Florham Park Public Schools

STEAM Lab Curriculum

3rd - 5th Grade

Revised March 2022
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PHILOSOPHY
In today's technology rich society, it's paramount that students be workplace ready with the 21st Century skills needed to be successful, problem solvers and global contributors. A foundation of Science, Technology, Engineering and Mathematics principles will help students be successful in solving tomorrow's problems. This is a non traditional model of Education in which the classroom resembles a work environment and students contribute to solving problems in the community. STEAM careers, experiences and skills drive the curriculum. Curriculum is integrated in authentic problem-based learning that is STEAM career-oriented and cross-disciplinary. Students collaborate in teams to solve problems. Teachers facilitate teams of students towards solving problems and developing work for skills commonly the skills required by a STEAM businesses in the area or region. Frequently, schools have partnerships with businesses to provide materials, resources, and capit

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3rd Grade STEAM Lab Units

3rd Grade - Scope and Sequence (Units are not sequential)

Trimester/Unit 1 - Coding

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Coding	Beginning Coding				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Intermediate Coding					

Trimester/Unit 2 - STEAM Challenges

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Challenges	Basic STEAM Challenges				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Advanced/Seasonal STEAM Challenges			Empathy STEAM Project		

Trimester/Unit 2 - Engineering

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Engineering	Beginning Engineering (foundational concepts)				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Intermediate Engineering (leveled concepts)					

3rd Grade Coding **Unit Summary**
Course D was created for students who read at roughly a third grade level. Angles and mathematical concepts are introduced with helpful videos and hints. The course begins with a review of the concepts found in Courses A, B, and C. This review helps introduce or refresh basic ideas such as repeat loops and events. Students will develop their understanding of algorithms, nested loops, while loops, conditionals, and events. Lessons on digital citizenship are also included. This course is crafted to build a strong foundation of basic concepts before opening up to a wide range of new and exciting topics.
Standards
Common Core English Language Arts Standards **L - Language** 1.L.6 - Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using frequently occurring conjunctions to signal simple relationships (e.g., because). 2.L.6 - Use words and phrases acquired through conversations, reading and being read to, and responding to texts, including using adjectives and adverbs to describe (e.g., When other kids are happy that makes me happy). 3.L.6 - Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships (e.g., After dinner that night we went looking for them). **SL - Speaking & Listening** 1.SL.1 - Participate in collaborative conversations with diverse partners about grade 1 topics and texts with peers and adults in small and larger groups. 1.SL.1.a - Follow agreed-upon rules for discussions (e.g., listening to others with care, speaking one at a time about the topics and texts under discussion). 1.SL.1.b - Build on others' talk in conversations by responding to the comments of others through multiple exchanges. 1.SL.1.c - Ask questions to clear up any confusion about the topics and texts under discussion. 2.SL.1 - Participate in collaborative conversations with diverse partners about grade 2 topics and texts with peers and adults in small and larger groups. 3.SL.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly. 3.SL.1.b - Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion). 3.SL.3 - Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. 3.SL.6 - Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification. **Common Core Math Standards** **G - Geometry** 2.G.1 - Recognize and draw shapes having specified attributes, such as a given number of angles or a given number of equal faces.5 Identify triangles, quadrilaterals, pentagons, hexagons, and cubes. 3.G.2 - Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape. **MP - Math Practices** MP.1 - Make sense of problems and persevere in solving them MP.2 - Reason abstractly and quantitatively MP.3 - Construct viable arguments and critique the reasoning of others MP.4 - Model with mathematics MP.5 - Use appropriate tools strategically

MP.6 - Attend to precision
MP.7 - Look for and make use of structure
MP.8 - Look for and express regularity in repeated reasoning

OA - Operations And Algebraic Thinking

1.OA.1 - Use addition and subtraction within 20 to solve word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using objects, drawings, and equations with a symbol for
2.OA.1 - Use addition and subtraction within 100 to solve one- and two-step word problems involving situations of adding to, taking from, putting together, taking apart, and comparing, with unknowns in all positions, e.g., by using drawings and equations with a sy
3.OA.3 - Use multiplication and division within 100 to solve word problems in situations involving equal groups, arrays, and measurement quantities, e.g., by using drawings and equations with a symbol for the unknown number to represent the problem.1
3.OA.4 - Determine the unknown whole number in a multiplication or division equation relating three whole numbers. For example, determine the unknown number that makes the equation true in each of the equations 8 × ? = 48, 5 = □ ÷ 3, 6 × 6 = ?.

2020 NJSLS - Computer Science and Design Thinking

Core Ideas

Different algorithms can achieve the same result.
Some algorithms are more appropriate for a specific use than others.
Programming languages provide variables, which are used to store and modify data.
A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).
Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist.
Individuals develop programs using an iterative process involving design, implementation, testing, and review.

Performance Expectations

8.1.5.AP.1: Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
8.1.5.AP.2: Create programs that use clearly named variables to store and modify data.
8.1.5.AP.3: Create programs that include sequences, events, loops, and conditionals.
8.1.5.AP.4: Break down problems into smaller, manageable sub-problems to facilitate program development.
8.1.5.AP.5: Modify, remix, or incorporate pieces of existing programs into one's own work to add additional features or create a new program.
8.1.5.AP.6: Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended.

CSTA K-12 Computer Science Standards

AP - Algorithms & Programming

1A-AP-09 - Model the way programs store and manipulate data by using numbers or other symbols to represent information.
1A-AP-10 - Develop programs with sequences and simple loops, to express ideas or address a problem.
1A-AP-14 - Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops.
1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
1B-AP-12 - Modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
1B-AP-13 - Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
1B-AP-15 - Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.

NI - Networks & the Internet

1B-NI-05 - Discuss real-world cybersecurity problems and how personal information can be protected.

Next Generation Science Standards

ETS - Engineering in the Sciences ETS1 - Engineering Design
K-2-ETS1-1 - Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
K-2-ETS1-2 - Develop a simple sketch, drawing, or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.
K-2-ETS1-3 - Analyze data from tests of two objects designed to solve the same problem to compare the strengths and weaknesses of how each performs.
3-5-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Career Ready Practices:

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

Essential Questions	Enduring Understanding
How does students in the primary grade level understand various coding concepts? How do the concepts of programming translate to real world scenarios? Who and what is “in charge” of the Internet and how it functions?	• Implement an algorithm in a programming language that involves the use of iteration and boolean logic. • Recognize the need to automate a process in the face of a large amount of data. • Identify simple algorithms that, when combined, solve a complex problem. • Recognize and program a solution that requires the use and manipulation of data in a list • Reason about and justify the need for well-written code (not just functional code) and understand why well-written code is important for robustness and usability. • Use appropriate tools and strategies for debugging and avoiding errors.

Student Learning Objectives

- Students will learn the process for debugging programming.
- Students will learn how persistence plays a vital role in program development.
- Students will learn the foundations of coding (writing code).
- Students will work cooperatively on grade level appropriate coding tasks & challenges.

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3rd Grade STEAM Lab Units

3rd Grade Coding Unit Sequence

Introduction to Coding		**Timeframe:** 1 day
Concepts	**Lesson Sequence**	**Formative Assessments**
• Understanding the routines and system of accessing Code.org • Using sequencing to create code. • Digital Citizenship	1. Logging into Code.org and setting up student accounts with the simple sign on feature. a. Students will then work on **Lesson 1: Graph Paper Programming** to understand some basic concepts of computer science. b. Students will complete **Lesson 16: Digital Citizenship** before starting any other Code.org lessons.	Teacher Observation
Differentiation		
• **Special Needs** – see resources provided through Code.org • **ESL** – Use the translation feature provided through Code.org (at the the bottom right corner of each web page) • **Gifted Learners** – Continue with additional lessons through Code.org Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)		

Beginning Lessons in Code.org		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Basic coding skills • Teamwork/cooperative coding • Debugging - finding issues with coding and resolving them • Creating events in programming • Creating loops in programming	2. **Lesson 2: Introduction to Online Puzzles** - This lesson will give you practice in the skills you will need for this course. 3. **Lesson 3: Relay Programming** - Remember at the beginning of the course when you made drawings with code? In this lesson, you will be working with a team to do something very similar! 4. **Lesson 4: Debugging with Laurel** - Have you ever run into problems while coding? In this lesson, you will learn about the secrets of debugging. Debugging is the process of finding and fixing problems in your code. 5. **Lesson 5: Events in Bounce** - Ever wish you could play	Teacher observation Completion of written activities provided through Code.org

	video games in school? In this lesson, you will get to make your own! 6. **Lesson 6: Loops in Ice Age** - In this lesson, students get introduced to creating loops in programming.	

