8.1.12.C.1 8.2.12.E.1
How to design a user friendly UX based on user testing and feedback.	8.1.12.C.19.3 .IT-PRG.5 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**

What constitutes a usable App.	8.2.12.E.1 8.2.12.E.3
How to solve a real-world problem by using an App.	8.1.12.C.1 8.2.12.E.1
How to design a user friendly UX with influence from user testing.	8.1.12.C.19.3 .IT-PRG.5 9.3.IT-PRG.6
Resources Mini Unit 2C:	PC, Internet Access, Online App Development Tools (Scratch or MIT App Inventor), and Progress Management Tools (Google Drive)

MINI UNIT 2D	
Title:	Gaming Design
Duration:	2 Weeks
Overview:	Students will use a variety of programming and coding applications to create a video game. Students may design their game for any mobile platform. A strong focus will be on developing a story and creating a unique gaming experience.
Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How to design a game using the EDP.	9.3.ST-ET.4
How to set and maintain productivity goals.	8.2.12.E.1
How to create an interactive story.	9.3.IT-PRG.5
How to troubleshoot code.	9.3.IT-PRG.5 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this	**Alignment to Standards**

course students will be able to (procedural):	
The methods of game design and the EDP.	9.3.ST-ET.4
How to set and maintain productivity goals.	8.2.12.E.1
How storytelling is an important part of the game design process.	9.3.IT-PRG.5
How to troubleshoot a program.	9.3.IT-PRG.5 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How to apply the EDP to game design.	9.3.ST-ET.4
Why setting and maintaining progress goals is important.	8.2.12.E.1
How to set up a troubleshooting procedure.	9.3.IT-PRG.5 9.3.IT-PRG.6
Why storytelling is an important part of the game design process.	9.3.IT-PRG.5
Resources Mini Unit 2C:	PC, Internet Access, Online Game Development Tools (Scratch or MIT App Inventor), and Progress Management Tools (Google Drive)

UMBRELLA UNIT 3	
Title:	Programming and Controlling an Arduino Micro Controller
Duration:	10 Weeks
Essential Questions:	What is a coding language? What are the advantages of C++? What can a microcontroller be used for? How can a microcontroller be used to solve a real-world problem? How has the DIY / Maker Movement influenced the use of programming? What is the purpose or goal of a sensor?
Summative Assessments: **(Assessment at the end the learning period)**	Performance-Based Assessment after Each Mini-Unit. Students will perform an Arduino or C++ task or procedure to demonstrate their understanding.
Formative Assessments: **(Ongoing assessments during the learning period)**	Weekly Arduino Challenges, Project Development Progress/Deliverables, and Programming Quizzes
Differentiation	All quizzes and coursework will be modified or adapted to fit individual student needs. Assignments will be modified to meet individual needs and expectations. Quizzes or tests will be modified in accordance with an IEP. This may include substituting questions or removing a choice from a multiple choice question. Students may choose to apply a project's method or steps to a different subject matter if they feel uncomfortable with the original subject matter.
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**

8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.
8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
8.2.12.E.2	Analyze the relationships between internal and external computer components.
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
9.3.IT-PRG.5	Apply an appropriate software development process to design a software application.
9.3.IT-PRG.6	Program a computer application using the appropriate programming language.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
9.3.ST-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

MINI UNIT 3A	
Title:	C++ and Arduino IDE Basics
Duration:	3 Weeks
Overview:	Students will explore the basic fundamentals of coding for Arduino microcontrollers via the C++ language. A strong emphasis will be placed on proper syntax and troubleshooting. Students will be expected to create their own code from scratch as well as compile code from external resources.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How to write code.	8.2.12.E.3 8.2.12.E.4 9.3.IT-PRG.6
How to troubleshoot code.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to compile code from external resources.	9.3.IT-PRG.6
How to work with an Arduino.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
The basics of coding and syntax.	8.2.12.E.3 8.2.12.E.4 9.3.IT-PRG.6
How to troubleshoot code.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to merge various code snippets.	9.3.IT-PRG.6

How to connect to and upload code to an Arduino.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How to write C++ code for Arduino.	8.2.12.E.3 8.2.12.E.4 9.3.IT-PRG.6
How to set up a troubleshooting procedure.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to identify and extract useful code snippets.	9.3.IT-PRG.6
How to work with an Arduino interface.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Resources Mini Unit 3A:	C++ code resources, Arduino Microprocessor, Breadboard, and Various electronic components.

