Digital Design

Eighth Grade

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Digital Design 8

Course Description: This course will empower students to productively utilize a variety of digital tools while solving complex, open-ended problems. Simultaneously, students will gain exposure to a variety of technologies that they can continue to harness throughout their educational careers and their lives. Technology genres will include: programming/coding, robotics and 3d printing if time allows

Course Sequence:

Programming – 5 weeks
Robotics – 4 weeks

Prerequisite: None

Unit 1 - Overview	
Content Area: Computer Science	
Unit Title: Programming	
Grade Level: Eighth	
Core Ideas: In this unit students will review programming skills that they learned in the seventh grade. Once students have a better understanding of basic programming students will use their knowledge to program different technologies in a series of competitions	
Unit 1 - Standards	
Standards (Content and Technology)**:**	
CPI#:	**Statement:**
Computer Science and Design Thinking	
8.1.8.AP.1	Design and illustrate algorithms that solve complex problems using flowcharts and/or pseudocode.
8.1.8.AP.2	Create clearly named variables that represent different data types and perform operations on their values.
8.1.8.AP.3	Design and iteratively develop programs that combine control structures, including nested loops and compound conditionals.
8.1.8.AP.4	Decompose problems and sub-problems into parts to facilitate the design, implementation, and review of programs.
8.1.8.AP.5	Create procedures with parameters to organize code and make it easier to reuse.
8.1.8.AP.6	Refine a solution that meets users' needs by incorporating feedback from team members and users.
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.
8.1.8.AP.9	Document programs in order to make them easier to follow, test, and debug.
8.2.8.NT.1	Examine a malfunctioning tool, product, or system and propose solutions to the problem.
Career Readiness, Life Literacies, and Key Skills	
9.1.8.CR.2	Compare various ways to give back through strengths, passions, goals, and other personal factors.
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.
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.DC.1	Analyze the resource citations in online materials for proper use.
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.TL.6	Collaborate to develop and publish work that provides perspectives on a real-world problem.
Intercultural Statements (Amistad, Holocaust, LGBT, etc...)	
LGBTQ and Disabilities NJSA 18A:35-4.35	Explore computer scientist in the LGBTQ community, including but not limited to Sofia Kovalevskaya, Alan Turing, Christopher Strachey, Peter Landin, Edith Windsor, Lynn Conway, Jon Hall, Sphie Wilson, Mary Ann Horton, and Audrey Tang
Amistad Law NJSA 18A:35-4.43	Explore African-American computer scientist, including but not limited to Clarence Ellis, Melba Roy Mouton, Katherine Johnson, Mary Jackson, and Annie Easley
Holocaust Law NJSA 18A:35-28	Explore Jewish computer scientist, including but not limited to Joseph Weizenbaum, Larry Page, Hilary Putnam, Jon von Neumann, Sergery Brin, Saul Amarel and Norbert Wiener
AAPI Law NJSA 18A:25-4.44	Explore Asian-American/Pacific Islander computer scientist, including but not limited to Peter Tsaai, Nainoa Thompson, Flossie Wong-Staal, Ajay Bhatt, Min Chueh Chang, Roseli Ocamp-Friedmann, Steven Shih Chen, and Ching Wan Tang
Interdisciplinary Connection	
Science: MS-ETS1-1	Define the criteria and constraints of a design problem with sufficient precision to ensure a successful solution, taking into account relevant scientific principles and potential impacts on people and the natural environment that may limit possible solutions.

Math:MP.2	Reason abstractly and quantitatively.
History: 6.1.8.EconNE.4. b	Analyze how technological innovations affected the status and social class of different groups of people and explain the outcomes that resulted.
Companion Standards	
WHST.6-8.8	Gather relevant information from multiple print and digital sources, using search terms effectively; assess the credibility and accuracy of each source; and quote or paraphrase the data and conclusions of others while avoiding plagiarism and following a standard format for citation
RST.6-8-1	Cite specific textual evidence to support analysis of science and technical texts.

Social and Emotional Learning	
Self-Awareness	• Examining prejudices and biases • Having a growth mindset
Self Management	• Exhibiting self-discipline and self-motivation • Using planning and organizational skills
Social Awareness	• Taking others' perspectives • Understanding the influences of organizations/systems on behavior
Relationship Skills	• Communicating effectively • Practicing teamwork and collaborative problem-solving • Showing leadership in groups
Responsible Decision Making	• Demonstrating curiosity and open-mindedness • Recognizing how critical thinking skills are useful both inside & outside of school

Unit Essential Question(s):

- What do I remember about programming?
- What are the basics of programming?
- How is programming the same across different technology? How is it different?
- How can I manipulate different technology with programming?
- How can innovative (hands-on) and coding technologies be used to solve problems?
- How can Coding and Computational Thinking processes encourage the creation of meaningful and innovative prototypes?
- How can students use design and computational thinking to customize coded games, projects, and animations?
- Why is it important for all individuals to have an appreciation for computer coding/programming?