Differentiation

- **Special Needs** – see resources provided through Code.org
- **ESL** – Use the translation feature provided through Code.org (at the the bottom right corner of each web page)
- **Gifted Learners** – Continue with additional lessons through Code.org

Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)

Intermediate Lessons in Code.org		**Timeframe:** 6 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Creating visuals with loops • Creating code with nested loops • Creating code with *while* loops • Creating code with *until* loops Extension Concepts • Creating code containing conditionals • If/Else statements	7. **Lesson 7: Drawing Shapes with Loops** - In this lesson, loops make it easy to make even cooler images with Artist! 8. **Lesson 8: Nested Loops in Maze** - Loops inside loops inside loops. What does this mean? This lesson will teach you what happens when you place a loop inside another loop. 9. **Lesson 9: Fancy Shapes using Nested Loops** - More nested loops! This time, you get to make some AMAZING drawing with nested loops. 10. **Lesson 10: Snowflakes with Anna and Elsa** - Anna and Elsa have excellent ice-skating skills, but need your help to create patterns in the ice. Use nested loops to create something super COOL. 11. **Lesson 11: While Loops in Farmer** - Loops are so useful in coding. This lesson will teach you about a new kind of loop: while loops! 12. **Lesson 12: Until Loops in Maze** - You can do some amazing things when you use until loops! Extension Lessons: 13. **Lesson 13: Conditionals with Cards** - It's time to play a game where you earn points only under certain conditions! 14. **Lesson 14: If/Else with Bee** - Now that you understand conditionals, it's time to program Bee to use them when collecting honey and nectar.	Teacher observation Completion of written activities provided through Code.org

	15. **Lesson 15: Harvesting with Conditionals** - It's not always clear when to use each conditional. This lesson will help you get practice deciding what to do.	

Differentiation

- **Special Needs** – see resources provided through Code.org
- **ESL** – Use the translation feature provided through Code.org (at the the bottom right corner of each web page)
- **Gifted Learners** – Continue with additional lessons through Code.org

Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)

Evidence of Learning (Assessments)

Formative Assessments:

- Exit Tickets
- Daily Check-Ins
- Teacher observation
- Completion of written activities provided through Code.org
- Appropriate computer usage

Summative Assessments:

- Project Evaluations
- Presentations

Benchmark Assessments:

- Multiple measures of student growth (Data points collected)
  - LinkIt!
  - Reading Levels
  - State Testing Data
- Project Evaluation

Alternative Assessments:

- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

Accommodations and Modifications

Special Education

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*
- *Curricular Modifications and Guidance for Students Educated in Special Class Settings*

Differentiation:

- *Preview content and concepts*
- *Behavior management plan*
- *Highlight text*
- *Small group setting*

High-Prep Differentiation:

- *Alternative formative and summative assessments*
- *Guided Reading*
- *Personal agendas*
- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
- *Exploration by interest*
- *Flexible groupings*

English Language Learners

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)

- Unit 1: Curriculum for ELL
- ***Subgroup Accommodations and Modifications***
- Multi-language glossary
- Pupil edition in Spanish
- Vocabulary flash cards

Students at Risk for Failure

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- ***Subgroup Accommodations and Modifications***

Gifted and Talented

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- ***Subgroup Accommodations and Modifications***
- *Math in Focus or Big Ideas G & T Activities*

Students with 504 Plans

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*

Core Instructional and Supplemental Materials Professional Resources:

Core Professional Resources:

- *AliceKeeler.com*
- *Florham Park STEM Lab Curriculum*
- *Code.org Teacher Resources*

Supplemental Professional Resources:

- *NJECC Trainings/PD*
- *ISTE.org*

Core Instructional, Supplemental, Instructional, and Intervention Resources

Core Instructional Resources:

- Code.org
- Google Classroom
- Google forms
- Instructional Videos

Supplemental Resources:

- Clever (single sign on app)
- Listening instead of reading
- Brainpop

Intervention Resources:

	• Noise Cancelling Headphones • Manipulatives • *Brainpop* • Code.org Course Leveling
Interdisciplinary Connections	**Integration of Technology through NJSLS**
• CSTA K-12 Computer Science Standards • AP - Algorithms & Programming • 1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate. • 1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. • 1B-AP-12 - Modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features. • 1B-AP-13 - Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.k	• Chromebooks • Mac Computers • Google Classroom • Projectors • Headphones • •
Integration of 21st Century Themes	**Media Literacy Integration**
• Creativity and Innovation • Critical Thinking and Problem Solving Communication and Collaboration Information Literacy • Media Literacy • Life and Career Skills • Global and Environmental Awareness • Problem Solving Skills • **Initiative and Self Direction** • Manage Goals and Time • Work Independently • Be Self-directed Learners	• Ask students to look for specific things when they view videos or read print material, and then ask questions about those items • Use print materials to practice reading and comprehension skills
Career Education	**Global Perspectives**
• 21st Century Standards • 9.2 Career Awareness, Exploration and Preparation • Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements • • 9.3 Career and Technical Education • Architecture & Construction Career Cluster • Arts, A/V Technology, & Communications Career Cluster • Science, Technology, Engineering & Mathematics Career Cluster	• Black History Month • Week of Respect • Red Ribbon Week • Kindness Month •

Resources	Links
• Course D - COMPLETE COURSE • Course D - Overview from Code.org • Course D - Standards • Course D - Vocabulary • Course D - Other Resources	• Course D - COMPLETE COURSE • Course D - Overview from Code.org • Course D - Standards • Course D - Vocabulary • Course D - Other Resources

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3rd Grade STEAM Lab Units

3rd Grade STEAM Challenges
Unit Summary

In this unit, students will be solving real world problems using various methods. The goal of this unit, is to provide students with an understanding that technology systems impact every aspect of the world in which we live in and the nature and impact of technology, engineering, technological design, computational thinking and the designed world as they relate to the individual, global society, and the environment. Through the STEAM challenges outlined in this unit, students will begin to do just that.

Standards

2020 NJSLS - Computer Science and Design Thinking
Core Ideas
Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.
Often, several design solutions exist, each better in some way than the others.
Engineering design requirements include desired features and limitations that need to be considered.
Societal needs and wants determine which new tools are developed to address real-world problems.
A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.
Technology spurs new businesses and careers.
Technology innovation and improvement may be influenced by a variety of factors.
Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.
The technology developed for the human designed world can have unintended consequences for the environment.
Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.
Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Performance Expectations
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.

8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.

NGSS Standards
PHYSICAL SCIENCE Motion and Stability: Forces and Interactions
Students who demonstrate understanding can:
3-PS2-1. Plan and conduct an investigation to provide evidence of the effects of balanced and unbalanced forces on the motion of an object.
3-PS2-2. Make observations and/or measurements of an object's motion to provide evidence that a pattern can be used to predict future motion.
3-PS2-3. Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
3-PS2-4. Define a simple design problem that can be solved by applying scientific ideas about magnets.

LIFE SCIENCE Biological Evolution: Unity and Diversity
Students who demonstrate understanding can:
3-LS4-2. Use evidence to construct an explanation for how the variations in characteristics among individuals of the same species may provide advantages in surviving, finding mates, and reproducing.
3-LS4-3. Construct an argument with evidence that in a particular habitat some organisms can survive well, some survive less well, and some cannot survive at all.
3-LS4-4. Make a claim about the merit of a solution to a problem caused when the environment changes and the types of plants and animals that live there may change.

ENGINEERING DESIGN
Students who demonstrate understanding can:
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Career Ready Practices

CRP1. Act as a responsible and contributing citizen and employee.

CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.

CRP6. Demonstrate creativity and innovation.

CRP7. Employ valid and reliable research strategies.

CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

Essential Questions	Enduring Understanding
How do we problem solve through a variety of tasks?	Problem solving through hands on methods will allow students to physically work through problems and learn to communicate their ideas with other students.
How do students continue to learn STEAM concepts?	The field of science, technology, engineering, arts and math are all interconnected. These topics can be explored through a variety of tasks and problem solving scenarios.
How can students effectively share ideas with partners or a group?	Being a good communicator is a skill that must be taught as early as possible. Being able to talk through issues or problems with a partner is a great life skill.

Student Learning Objectives

NGSS Learning Objectives
ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
ETS1.B: Developing Possible Solutions Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

PS2.A: Forces and Motion
Each force acts on one particular object and has both strength and a direction. An object at rest typically has multiple forces acting on it, but they add to give zero net force on the object. Forces that do not sum to zero can cause changes in the object's speed or direction of motion. The patterns of an object's motion in various situations can be observed and measured; when that past motion exhibits a regular pattern, future motion can be predicted from it.

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3rd Grade STEAM Lab Units

3rd Grade STEAM Challenges
Unit Sequence

Basic STEAM Challenges - Focus on Empathy		**Timeframe:** 1 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Persistence when solving a problem • Discuss the concept of empathy • Engineering • Construction • Simple Machines • Transfer of Energy	1. **Intro Lesson** - Lesson on Empathy. Students will complete an activity that explains the idea of empathy. 2. **Float Your Boat** - Students will use aluminum foil to create a boat that can hold the most marbles without sinking. a. Empathy Focus: A small group of islanders need to transport food from one island to another. Help them create a boat that will allow them to do so without losing any food. 3. **Wheel-y Fun** - Create a working model of a water wheel. a. Empathy Focus: A family living in the wilderness is without power. However, they do have a river that runs next to their house. Help them use the water to power their house. 4. **Ready, Set, Recycle!** - Create an educational game or puzzle with recycled materials. 5. **Starry Show-and-Tell** - Create a planetarium to show various constellations. 6. **Newsworthy Towers** - Create the tallest tower you can that can support the weight of an erase on the top. 7. **Super Seesaw: Simple Machines** - Create a device that can balance two unevenly weighted objects. Your device should be adjustable, and the cups should rest on the top of the ruler. 8. **No Bones about It** - Design a creature with an internal skeletal system. Your creature should be able to stand on its own. 9. **Motoring** - User rubber band energy to create a self-propelled vehicle such as a car or boat. 10. **Going Up!** - Create a working elevator for an action figure. a. A window cleaning company needs to create a	Teacher observation Worksheets associated with each lesson STEM Performance Rubric

	better way to hoist their workers up different floors to clean windows. Create the next best elevator!	