MINI UNIT 3B	
Title:	Sensing and Controlling the World Around You
Duration:	3 Weeks
Overview:	Students will utilize sensing technologies to create interactive Arduino builds. These projects will focus on utilizing sensors to control the Arduino based on external inputs.
Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**

How to write code.	8.2.12.E.3 8.2.12.E.4 9.3.IT-PRG.6
How to troubleshoot code and/or electronic components.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to compile code from external resources.	9.3.IT-PRG.6
How to work with an Arduino and sensors.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
The basics of coding and syntax.	8.2.12.E.3 8.2.12.E.4 9.3.IT-PRG.6
How to troubleshoot code and check a circuit.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to merge various code snippets.	9.3.IT-PRG.6
How to connect and utilize sensors with an Arduino.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How to write C++ code for Arduino.	8.2.12.E.3 8.2.12.E.4 9.3.IT-PRG.6
How to set up a troubleshooting procedure and check circuit connections.	9.3.IT-PRG.5 9.3.IT-PRG.6

How to identify and extract useful code snippets.	9.3.IT-PRG.6
How to work with an Arduino and breadboard interface.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Resources Mini Unit 3B:	C++ code resources, Arduino Microprocessor, Breadboard, and Various electronic components.

MINI UNIT 3C	
Title:	Solving Real World Problems Through Programming
Duration:	4 Weeks
Overview:	In this Mini Unit students will use their programming skillset to identify, plan, design, develop, and implement a solution to a real-world problem. Students will choose a meaningful real-world problem that they can solve using an Arduino and the variety of electronics components at their disposal.
Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How to solve a real-world problem via coding and Arduino.	8.1.12.C.1 8.2.12.D.1 9.3.ST-ET.1 9.3.ST-ET.5 9.3.ST-ET.6
How to troubleshoot code and/or electronic components.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to compile code from external resources.	9.3.IT-PRG.6
How to work with an Arduino and sensors.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3

Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
How to approach a real-world problem via coding and Arduino.	8.1.12.C.1 8.2.12.D.1 9.3.ST-ET.1 9.3.ST-ET.5 9.3.ST-ET.6
How to troubleshoot code and/or electronic components.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to search for and compile code from external resources.	9.3.IT-PRG.6
How to interact with an Arduino.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How to approach a real-world problem via coding, Arduino, and the EDP.	8.1.12.C.1 8.2.12.D.1 9.3.ST-ET.1 9.3.ST-ET.5 9.3.ST-ET.6
How to create and maintain a troubleshooting program.	9.3.IT-PRG.5 9.3.IT-PRG.6
How to locate code snippets from external sources..	9.3.IT-PRG.6
How to interact with an Arduino via multiple platforms.	8.2.12.E.1 8.2.12.E.2 8.2.12.E.3
Resources Mini Unit 3C:	C++ code resources, Arduino Microprocessor, Breadboard, and Various electronic components.

UMBRELLA UNIT 4	
Title:	Programming and Machine Use in the Real World
Duration:	7 Weeks
Essential Questions:	What roles does machinery play in our daily lives? How does programming affect your life? What are the advantages of rapid prototyping? How has 3D Printing and other rapid prototyping technologies affected the world? How can 3D printing be used to solve a problem?
Summative Assessments: **(Assessment at the end the learning period)**	Performance-Based Assessment after Each Mini-Unit. Students will perform a 3D Modeling task or procedure to demonstrate their understanding.
Formative Assessments: **(Ongoing assessments during the learning period)**	3D Modeling Challenges and 3D / Real-World Applications Quizzes
Differentiation	All quizzes and coursework will be modified or adapted to fit individual student needs. Assignments will be modified to meet individual needs and expectations. Quizzes or tests will be modified in accordance with an IEP. This may include substituting questions or removing a choice from a multiple choice question. Students may choose to apply a project's method or steps to a different subject matter if they feel uncomfortable with the original subject matter.
TECHNOLOGY STANDARD (STANDARD 8)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
8.2.12.B.1	Research and analyze the impact of the design constraints (specifications and limits) for a product or technology driven by a cultural, social, economic or political need and publish for review.

8.1.12.B.2	Apply previous content knowledge by creating and piloting a digital learning game or tutorial.
8.1.12.C.1	Develop an innovative solution to a real world problem or issue in collaboration with peers and experts, and present ideas for feedback through social media or in an online community.
8.2.12.D.1	Design and create a prototype to solve a real world problem using a design process, identify constraints addressed during the creation of the prototype, identify trade-offs made, and present the solution for peer review.
8.2.12.D.3	Determine and use the appropriate resources (e.g., CNC (Computer Numerical Control) equipment, 3D printers, CAD software) in the design, development and creation of a technological product or system.
8.2.12.D.5	Explain how material processing impacts the quality of engineered and fabricated products.
8.2.12.E.1	Demonstrate an understanding of the problem-solving capacity of computers in our world.
8.2.12.E.2	Analyze the relationships between internal and external computer components.
8.2.12.E.3	Use a programming language to solve problems or accomplish a task (e.g., robotic functions, website designs, applications, and games).
8.2.12.E.4	Use appropriate terms in conversation (e.g., troubleshooting, peripherals, diagnostic software, GUI, abstraction, variables, data types and conditional statements).
21ST CENTURY LIFE AND CAREER (STANDARD 9)	
CPI #	**CUMULATIVE PROGRESS INDICATOR (CPI)**
9.3.IT-PRG.5	Apply an appropriate software development process to design a software application.
9.3.IT-PRG.6	Program a computer application using the appropriate programming language.
9.3.ST-ET.1	Use STEM concepts and processes to solve problems involving design and/or production.
9.3.ST-ET.5	Apply the knowledge learned in STEM to solve problems.
9.3.ST-ET.6	Apply the knowledge learned in the study of STEM to provide solutions to human and societal problems in an ethical and legal manner.