Unit Enduring Understandings:

- Understand the basics of programming
- Understand that programming has similar properties across different platforms
- Use programming to manipulate different technology
- Coding/Programming and hands-on construction of technological elements can help create innovative and productive prototypes, ultimately solving problems.
- Coding and Computational Thinking processes encourage the creation of meaningful and innovative prototypes.
- Design and computational thinking can enable students to customize coded games, project, and animations.

Evidence of Learning

Formative Assessments:

- Do Now
- Teacher observations
- Questioning
- Quizzes
- Practice Programs
- Entry tickets
- Exit tickets
- Online games
- Discussions
- Homework

Summative/Benchmark Assessment(s):

- Projects
- Tests
- Chapter Review / Quizzes
- Chapter Assignments

- Labs
- Final Project

Alternative Assessments:
- Portfolio
- Projects
- Online tests / assignments

Resources/Materials:
- Sam Labs: https://studio.samlabs.com/subscription required
- Drones
- Spheros: https://edu.sphero.com/
- RVR cars: https://edu.sphero.com/

Key Vocabulary:
Algorithm, Bug, Class, Debugging, Error, Flow, Function, Method, Object, Properties, Software design, Software engineering, Testing, Comment, Parameter, Variable, Assignment operator, Assignment statement, Boolean expression, Boolean operators, Boolean type, Condition, Control Structure, Counting loop, Flow Control, for statement, General Loop, if statement, Infinite loop, Nested if, while statement, Iterating, Random number, Flight path, Obstacle

Suggested Pacing Guide

Lesson Name/Topic	Student Learning Objective(s)	Suggested Tasks/Activities:	Day(s) to Complete
Beginning Programming	• Use variables to store values that can be used later in a method • Use a variable to store the value of an arithmetic expression • Use a variable to store the value produced by a function • Use parameters to write methods that are more broadly useful • Create functions Use the Boolean type and its basic operation • Use the if statement to perform some statements while skipping others • Use the for and while statements to perform statements more than once • Use Boolean variables and functions to control if and while statements • Use random numbers to vary the behavior of a program	• Students will share their experience with coding and what they know about coding in a discussion • Hands-On technologies can include: ○ Micro:bit ○ Sam Labs ○ Micro-Queen Robotics • Students will learn the following topics through lecture and demonstration: ○ Methods ○ Variables and Expressions ○ Flow Control • After each lesson students will be asked to complete practice programs • Each lesson will also include vocabulary and questions to check for understanding.	2 Weeks

Triathlon	• To use what was learned to create programs • Understand the extreme literal nature of communicating with a computer • Use computational thinking and coding concepts to design programs • Use block and text-based coding to control the actions of digital and physical tools	• Students are to use what they learned to create a program different robotics through a series of challenges • Challenges will represent a triathlon of technology using Drones, Spheros and RVR cars • Groups will compete for the best time through all challenges	3 Weeks
Teacher Notes: Triathlon is meant to use drones, Sphero's and RVR cars. If these are not available other technology can be substituted.			

Additional Resources:				
Differentiation/Modification Strategies				
Students with Disabilities	**English Language Learners**	**Gifted and Talented Students**	**Students at Risk**	**504 Students**
• Allow errors • Rephrase questions, directions, and explanations • Allow extended time to answer questions and permit drawing as an explanation • Accept participation on any level, even one word • Consult with Case Managers and follow IEP accommodations/ modifications	• Assign a buddy, same language or English speaking • Allow errors in speaking • Rephrase questions, directions, and explanations • Allow extended time to answer questions • Accept participation at any level, even one word	• Provide extension activities • Build on students' intrinsic motivation • Consult with parents to accommodate students' interests in completing tasks at their level of engagement	• Provide extended time to complete tasks • Consult with Guidance Counselors and follow I&RS procedures/action plans • Consult with other members of the 7th grade team for specific behavior interventions • Provide rewards as necessary	• Allow errors • Rephrase questions, directions, and explanations • Allow extended time to answer questions and permit drawing as an explanation • Accept participation on any level, even one word • Consult with Case Managers and follow IEP accommodations/ modifications • Assign a buddy, same language or English speaking

Unit 2 - Overview

Content Area: Computer Science

Unit Title: Robotics

Grade Level: Eighth

Core Ideas: Students will make a robot that must compete in a series of challenging events. The students will also design and build attachments for each event and test their robots. All electrical and programmable components must be work properly and the robot must work towards the common goal of the completion of the event.