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students can create "bugs" in their creations and have other students solve the problems

Seasonal STEAM Challenges		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Basic engineering • Buoyancy • Practicing the design model	These seasonal lessons can be used during their appropriate season to supplement or in lieu of the above engineering lessons 1. Autumn Challenges a. **The Art of the Leaf** - Create a leaf structure at least 20 cm high. b. **Chucking Pumpkins challenge** - Design a catapult that will launch a candy pumpkin through the air. c. **Dancing Ghosts** - Use the balloon to make your "ghosts" dance. d. **Weave a Web** - Create a strong realistic spider web that will hold a plastic spider e. **Tepee Me!** - Create a tepee that one person can find inside of. f. **Help! Hide me!** - Create a hideout to help a turkey escape from the farmer on Thanksgiving Day. 2. Winter Challenges a. **Zippy's Zip Line** - Zippy the elf is stuck on a shelf. Create a zip line and trolley that will carry the elf safely down from the shelf to the floor. 3. Spring/Summer Challenges a. **To Catch a Leprechaun** - Create a trap to catch a leprechaun. b. **My Scream Machine** - Build a roller coaster with ramps and turns for the table tennis ball to travel over. c. **Up a Creek with a Paddle** - Build a boat that can paddle across a container of water on its own. d. **Cargo Hold** - Design a paper airplane that will	Teacher observation Worksheets associated with each lesson STEM Performance Rubric

	hold the most "cargo" while gliding more than eight feet in the air. e. **Terrific Turbines** - Use materials to make a working windmill (turbine)	

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students can create "bugs" in their creations and have other students solve the problems

Empathy STEAM Challenge		**Timeframe:** 4 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Real world problem solving	Change Makers for Change Makers activity • Students will have a suggestion box for things to change in the school. Teachers, staff and students can add their suggestions to what can be improved in the school • The "Change Makers" (students in the class) will look at the suggestions in the suggestion box, design a prototype, and 3D print a solution for any of the problems in the box • Change Makers Resources ○ Sample Problem Bank	Teacher observation Sketched Out initial prototypes

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students can create "bugs" in their creations and have other students solve the problems

Evidence of Learning (Assessments)	**Accommodations and Modifications**
Formative Assessments:	**Special Education**

- Exit Tickets
- Daily Check-Ins
- Teacher observation
- Completion of written activities provided through Code.org
- Appropriate computer usage

Summative Assessments:

- Project Evaluations
- Presentations

Benchmark Assessments:

- Multiple measures of student growth (Data points collected)
  - LinkIt!
  - Reading Levels
  - State Testing Data
- Project Evaluation

Alternative Assessments:

- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*
- *Curricular Modifications and Guidance for Students Educated in Special Class Settings*

Differentiation:

- *Preview content and concepts*
- *Behavior management plan*
- *Highlight text*
- *Small group setting*

High-Prep Differentiation:

- *Alternative formative and summative assessments*
- *Guided Reading*
- *Personal agendas*
- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
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English Language Learners

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- Unit 1: Curriculum for ELL
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Integration of 21st Century Themes

Media Literacy Integration

• Creativity and Innovation • Critical Thinking and Problem Solving Communication and Collaboration Information Literacy • Media Literacy • Life and Career Skills • Global and Environmental Awareness • Problem Solving Skills • **Initiative and Self Direction** • Manage Goals and Time • Work Independently • Be Self-directed Learners	• Ask students to look for specific things when they view videos or read print material, and then ask questions about those items • Use print materials to practice reading and comprehension skills
Career Education	**Global Perspectives**
• 21st Century Standards • 9.2 Career Awareness, Exploration and Preparation • Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements • • 9.3 Career and Technical Education • Architecture & Construction Career Cluster • Arts, A/V Technology, & Communications Career Cluster • Science, Technology, Engineering & Mathematics Career Cluster	• Black History Month • Week of Respect • Red Ribbon Week • Kindness Month •

Resources	Links
• Course D - COMPLETE COURSE • Course D - Overview from Code.org • Course D - Standards • Course D - Vocabulary • Course D - Other Resources	• Course D - COMPLETE COURSE • Course D - Overview from Code.org • Course D - Standards • Course D - Vocabulary • Course D - Other Resources

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3rd Grade STEAM Lab Units

3rd Grade Engineering - Lego WeDo
Unit Summary

LEGO® Education WeDo 2.0 is developed to engage and motivate elementary students' interest in learning science- and engineering-related subjects. This is done through the use of motorized LEGO® models and simple programming. WeDo 2.0 supports a hands-on, "minds on" learning solution that gives students the confidence to ask questions and the tools to find the answers and to solve real-life problems. Students learn by asking questions and solving problems. This material does not tell students everything they need to know. Instead it makes them question what they know and explore what they do not yet understand. Lego WeDo Curriculum

Standards

2020 NJSLS - Computer Science and Design Thinking

Core Ideas

Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.
Often, several design solutions exist, each better in some way than the others.
Engineering design requirements include desired features and limitations that need to be considered.
Societal needs and wants determine which new tools are developed to address real-world problems.
A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.
Technology spurs new businesses and careers.
Technology innovation and improvement may be influenced by a variety of factors.
Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.
The technology developed for the human designed world can have unintended consequences for the environment.
Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.
Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Performance Expectations

8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.

8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.

NGSS Science Standards:

Energy
4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-3. Ask questions and predict outcomes about the changes in energy that occur when objects collide.
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
4-ESS3-1. Obtain and combine information to describe the fact that energy and fuels are derived from natural resources and that their use will affect the environment. Structure, Function, and Information Processing
4-PS4-2. Develop a model to describe how light reflecting from objects and entering the eye of a sighted person allows objects to be seen.
4-LS1-1. Construct an argument that plants and animals have internal and external structures that function to support their survival, growth, behavior, and reproduction.
4-LS1-2. Use a model to describe how animals receive different types of information through their senses, then process the information in their brain, and respond to the information in a range of different ways. Waves: Waves and Information
4-PS4-1. Develop a model of waves to describe patterns in terms of amplitude and wavelength, and that waves can cause objects to move.
4-PS4-3. Generate and compare multiple solutions that use patterns for the transfer of information.

Earth's Systems: Processes That Shape the Earth
4-ESS1-1. Identify evidence from patterns in rock formations and fossils in rock layers to support an explanation for changes in a landscape over time.
4-ESS2-1. Make observations and/or measurements to provide evidence of the effects of weathering or the rate of erosion by water, ice, wind, or vegetation.
4-ESS2-2. Analyze and interpret data from maps to describe patterns of earth's features.
4-ESS3-2. Generate and compare multiple solutions to reduce the impacts of natural earth processes on humans.

Engineering
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes criteria for success, and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare possible solutions to a problem based on how well eachmeets the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

WeDo 2.0 projects develop eight science and engineering practices:

1. **Ask questions and solve problems**
2. **Use models**
3. **Design prototypes**
4. **Investigate**
5. **Analyze and interpret data**
6. **Use computational thinking**
7. **Engage in argument from evidence**
8. **Obtain, evaluate, and communicate information**

Common Core State Standards ELA/Literacy
RI.5.1
RI.5.7
W.5.8

Mathematics
MP2
MP4

Computer Science and Design Thinking:
Core Ideas:
Different algorithms can achieve the same result.
Some algorithms are more appropriate for a specific use than others.
Programming languages provide variables, which are used to store and modify data.
A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).
Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist.
Individuals develop programs using an iterative process involving design, implementation, testing, and review.
Information needs a physical or wireless path to travel to be sent and received.

Performance Expectations:
8.1.5.AP.1: Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
8.1.5.AP.2: Create programs that use clearly named variables to store and modify data.
8.1.5.AP.3: Create programs that include sequences, events, loops, and conditionals.
8.1.5.AP.4: Break down problems into smaller, manageable sub-problems to facilitate program development.
8.1.5.AP.5: Modify, remix, or incorporate pieces of existing programs into one's own work to add additional features or create a new program.
8.1.5.AP.6: Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended.
8.1.5.NI.1: Develop models that successfully transmit and receive information using both wired and wireless methods.

Career Ready Practices:
CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.

CRP4. Communicate clearly and effectively and with reason.
CRP5. Consider the environmental, social and economic impacts of decisions.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
9.2.4.A.4 Explain why knowledge and skills acquired in the elementary grades lay the foundation for future academic and career success.
9.3.ST-SM.4 Apply critical thinking skills to review information, explain statistical analysis, and to translate, interpret and summarize research and statistical data.