MINI UNIT 4A	
Title:	How It's Made: Programming and Machinery
Duration:	1 Weeks
Overview:	Students will focus on exploring the unique relationship between machine and maker. They will utilize internet resources to perform research and investigate how programming and machinery are intertwined with our daily lives.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How machines are used in our daily lives.	8.2.12.D.3 8.2.12.D.5
How programming can be used to solve real-world problems.	8.2.12.E.1 8.2.12.E.3 9.3.IT-PRG.6
How to ethically utilize programming and machinery.	8.2.12.B.1
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Identify machine uses in our daily lives.	8.2.12.D.3 8.2.12.D.5
Solve real-world problems using programming.	8.2.12.E.1 8.2.12.E.3 9.3.IT-PRG.6
Use programming and machinery in an ethical manner.	8.2.12.B.1

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
The historical importance of advances in machinery in our daily lives.	8.2.12.D.3 8.2.12.D.5 6.1.12.C.5.c
How to solve real-world problems via programming.	8.2.12.E.1 8.2.12.E.3 9.3.IT-PRG.6
How to ethically utilize programming and machinery.	8.2.12.B.1
Resources Mini Unit 4A:	PC, Internet Search Engines, Machinery Samples

MINI UNIT 4B	
Title:	3D Modeling, Printing, and G-Code
Duration:	3 Weeks
Overview:	Students will utilize 3D modeling software to create unique 3D models. These 3D models will be used to explore G-Code and the language of machines. Students will explore how a 3D model is translated into a series of commands and delivered to the 3D printer.

Essential Outcomes - Upon completion of this course students will know (declarative):	Alignment to Standards
How to utilize 3D modeling and programming.	8.2.12.D.3 8.2.12.D.5
How rapid prototyping machines use G-Code.	8.2.12.E.3 8.2.12.E.4
How to communicate with 3D Printers.	8.2.12.E.2 9.3.IT-PRG.6

Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Design and develop 3D models.	8.2.12.D.3 8.2.12.D.5
Modify and edit G-Code.	8.2.12.E.3 8.2.12.E.4
Connect to a 3D Printer to perform specific actions.	8.2.12.E.2 9.3.IT-PRG.6
Troubleshoot a 3D Printer via loading/unloading filament, regular printer maintenance, and modifying a 3D model.	8.2.12.E.2 9.3.IT-PRG.6
Essential Outcomes - Upon completion of this course students will understand (conceptual):	**Alignment to Standards**
How to create a 3D model.	8.2.12.D.3 8.2.12.D.5
How G-Code syntax works.	8.2.12.E.3 8.2.12.E.4
How a computer communicates with a 3D Printer.	8.2.12.E.2 9.3.IT-PRG.6
The importance of machine maintenance.	8.2.12.E.2 9.3.IT-PRG.6
Resources Mini Unit 4B:	3D Printer, 3D Modeling software (TinkerCAD, SketchUp, Autodesk Suite)

MINI UNIT 4C	
Title:	Solving Problems Through 3D Printing
Duration:	4 Weeks
Overview:	Students will utilize 3D printing to identify, design, and develop solutions to a problem. Careful consideration will be paid to the use of 3D printing as an appropriate solution. The application of 3D printing will be used to create a unique design and offer a meaningful contribution.

Essential Outcomes - Upon completion of this course students will know (declarative):	**Alignment to Standards**
How to solve a real-world problem.	8.2.12.B.1 8.2.12.D.1
How to utilize 3D modeling and 3D printing.	8.2.12.D.3 8.2.12.D.5 8.2.12.E.1 8.2.12.E.2
How to use the EDP.	9.3.ST-ET.5 9.3.ST-ET.6
Essential Outcomes - Upon completion of this course students will be able to (procedural):	**Alignment to Standards**
Develop a solution for a real-world problem.	8.2.12.B.1 8.2.12.D.1
Design a 3D model for 3D printing.	8.2.12.D.3 8.2.12.D.5 8.2.12.E.1 8.2.12.E.2
Utilize the EDP.	9.3.ST-ET.5 9.3.ST-ET.6

Essential Outcomes - Upon completion of this course students will understand (conceptual):	Alignment to Standards
How to approach real-world problem solving.	8.2.12.B.1 8.2.12.D.1
How to 3D model for 3D printing.	8.2.12.D.3 8.2.12.D.5 8.2.12.E.1 8.2.12.E.2
How and why the EDP is used.	9.3.ST-ET.5 9.3.ST-ET.6
Resources Mini Unit 4C:	3D Printer, 3D Modeling software (TinkerCAD, SketchUp, Autodesk Suite)

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