Unit 2 - Standards

Standards (Content and Technology)**:**

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8.1.8.AP.9	Document programs in order to make them easier to follow, test, and debug.
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.2	Identify the steps in the design process that could be used to solve a problem.
8.2.8.ED.4	Investigate a malfunctioning system, identify its impact, and explain the step-by-step process used to troubleshoot, evaluate, and test options to repair the product in a collaborative team.
8.2.8.ED.5	Explain the need for optimization in a design process.
8.2.8.ED.6	Analyze how trade-offs can impact the design of a product.
Career Readiness, Life Literacies, and Key Skills	
9.1.8.CR.2	Compare various ways to give back through strengths, passions, goals, and other personal factors.
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Unit Essential Question(s):

- How will the electrical components and attachments work for each event?
- How must the attachments be designed in order to support the success of the event?
- What is a Sound Structure?
- How can you build a robot/attachment that will be more successful than the other teams?
- How can I program the Robot to be successful? • What is a Simple Machine, and how do they work?

Unit Enduring Understandings:

- How to build with Tetrix (using Allen Wrenches / Screws / Nuts / Hubs)
- Problem Solving/Engineering Loop
- Evaluation and Revision of their project and attachments
- Programming Skills
- The concept of Robotic Engineering,
- The idea of building a strong structurally sound robot

Formative Assessments:

- Do Now
- Teacher observations
- Questioning
- Quizzes
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- Entry tickets
- Exit tickets
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Summative/Benchmark Assessment(s):

- Projects
- Tests

- Chapter Review / Quizzes
- Chapter Assignments
- Labs
- Final Project

Alternative Assessments:
- Portfolio
- Projects
- Online tests / assignments

Resources/Materials:	**Key Vocabulary:**
• Tetrix Robotics	Algorithm, Bug, Debugging, Error, Flow, Function, Method, Object, Properties, Software design, Software engineering, Testing, Comment, Parameter, Variable, Condition, Control Structure, Counting loop, Flow Control, for statement, General Loop, if statement, Infinite loop, Nested if, while statement, Iterating, Random number, Robotics, Obstacles

Suggested Pacing Guide

Lesson Name/Topic	**Student Learning Objective(s)**	**Suggested Tasks/Activities:**	**Day(s) to Complete**
Robotics	• To determine how the events are scored and how to build an attachment for the event. • To adapt only ONE ratio and produce a successful attachment based on that ratio. • Work together in teams to accomplish this task. • Develop and create a 3D printed attachment that will fit on the robot they created. • Program the robot through each task • To understand engineering process and how to implement their knowledge into the robot and attachment for complete success during the events. • To understand the value of documentation of progress • To document the final stage of the robot/attachment and learned process.	• Step guide for lesson interactive lecture: Lecture with interaction within the lecture to stay with the lesson • Website (includes all documents and video lessons) • Students will learn to build a robot that can complete a specific task with attachments. • Students will be able to program their robots • Students will compete in in class robotic competitions.	4 Weeks

Teacher Notes: Tetrix are the best robots to use but in general any robot that can be build and program will work.

Additional Resources:

Differentiation/Modification Strategies

Students with Disabilities	English Language Learners	Gifted and Talented Students	Students at Risk	504 Students
• Allow errors • Rephrase questions, directions, and explanations • Allow extended time to answer	• Assign a buddy, same language or English speaking • Allow errors in speaking	• Provide extension activities • Build on students' intrinsic motivation • Consult with parents to accommodate	• Provide extended time to complete tasks • Consult with Guidance Counselors and follow I&RS	• Allow errors • Rephrase questions, directions, and explanations • Allow extended time to answer

questions and permit drawing as an explanation • Accept participation on any level, even one word • Consult with Case Managers and follow IEP accommodations/ modifications	• Rephrase questions, directions, and explanations • Allow extended time to answer questions • Accept participation at any level, even one word	students' interests in completing tasks at their level of engagement	procedures/action plans • Consult with other members of the 7th grade team for specific behavior interventions • Provide rewards as necessary	questions and permit drawing as an explanation • Accept participation on any level, even one word • Consult with Case Managers and follow IEP accommodations/ modifications • Assign a buddy, same language or English speaking