Essential Questions	Enduring Understanding

Student Learning Objectives

- Apply collaboration strategies to support problem solving within the design cycle of a program.
- Use proper citations and document when ideas are borrowed and changed for their own use (e.g., using pictures created by others, using music created by others, remixing programming projects).
- Create a plan as part of the iterative design process, both independently and with diverse collaborative teams (e.g., storyboard, flowchart, pseudocode, story map).
- Construct programs, in order to solve a problem or for creative expression, that includes sequencing, events, loops, conditionals, parallelism, and variables, using a block-based visual programming language or text-based language, both independently and collaboratively (e.g., pair programming).
- Decompose (break down) a larger problem into smaller sub-problems, independently or in a collaborative group.

Evidence of Learning (Assessments)

Formative Assessments:

- Exit Tickets
- Daily Check-Ins
- Teacher observation
- Completion of written activities provided through Code.org
- Appropriate computer usage

Summative Assessments:

- Project Evaluations

Accommodations and Modifications

Special Education

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*
- *Curricular Modifications and Guidance for Students Educated in Special Class Settings*

Differentiation:

- *Preview content and concepts*
- *Behavior management plan*
- *Highlight text*
- *Small group setting*

- Presentations

Benchmark Assessments:

- Multiple measures of student growth (Data points collected)
  - LinkIt!
  - Reading Levels
  - State Testing Data
- Project Evaluation

Alternative Assessments:

- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

High-Prep Differentiation:

- *Alternative formative and summative assessments*
- *Guided Reading*
- *Personal agendas*
- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
- *Exploration by interest*
- *Flexible groupings*

English Language Learners

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- Unit 1: Curriculum for ELL
- ***Subgroup Accommodations and Modifications***
- Multi-language glossary
- Pupil edition in Spanish
- Vocabulary flash cards

Students at Risk for Failure

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Students with 504 Plans

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Core Instructional and Supplemental Materials Professional Resources:

Core Instructional, Supplemental, Instructional, and Intervention Resources

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Supplemental Professional Resources:

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Core Instructional Resources:

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- Google Classroom
- Google forms
- Instructional Videos

Supplemental Resources:

- Clever (single sign on app)
- Listening instead of reading
- Brainpop

Intervention Resources:

- Noise Cancelling Headphones
- Manipulatives
- *Brainpop*
- Code.org Course Leveling

Interdisciplinary Connections

- CSTA K-12 Computer Science Standards
- AP - Algorithms & Programming
- 1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
- 1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
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- Life and Career Skills
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- Manage Goals and Time
- Work Independently
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- Ask students to look for specific things when they view videos or read print material, and then ask questions about those items
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3rd Grade Engineering - Lego WeDo
Unit Sequence

Intro to Engineering - Using LEGO kits		**Timeframe:** 2 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Introduce students to the software features and learning experience of WeDo 2.0. • In this project, a character called "Milo" will take you and your students on a journey where you will explore places that humans cannot go in order to find a special plant specimen.	In part A, "Milo, the Science Rover," students will: • Engage in a discussion • Build a LEGO® model • Connect the Smarthub to their device • Program a LEGO model • Take a picture with the Capture tool • Write in the Documentation tool In part B, "Milo's Motion Sensor," students will: • Explore ways to use the Motion Sensor • Record a video using the Capture tool In part C, "Milo's Tilt Sensor," students will: • Explore ways to use the Tilt Sensor • Use the Capture tool to capture an image of their program In part D, "Collaborating," students will: • Use more then one Smarthub at a time • Collaborate with other teams	Teacher Observations Assessment Rubrics Student Led Assessments
Differentiation		
• **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list • **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list • **Gifted Learners** – Develop ways to use the Motion Sensors		

Beginning Engineering		**Timeframe:** 8 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Construct and execute an algorithm (set of step-by-step instructions) that includes sequencing, loops, and conditionals to accomplish a task, both independently and collaboratively, with or without a computing device.	Guided Projects 1. Pulling Investigate the effects of balanced and unbalanced forces on the movement of an object. 2. Speed Investigate what factors can make a car go faster to help predict future motion.	Teacher Observations Assessment Rubrics Student Led Assessments

• Analyze and debug (fix) an algorithm that includes sequencing, events, loops, conditionals, parallelism, and variables.	3. Robust Structures Investigate what characteristics of a building would help make it resistant to an earthquake using an earthquake simulator constructed from LEGO® bricks. 4. Frog's Metamorphosis Model a frog's metamorphosis using a LEGO representation, and identify the characteristics of the organism at each stage. 5. Plants and Pollinators Model a LEGO representation of the relationship between a pollinator and flower during the reproduction phase. 6. Prevent Flooding Design an automatic LEGO floodgate to control water according to various precipitation patterns. 7. Drop and Rescue Design a device to reduce the impacts on humans, animals, and the environment after an area has been damaged by a weather-related hazard. 8. Sort to Recycle Design a device to use physical properties of objects, including their shape and size, to sort them. 9. Predator and Prey Model a LEGO® representation of the behaviors of several predators and their prey. 10. Animal Expression Model a LEGO representation of various communication methods in the animal kingdom. 11. Extreme Habitats Model a LEGO representation of the influence of the habitat on the survival of some species. 12. Space Exploration Design a LEGO prototype of a rover that would be ideal for exploring distant planets. 13. Hazard Alarm Design a LEGO prototype of a weather alarm device to reduce the impact of severe storms. 14. Cleaning the Ocean Design a LEGO prototype to help people remove plastic waste from the ocean. 15. Wildlife Crossing Design a LEGO prototype to allow an endangered species to safely cross a road or other hazardous area. 16. Moving Materials Design a LEGO prototype of a device that can move specific objects in a safe and efficient way.	

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- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students can add additional programming to accomplish additional tasks.

Intermediate Engineering		**Timeframe:** 2 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• The key to using the Open Projects is to make them your own; • Develop solutions to locally relevant and challenging in the areas you want them to be.	Open Projects Use two lessons of 45 minutes each to make you own project based on one of the suggested This project should integrate all of the programming principles, as well as the computational thinking skills developed during the Guided Projects.	Teacher Observations Assessment Rubrics Student Led Assessments
Differentiation		
• **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list • **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list • **Gifted Learners** – see additional extension resources provided through Lego WeDo Open Projects		

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Integration of 21st Century Themes

- Creativity and Innovation
- Critical Thinking and Problem Solving Communication and Collaboration Information Literacy
- Media Literacy
- Life and Career Skills
- Global and Environmental Awareness
- Problem Solving Skills
- **Initiative and Self Direction**
- Manage Goals and Time
- Work Independently
- Be Self-directed Learners

Media Literacy Integration

- Ask students to look for specific things when they view videos or read print material, and then ask questions about those items
- Use print materials to practice reading and comprehension skills

Career Education

- 21st Century Standards
- 9.2 Career Awareness, Exploration and Preparation
- Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements
-
- 9.3 Career and Technical Education
- Architecture & Construction Career Cluster
- Arts, A/V Technology, & Communications Career Cluster
- Science, Technology, Engineering & Mathematics Career Cluster

Global Perspectives

- Black History Month
- Week of Respect
- Red Ribbon Week
- Kindness Month
-

Resources	Links
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4th Grade STEAM Lab Units	
4th Grade Scope and Sequence	Link
Unit 1 - Coding	Link
Unit 2 - STEAM Challenges	Link
Unit 3 - Engineering	Link

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4th Grade STEAM Lab Units

4th Grade - Scope and Sequence (Units are not sequential)

Trimester/Unit 1 - Coding

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Coding	Beginning Coding				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Intermediate Coding					

Trimester/Unit 2 - STEAM Challenges

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Challenges	Simple STEAM Challenges				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Advanced STEAM Challenges					

Trimester/Unit 3 - Engineering

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Engineering	Beginning Engineering (foundational concepts)				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Intermediate Engineering (leveled concepts)					

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4th Grade STEAM Lab Units

4th Grade Coding **Unit Summary**
Created with fourth grade students in mind, this course begins with a brief review of concepts previously taught in courses C and D. This introduction is intended to inspire beginners and remind the experts of the wonders of computer science. Students will practice coding with algorithms, loops, conditionals, and events before they are introduced to functions. At the end of the course, students will have the opportunity to create a capstone project that they can proudly share with peers and loved ones.

Standards

Common Core English Language Arts Standards

L - Language

3.L.6 - Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships (e.g., After dinner that night we went looking for them).

4.L.3 - Use knowledge of language and its conventions when writing, speaking, reading, or listening.

4.L.3.a - Choose words and phrases to convey ideas precisely.*

4.L.6 - Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g

RI - Reading Informational

4.RI.1 - Refer to details and examples in a text when explaining what the text says explicitly and when drawing inferences from the text.

SL - Speaking & Listening

3.SL.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly.

3.SL.3 - Ask and answer questions about information from a speaker, offering appropriate elaboration and detail.

3.SL.6 - Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification.

4.SL.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly.

4.SL.1.a - Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.

4.SL.1.b - Follow agreed-upon rules for discussions and carry out assigned roles.

4.SL.1.c - Pose and respond to specific questions to clarify or follow up on information, and make comments that contribute to the discussion and link to the remarks of others.

4.SL.1.d - Review the key ideas expressed and explain their own ideas and understanding in light of the discussion.

4.SL.4 - Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace.

4.SL.6 - Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation.

Common Core Math Standards

G - Geometry

4.G.2 - Classify two-dimensional figures based on the presence or absence of parallel or perpendicular lines, or the presence or absence of angles of a specified size. Recognize right triangles as a category, and identify right triangles.

MD - Measurement And Data

4.MD.5 - Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:

4.MD.5.a - An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the circular arc between the points where the two rays intersect the circle. An angle that turns through 1/360 of a circle i

4.MD.5.b - An angle that turns through n one-degree angles is said to have an angle measure of n degrees.

MP - Math Practices

MP.1 - Make sense of problems and persevere in solving them

MP.2 - Reason abstractly and quantitatively

MP.3 - Construct viable arguments and critique the reasoning of others

MP.4 - Model with mathematics

MP.5 - Use appropriate tools strategically

MP.6 - Attend to precision

MP.7 - Look for and make use of structure

MP.8 - Look for and express regularity in repeated reasoning

NBT - Number And Operations In Base Ten

4.NBT.4 - Fluently add and subtract multi-digit whole numbers using the standard algorithm.

OA - Operations And Algebraic Thinking

4.OA.1 - Interpret a multiplication equation as a comparison, e.g., interpret 35 = 5 × 7 as a statement that 35 is 5 times as many as 7 and 7 times as many as 5. Represent verbal statements of multiplicative comparisons as multiplication equations.

4.OA.5 - Generate a number or shape pattern that follows a given rule. Identify apparent features of the pattern that were not explicit in the rule itself. For example, given the rule "Add 3" and the starting number 1, generate terms in the resulting sequence and

2020 NJSLS - Computer Science and Design Thinking

Core Ideas

Different algorithms can achieve the same result.

Some algorithms are more appropriate for a specific use than others.

Programming languages provide variables, which are used to store and modify data.

A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).

Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist.

Individuals develop programs using an iterative process involving design, implementation, testing, and review.

Performance Expectations

8.1.5.AP.1: Compare and refine multiple algorithms for the same task and determine which is the most appropriate.

8.1.5.AP.2: Create programs that use clearly named variables to store and modify data.

8.1.5.AP.3: Create programs that include sequences, events, loops, and conditionals.

8.1.5.AP.4: Break down problems into smaller, manageable sub-problems to facilitate program development.

8.1.5.AP.5: Modify, remix, or incorporate pieces of existing programs into one's own work to add additional features or create a new program.
8.1.5.AP.6: Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended.

CSTA K-12 Computer Science Standards
AP - Algorithms & Programming
1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
1B-AP-12 - Modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
1B-AP-13 - Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.
NI - Networks & the Internet
1B-NI-05 - Discuss real-world cybersecurity problems and how personal information can be protected.

Next Generation Science Standards
ETS - Engineering in the Sciences ETS1 - Engineering Design
3-5-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Career Ready Practices:
CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

Essential Questions	Enduring Understanding
• How are real world phenomena modeled and simulated on a computer? • How do you write programs to store and retrieve lots of information? • What are "data structures" in a program and when do you need them? • How are algorithms evaluated for "speed"?	• Collaborate with a partner to create a physical device to send a bit of information to a classmate. • Hypothesize about and connect the concept of sending bits in digital networks. • Describe the large-scale characteristics of the Internet such as hierarchy, redundancy, and fault-tolerance. • Name different representations of bit. Define bit, byte, kilobyte, megabyte. • Describe how multiple levels of abstraction are used in the encoding of information with bits (e.g. numbers, text, sound, images).

	• Describe different file formats and any compression within them. • View the hex representation of a file on a computer. • Consider the problems of abstraction required in managing large numbers of bits.

Student Learning Objectives

- Students will learn the process for debugging programming.
- Students will learn the how persistence plays a vital role in program development.
- Students will learn foundations of coding (writing code).
- Students will work cooperatively on grade level appropriate coding tasks & challenges.

Evidence of Learning (Assessments)

Formative Assessments:

- Exit Tickets
- Daily Check-Ins
- Teacher observation
- Completion of written activities provided through Code.org
- Appropriate computer usage

Summative Assessments:

- Project Evaluations
- Presentations

Benchmark Assessments:

- Multiple measures of student growth (Data points collected)
  - LinkIt!
  - Reading Levels
  - State Testing Data
- Project Evaluation

Alternative Assessments:

Accommodations and Modifications

Special Education

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*
- *Curricular Modifications and Guidance for Students Educated in Special Class Settings*

Differentiation:

- *Preview content and concepts*
- *Behavior management plan*
- *Highlight text*
- *Small group setting*

High-Prep Differentiation:

- *Alternative formative and summative assessments*
- *Guided Reading*
- *Personal agendas*
- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
- *Exploration by interest*
- *Flexible groupings*

- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

English Language Learners

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- Unit 1: Curriculum for ELL
- ***Subgroup Accommodations and Modifications***
- Multi-language glossary
- Pupil edition in Spanish
- Vocabulary flash cards

Students at Risk for Failure

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Gifted and Talented

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- *Math in Focus or Big Ideas G & T Activities*

Students with 504 Plans

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Core Instructional and Supplemental Materials Professional Resources:

Core Professional Resources:

- *AliceKeeler.com*
- *Florham Park STEM Lab Curriculum*
- *Code.org Teacher Resources*

Supplemental Professional Resources:

- *NJECC Trainings/PD*
- *ISTE.org*

Core Instructional, Supplemental, Instructional, and Intervention Resources

Core Instructional Resources:

- Code.org
- Google Classroom
- Google forms
- Instructional Videos

Supplemental Resources:

- Clever (single sign on app)

- Listening instead of reading
- Brainpop

Intervention Resources:

- Noise Cancelling Headphones
- Manipulatives
- *Brainpop*
- Code.org Course Leveling

Interdisciplinary Connections

- CSTA K-12 Computer Science Standards
- AP - Algorithms & Programming
- 1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
- 1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
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Integration of Technology through NJSLS

- Chromebooks
- Mac Computers
- Google Classroom
- Projectors
- Headphones
-
-

Integration of 21st Century Themes

- Creativity and Innovation
- Critical Thinking and Problem Solving Communication and Collaboration Information Literacy
- Media Literacy
- Life and Career Skills
- Global and Environmental Awareness
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- Ask students to look for specific things when they view videos or read print material, and then ask questions about those items
- Use print materials to practice reading and comprehension skills

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- 21st Century Standards
- 9.2 Career Awareness, Exploration and Preparation
- Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements
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- 9.3 Career and Technical Education
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-

• Science, Technology, Engineering & Mathematics Career Cluster	

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4th Grade STEAM Lab Units

4th Grade Coding
Unit Sequence

Introduction to Coding		**Timeframe:** 1 day
Concepts	**Lesson Sequence**	**Formative Assessments**
• Understanding the routines and system of accessing Code.org • Using sequencing to create code. • Digital Citizenship	1. Logging into Code.org and setting up student accounts with the simple sign on feature. a. Students will then work on **Lesson 1: My Robotic Friends** to understand some basic concepts of computer science. b. Students will complete **Lesson 17: Digital Sharing** before starting any other Code.org lessons.	Teacher Observation
Differentiation		
• **Special Needs** – see resources provided through Code.org • **ESL** – Use the translation feature provided through Code.org (at the the bottom right corner of each web page) • **Gifted Learners** – Continue with additional lessons through Code.org Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)		

Beginning Lessons in Code.org		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Sequencing • Persistence • Debugging • Creating visual art with code • Introduction to loops	2. **Lesson 2: Coding with Comments** - In this lesson, you will learn how to write your very own programs! 3. **Lesson 3: Building a Foundation** - Build a structure that can hold a textbook. You might feel frustrated- remember to be persistent! 4. **Lesson 4: Debugging with Scrat** - Find problems in Ice Age puzzles and practice your debugging skills. 5. **Lesson 5: Creating Art with Code** - Create beautiful images by programming the Artist. 6. **Lesson 6: My Loopy Robotic Friends** - Turn your friends into robots and tell them what to do using loops!	Teacher observation Worksheets and any other offline materials
Differentiation		

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Intermediate Lessons in Code.org		**Timeframe:** 6 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Creating art with loops • Nested loops • Conditionals • Online privacy • Digital engineering Extension Activities • Digital song writing • Writing functions	7. **Lesson 7: Drawing Shapes with Loops** - In this lesson, loops make it easy to make even cooler images with Artist! 8. **Lesson 8: Nested Loops in Maze** - Loops inside loops inside loops. What does this mean? This lesson will teach you what happens when you place a loop inside another loop. 9. **Lesson 9: Nested Loops with Frozen** - Anna and Elsa have excellent ice-skating skills, but need your help to create patterns in the ice. Use nested loops to create something super COOL. 10. **Lesson 10: Conditionals with Cards** - It's time to play a game where you earn points only under certain conditions! 11. **Lesson 11: Conditionals with the Farmer** - You will get to tell the computer what to do under certain conditions in this fun and challenging series. 12. **Lesson 12: Private and Personal Information** - The internet is fun and exciting, but it's important to stay safe too. This lesson teaches you the difference between information that is safe to share and information that is private. 13. **Lesson 13: Build a Star Wars Game** - Feel the force as you build your own Star Wars game in this lesson. Extension Activities 14. **Lesson 14: Songwriting** - Even rock stars need programming skills. This lesson will teach you about functions using lyrics from songs. 15. **Lesson 15: Functions in Minecraft** - Can you figure out how to use functions for the most efficient code? 16. **Lesson 16: Functions with Harvester** - Functions will save you lots of work as you help the farmer with her	Teacher observation Offline worksheets and activities

	harvest!	

Differentiation

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Resources	Links

• Course E - COMPLETE COURSE • Course E - Overview from Code.org • Course E - Standards • Course E - Vocabulary • Course E - Other Resources	• Course E - COMPLETE COURSE • Course E - Overview from Code.org • Course E - Standards • Course E - Vocabulary • Course E - Other Resources

Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)

TABLE OF CONTENTS
4th Grade STEAM Lab Units

4th Grade STEAM Challenges
Unit Summary

In this unit, students build on the previously learned concepts from the 3rd grade challenges and focus on lessons that require higher levels of thinking and problem solving. While the units cover specific concepts (engineering, energy transfer, etc) the skills required to complete these lessons can be applied in all subject areas.

Standards

2020 NJSLS - Computer Science and Design Thinking
Core Ideas
Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.
Often, several design solutions exist, each better in some way than the others.
Engineering design requirements include desired features and limitations that need to be considered.
Societal needs and wants determine which new tools are developed to address real-world problems.
A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.
Technology spurs new businesses and careers.
Technology innovation and improvement may be influenced by a variety of factors.
Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.
The technology developed for the human designed world can have unintended consequences for the environment.
Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.
Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Performance Expectations
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.

NGSS Standards
PHYSICAL SCIENCE
Energy
Students who demonstrate understanding can:
4-PS3-1. Use evidence to construct an explanation relating the speed of an object to the energy of that object.
4-PS3-2. Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-4. Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.
Waves and their Applications in Technologies for Information Transfer
Students who demonstrate understanding can:
4-PS4-3. Generate and compare multiple solutions that use patterns to transfer information.

EARTH AND SPACE SCIENCE
Earth's Systems
Students who demonstrate understanding can:
4-ESS2-2. Analyze and interpret data from maps to describe patterns of Earth's features.
4-ESS3. Earth and Human Activity
Students who demonstrate understanding can:
4-ESS3-1. Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment.

ENGINEERING DESIGN
3-5-ETS1. Engineering Design
Students who demonstrate understanding can:
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Career Ready Practices:

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
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CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.

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CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

Essential Questions	Enduring Understanding
• How can you use the engineering practices to solve real world problems for others? • How can you use the basic principles of the design model? •	• In this unit, the idea of empathy is stress and requires students to not only solve a problem, but solve a problem that someone else is experiencing. • Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints. • Effective communication requires actively listening to others' perspectives.

Student Learning Objectives

NGSS Learning Objectives
ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
ETS1.B: Developing Possible Solutions Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.
The faster a given object is moving, the more energy it possesses. Energy can be moved from place to place by moving objects or through sound, light, or electric currents.

PS3.B: Conservation of Energy and Energy Transfer Energy is present whenever there are moving objects, sound, light, or heat. When objects collide, energy can be transferred from one object to another, thereby changing their motion. In such collisions, some energy is typically also transferred to the surrounding air; as a result, the air gets heated and sound is produced. Light also transfers energy from place to place. Energy can also be transferred from place to place by electric currents, which can then be used locally to produce motion, sound, heat, or light. The currents may have been produced to begin with by transforming the energy of motion into electrical energy.
PS3.C: Relationship Between Energy and Forces When objects collide, the contact forces transfer energy so as to change the object's' motions.
PS3.D: Energy in Chemical Processes and Everyday Life The expression "produce energy" typically refers to the conversion of stored energy into a desired form for practical use.
ETS1.A: Defining Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.

Evidence of Learning (Assessments)

Formative Assessments:

- Exit Tickets
- Daily Check-Ins
- Teacher observation
- Completion of written activities provided through Code.org
- Appropriate computer usage

Summative Assessments:

- Project Evaluations
- Presentations

Benchmark Assessments:

- Multiple measures of student growth (Data points collected)
  - LinkIt!
  - Reading Levels
  - State Testing Data
- Project Evaluation

Alternative Assessments:

- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

Accommodations and Modifications

Special Education

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*
- *Curricular Modifications and Guidance for Students Educated in Special Class Settings*

Differentiation:

- *Preview content and concepts*
- *Behavior management plan*
- *Highlight text*
- *Small group setting*

High-Prep Differentiation:

- *Alternative formative and summative assessments*
- *Guided Reading*
- *Personal agendas*
- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
- *Exploration by interest*
- *Flexible groupings*

English Language Learners

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- Unit 1: Curriculum for ELL
- ***Subgroup Accommodations and Modifications***
- Multi-language glossary
- Pupil edition in Spanish
- Vocabulary flash cards

Students at Risk for Failure

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- ***Subgroup Accommodations and Modifications***

Gifted and Talented

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- ***Subgroup Accommodations and Modifications***
- *Math in Focus or Big Ideas G & T Activities*

Students with 504 Plans

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*

Core Instructional and Supplemental Materials Professional Resources:	Core Instructional, Supplemental, Instructional, and Intervention Resources

Core Professional Resources:

- *AliceKeeler.com*
- *Florham Park STEM Lab Curriculum*
- *Code.org Teacher Resources*

Supplemental Professional Resources:

- *NJECC Trainings/PD*
- *ISTE.org*

Core Instructional Resources:

- Code.org
- Google Classroom
- Google forms
- Instructional Videos

Supplemental Resources:

- Clever (single sign on app)
- Listening instead of reading
- Brainpop

Intervention Resources:

- Noise Cancelling Headphones
- Manipulatives
- *Brainpop*
- Code.org Course Leveling

Interdisciplinary Connections

- CSTA K-12 Computer Science Standards
- AP - Algorithms & Programming
- 1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
- 1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
- 1B-AP-12 - Modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
- 1B-AP-13 - Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.k

Integration of Technology through NJSLS

- Chromebooks
- Mac Computers
- Google Classroom
- Projectors
- Headphones
-
-

Integration of 21st Century Themes

- Creativity and Innovation
- Critical Thinking and Problem Solving Communication and Collaboration Information Literacy
- Media Literacy
- Life and Career Skills
- Global and Environmental Awareness
- Problem Solving Skills
- **Initiative and Self Direction**
- Manage Goals and Time
- Work Independently
- Be Self-directed Learners

Media Literacy Integration

- Ask students to look for specific things when they view videos or read print material, and then ask questions about those items
- Use print materials to practice reading and comprehension skills

Career Education

- 21st Century Standards
- 9.2 Career Awareness, Exploration and Preparation
- Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements
-
- 9.3 Career and Technical Education
- Architecture & Construction Career Cluster
- Arts, A/V Technology, & Communications Career Cluster
- Science, Technology, Engineering & Mathematics Career Cluster

Global Perspectives

- Black History Month
- Week of Respect
- Red Ribbon Week
- Kindness Month
-

TABLE OF CONTENTS
4th Grade STEAM Lab Units

4th Grade STEAM Challenges
Unit Sequence

STEAM Challenges - Focus on Empathy		**Timeframe:** 1 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Empathy • Design Model • Engineering • Simple Machines • Energy Transfer	1. **Empathy Lesson** - How can we help make our partners have a productive day in school? This lesson introduces the students to the concept of effective communication, collaboration and the design thinking model. All of which is revolved around empathy. 2. **Paper Pals: Engineering** - using only folded paper and scissors, create at least two paper people linked together 3. **Cardboard Car: Building and Design** - Using toilet paper tube, create a car that can roll 1 foot. 4. **Pulley with a Purpose: Simple Machines** - Create a pulley that can lift a paper cup. 5. **Need a Ride?** - Figure out a way to move a toy car without touching it. 6. **Say Cheese! Exploring Light** - Take a picture of a friend so that your friend is in silhouette (in shadow in front of a light background 7. **Wind Wheel: Combining Design and Wind Power** - Create a pinwheel that spins in the wind. a. Empathy Focus - You're trying to design a self sustaining community in a windy location. How can you harness the wind to lessen your carbon footprint. 8. **Puddle Predicament** - Find a way to measure the water in a puddle. 9. **Paper 'Scraper: Engineering** - Create the tallest structure you can using only paper and tape. 10. **Clear it up: Water Filtration** - Create a filter to clean dirty water. a. Water filtration is a big necessity in many areas where water is scarce. Design a system that can help locals filter clean water.	Teacher observation Worksheets associated with each lesson STEM Performance Rubric

	11. **High Flying Marshmallows: Building a Catapult** - Make a marshmallow catapult. 12. **Outdoor Clock: Building a Sundial** - Design a sundial that can accurately show the time. 13. **Build a Better Bridge** - Using wooden craft sticks, design a bridge that can hold up a textbook. 14. **Look Out Below! -** Create a parachute that will allow an action figure to land safely on the ground. a. Empathy Focus - Remote locations often need food and medical supplies air dropped to them. But in order for the supplies to be usable, they must land safely.	

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students can create "bugs" in their creations and have other students solve the problems

Seasonal STEAM Challenges		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Basic engineering • Buoyancy • Practicing the design model	These seasonal lessons can be used during their appropriate season to supplement or in lieu of the above engineering lessons 1. <u>Autumn Challenges</u> a. **The Art of the Leaf** - Create a leaf structure at least 20 cm high. b. **Chucking Pumpkins challenge** - Design a catapult that will launch a candy pumpkin through the air. c. **Dancing Ghosts** - Use the balloon to make your "ghosts" dance. d. **Weave a Web** - Create a strong realistic spider web that will hold a plastic spider e. **Tepee Me!** - Create a tepee that one person can find inside of. f. **Help! Hide me!** - Create a hideout to help a turkey escape from the farmer on Thanksgiving Day. 2. <u>Winter Challenges</u> a. **Zippy's Zip Line** - Zippy the elf is stuck on a shelf. Create a zip line and trolley that will carry the elf	Teacher observation Worksheets associated with each lesson STEM Performance Rubric

	safely down from the shelf to the floor. 3. Spring/Summer Challenges a. **To Catch a Leprechaun** - Create a trap to catch a leprechaun. b. **My Scream Machine** - Build a roller coaster with ramps and turns for the table tennis ball to travel over. c. **Up a Creek with a Paddle** - Build a boat that can paddle across a container of water on its own. d. **Cargo Hold** - Design a paper airplane that will hold the most "cargo" while gliding more than eight feet in the air. e. **Terrific Turbines** - Use materials to make a working windmill (turbine)	

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
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Evidence of Learning (Assessments)	Accommodations and Modifications
Formative Assessments: • Exit Tickets • Daily Check-Ins • Teacher observation • Completion of written activities provided through Code.org • Appropriate computer usage **Summative Assessments:** • Project Evaluations • Presentations **Benchmark Assessments:**	**Special Education** • Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners) • *Subgroup Accommodations and Modifications* • *Curricular Modifications and Guidance for Students Educated in Special Class Settings* ***Differentiation:*** • *Preview content and concepts* • *Behavior management plan* • *Highlight text* • *Small group setting* ***High-Prep Differentiation:*** • *Alternative formative and summative assessments* • *Guided Reading* • *Personal agendas* • *Project-based learning*

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- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

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- *Tiered activities/assignments*
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Interdisciplinary Connections

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- Ask students to look for specific things when they view videos or read print material, and then ask questions about those items
- Use print materials to practice reading and comprehension skills

Career Education

- 21st Century Standards
- 9.2 Career Awareness, Exploration and Preparation

Global Perspectives

- Black History Month
- Week of Respect

• Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements • • 9.3 Career and Technical Education • Architecture & Construction Career Cluster • Arts, A/V Technology, & Communications Career Cluster • Science, Technology, Engineering & Mathematics Career Cluster	• Red Ribbon Week • Kindness Month •

Resources	Links
• Empathy Lesson Material • Main STEAM Seasonal Challenges ○ Supplemental Seasonal STEAM Challenges • 4th Grade STEAM Challenges	• STEM to STEAM Resources - Edutopia • STEAM Resources - Edutopia • STEAM Resources and Downloads • Resources for Maker Spaces

TABLE OF CONTENTS
4th Grade STEAM Lab Units

4th Grade Engineering - Makey Makey
Unit Summary

The Makey Makey allows you to take everyday objects and combine them with the internet. Using the alligator clips attached to any conductive material you can control the keyboard of your computer, such as the space bar, arrow keys and left click of the mouse. When you are ready the back of the Makey Makey allows you to key map even more keys! Makey Makey Educator Guide

Standards

2020 NJSLS - Computer Science and Design Thinking

Core Ideas

Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.
Often, several design solutions exist, each better in some way than the others.
Engineering design requirements include desired features and limitations that need to be considered.
Societal needs and wants determine which new tools are developed to address real-world problems.
A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.
Technology spurs new businesses and careers.
Technology innovation and improvement may be influenced by a variety of factors.
Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.
The technology developed for the human designed world can have unintended consequences for the environment.
Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.
Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Performance Expectations

8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.

Physical Science (Grades 3 and 4)
3-PS2-3: Ask questions to determine cause and effect relationships of electric or magnetic interactions between two objects not in contact with each other.
4-PS3-2: Make observations to provide evidence that energy can be transferred from place to place by sound, light, heat, and electric currents.
4-PS3-4: Apply scientific ideas to design, test, and refine a device that converts energy from one form to another.

CSTA K-12 Computer Science Standards
AP - Algorithms & Programming
1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
1B-AP-12 - Modify, remix or incorporate portions of an existing program into one's own work, to develop something new or add more advanced features.
1B-AP-13 - Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.

Career Ready Practices:
CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

Essential Questions	Enduring Understanding
• What is computational thinking? • How can we prepare students for a programmable world?	• Students know and use a deliberate design process for generating ideas, testing theories, creating innovative artifacts, or solving authentic problems. • Students select and use digital tools to plan and manage a design process

• What programming skills are needed for individuals to survive and thrive in the internet of things? • How can use computational thinking to solve challenges? • How can I use computational thinking to help others? • How can computational thinking aid my learning?	that considers design constraints and calculated risks. • Students develop, test, and refine prototypes as part of a cyclical design process.

Student Learning Objectives
• Students will develop an understanding of the role of troubleshooting, research and development, invention and innovation, and experimentation in problem solving. • Students should be able to identify everyday items that utilize electricity and programmable code. (Car key buttons) • Students should be familiar with finding games in Scratch • Students should be able to create a simple game with a controller and musical device in Scratch • Students should be able to connect wires to controller (conductive to electricity material) and to Makey Makey key Students should be able de-bug programs and trouble shoot • Students should be able to create, iterate and share computer programs to create a external controller for their game • Students should be self-directed learners who seek out new learning and opportunities to complete, improve and iterate projects (learner transformed) • Students should be able to create, iterate and share a external controller using play doe and a playable game for their arcade

TABLE OF CONTENTS
4th Grade STEAM Lab Units

4th Grade Engineering - Makey Makey
Unit Sequence

Intro to Engineering/Programming - Makey Makey		**Timeframe:** 2 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Learn the basic concepts of electricity • Determine materials that conduct electricity	• Makey Makey Intro Lessons • Basics of Electricity and identifying real world everyday items that • The Conduct - O - Meter 3000	Teacher Observations Student Led Assessments
Differentiation		
• **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list • **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list • **Gifted Learners** – Students can use scratch to begin programming. Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)		

Beginning Engineering		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Use the electricity and code to perform defined tasks	• Makey Makey test buttons • Drum Machine remix • Piano Remix	Teacher Observations Assessment Rubrics Student Led Assessments
Differentiation		
• **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list • **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list • **Gifted Learners** – Students add extra features to the defined tasks. Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)		

Intermediate Engineering	**Timeframe:** 5 days

Concepts	Lesson Sequence	Formative Assessments
• Utilize the principles of electricity and code to control and perform physical tasks with robotics.	• Open Project: Use what they have learned to accomplish a real world task.	Teacher Observations Assessment Rubrics Student Led Assessments

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students have complete autonomy with the complexity of the open task.

Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)

Evidence of Learning (Assessments)

Formative Assessments:

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- Teacher observation
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- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
- *Exploration by interest*
- *Flexible groupings*

English Language Learners

- Minimize sophistication of skill application

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
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Gifted and Talented

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Interdisciplinary Connections	**Integration of Technology through NJSLS**
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Integration of 21st Century Themes	**Media Literacy Integration**
• Creativity and Innovation • Critical Thinking and Problem Solving Communication and Collaboration Information Literacy • Media Literacy • Life and Career Skills • Global and Environmental Awareness • Problem Solving Skills • **Initiative and Self Direction** • Manage Goals and Time • Work Independently • Be Self-directed Learners	• Ask students to look for specific things when they view videos or read print material, and then ask questions about those items • Use print materials to practice reading and comprehension skills
Career Education	**Global Perspectives**
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Resources	Links
• FOSS Electricity Unit materials • Makey Makey Classroom Sets • Curriculum Overview	• Makey Makey Intro Lessons with QR codes • http://21stcscience.blogspot.com/2014/08/physical-computing-for-kids.html

Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)

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5th Grade STEAM Lab Units

5th Grade - Scope and Sequence

Trimester/Unit 1 - Coding

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Coding	Beginning Coding				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Intermediate Coding					

Trimester/Unit 2 - STEAM Challenges

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Challenges	Simple STEAM Challenges				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Advanced STEAM Challenges					

Trimester/Unit 3 - Engineering

	Day 1	Day 2	Day 3	Day 4	Day 5	Day 6
Concept	Intro to Engineering	Beginning Engineering (foundational concepts)				
	Day 7	**Day 8**	**Day 9**	**Day 10**	**Day 11**	**Day 12**
Concept	Intermediate Engineering (leveled concepts)					

5th Grade Coding **Unit Summary**
The last course in CS Fundamentals was tailored to the needs students in the fifth grade. In these lessons, students will create programs with different kinds of loops, events, functions, and conditionals. They will also investigate different problem-solving techniques and discuss societal impacts of computing and the internet. By the end of the curriculum, students create interactive stories and games that they can share with their friends and family.
Standards
Common Core English Language Arts Standards **L - Language** 3.L.6 - Acquire and use accurately grade-appropriate conversational, general academic, and domain-specific words and phrases, including those that signal spatial and temporal relationships (e.g., After dinner that night we went looking for them). 4.L.6 - Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal precise actions, emotions, or states of being (e.g., quizzed, whined, stammered) and that are basic to a particular topic (e.g 5.L.6 - Acquire and use accurately grade-appropriate general academic and domain-specific words and phrases, including those that signal contrast, addition, and other logical relationships (e.g., however, although, nevertheless, similarly, moreover, in addition). **SL - Speaking & Listening** 3.SL.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 3 topics and texts, building on others' ideas and expressing their own clearly. 3.SL.3 - Ask and answer questions about information from a speaker, offering appropriate elaboration and detail. 3.SL.6 - Speak in complete sentences when appropriate to task and situation in order to provide requested detail or clarification. 4.SL.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 4 topics and texts, building on others' ideas and expressing their own clearly. 4.SL.1.a - Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion. 4.SL.4 - Report on a topic or text, tell a story, or recount an experience in an organized manner, using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. 4.SL.6 - Differentiate between contexts that call for formal English (e.g., presenting ideas) and situations where informal discourse is appropriate (e.g., small-group discussion); use formal English when appropriate to task and situation. 5.SL.1 - Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on grade 5 topics and texts, building on others' ideas and expressing their own clearly. 5.SL.4 - Report on a topic or text or present an opinion, sequencing ideas logically and using appropriate facts and relevant, descriptive details to support main ideas or themes; speak clearly at an understandable pace. 5.SL.6 - Adapt speech to a variety of contexts and tasks, using formal English when appropriate to task and situation. **Common Core Math Standards** **G - Geometry** 5.G.2 - Represent real world and mathematical problems by graphing points in the first quadrant of the coordinate plane, and interpret coordinate values of points in the context of the situation. 5.G.3 - Understand that attributes belonging to a category of two- dimensional figures also belong to all subcategories of that category. For example, all rectangles have four right angles and squares are rectangles, so all squares have four right angles. 5.G.4 - Classify two-dimensional figures in a hierarchy based on properties. **MP - Math Practices**

MP.1 - Make sense of problems and persevere in solving them
MP.2 - Reason abstractly and quantitatively
MP.3 - Construct viable arguments and critique the reasoning of others
MP.4 - Model with mathematics
MP.5 - Use appropriate tools strategically
MP.6 - Attend to precision
MP.7 - Look for and make use of structure
MP.8 - Look for and express regularity in repeated reasoning

NBT - Number And Operations In Base Ten

4.NBT.4 - Fluently add and subtract multi-digit whole numbers using the standard algorithm.
5.NBT.5 - Fluently multiply multi-digit whole numbers using the standard algorithm.

OA - Operations And Algebraic Thinking

5.OA.2 - Write simple expressions that record calculations with numbers, and interpret numerical expressions without evaluating them. For example, express the calculation “add 8 and 7, then multiply by 2” as 2 × (8 + 7). Recognize that 3 × (18932 + 921) is three t

2020 NJSLS - Computer Science and Design Thinking

Core Ideas

Different algorithms can achieve the same result.
Some algorithms are more appropriate for a specific use than others.
Programming languages provide variables, which are used to store and modify data.
A variety of control structures are used to change the flow of program execution (e.g., sequences, events, loops, conditionals).
Programs can be broken down into smaller parts to facilitate their design, implementation, and review. Programs can also be created by incorporating smaller portions of programs that already exist.
Individuals develop programs using an iterative process involving design, implementation, testing, and review.

Performance Expectations

8.1.5.AP.1: Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
8.1.5.AP.2: Create programs that use clearly named variables to store and modify data.
8.1.5.AP.3: Create programs that include sequences, events, loops, and conditionals.
8.1.5.AP.4: Break down problems into smaller, manageable sub-problems to facilitate program development.
8.1.5.AP.5: Modify, remix, or incorporate pieces of existing programs into one’s own work to add additional features or create a new program.
8.1.5.AP.6: Develop programs using an iterative process, implement the program design, and test the program to ensure it works as intended.

CSTA K-12 Computer Science Standards

AP - Algorithms & Programming

1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
1B-AP-09 - Create programs that use variables to store and modify data.
1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
1B-AP-13 - Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences.

NI - Networks & the Internet

1B-NI-05 - Discuss real-world cybersecurity problems and how personal information can be protected.

Next Generation Science Standards

ETS - Engineering in the Sciences ETS1 - Engineering Design

3-5-ETS1-1 - Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2 - Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3 - Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Career Ready Practices:

Essential Questions	Enduring Understanding
	• Describe different file formats and any compression within them. • View the hex representation of a file on a computer. • Consider the problems of abstraction required in managing large numbers of bits. • Explain the need for compression, and demonstrate understanding using a purpose-built computer-based tool (called a "widget"). • Describe an invented device that sends periodic data via the Internet, design a data encoding method for this device, write out a sample data file generated by this device, and consider how to compress large files of this type.

Student Learning Objectives

- Students will learn the process for debugging programming.
- Students will learn the how persistence plays a vital role in program development.
- Students will learn foundations of coding (writing code).
- Students will work cooperatively on grade level appropriate coding tasks & challenges.

Evidence of Learning (Assessments)

Formative Assessments:

- Exit Tickets
- Daily Check-Ins
- Teacher observation
- Completion of written activities provided through Code.org
- Appropriate computer usage

Summative Assessments:

- Project Evaluations
- Presentations

Accommodations and Modifications

Special Education

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- *Subgroup Accommodations and Modifications*
- *Curricular Modifications and Guidance for Students Educated in Special Class Settings*

Differentiation:

- *Preview content and concepts*
- *Behavior management plan*
- *Highlight text*
- *Small group setting*

High-Prep Differentiation:

- *Alternative formative and summative assessments*

Benchmark Assessments:

- Multiple measures of student growth (Data points collected)
  - LinkIt!
  - Reading Levels
  - State Testing Data
- Project Evaluation

Alternative Assessments:

- Verbal Checks
- Modified Projects
- Minimize sophistication of skill application

- *Guided Reading*
- *Personal agendas*
- *Project-based learning*
- *Problem-based learning*
- *Stations/centers*
- *Tiered activities/assignments*
- *Varying organizers for instructions*

Low-Prep Differentiation:

- *Clubbing activities*
- *Exploration by interest*
- *Flexible groupings*

English Language Learners

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- Unit 1: Curriculum for ELL
- ***Subgroup Accommodations and Modifications***
- Multi-language glossary
- Pupil edition in Spanish
- Vocabulary flash cards

Students at Risk for Failure

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
- ***Subgroup Accommodations and Modifications***

Gifted and Talented

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
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- *Math in Focus or Big Ideas G & T Activities*

Students with 504 Plans

- Differentiation for All Students (Special Needs, ESL, Gifted Learners, & Mainstream Learners)
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Core Instructional and Supplemental Materials Professional Resources:	Core Instructional, Supplemental, Instructional, and Intervention Resources

Core Professional Resources:

- *AliceKeeler.com*
- *Florham Park STEM Lab Curriculum*
- *Code.org Teacher Resources*

Supplemental Professional Resources:

- *NJECC Trainings/PD*
- *ISTE.org*

Core Instructional Resources:

- Code.org
- Google Classroom
- Google forms
- Instructional Videos

Supplemental Resources:

- Clever (single sign on app)
- Listening instead of reading
- Brainpop

Intervention Resources:

- Noise Cancelling Headphones
- Manipulatives
- *Brainpop*
- Code.org Course Leveling

Interdisciplinary Connections

- CSTA K-12 Computer Science Standards
- AP - Algorithms & Programming
- 1B-AP-08 - Compare and refine multiple algorithms for the same task and determine which is the most appropriate.
- 1B-AP-11 - Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process.
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Integration of Technology through NJSLS

- Chromebooks
- Mac Computers
- Google Classroom
- Projectors
- Headphones
-
-

Integration of 21st Century Themes

- Creativity and Innovation
- Critical Thinking and Problem Solving Communication and Collaboration Information Literacy
- Media Literacy
- Life and Career Skills
- Global and Environmental Awareness
- Problem Solving Skills
- **Initiative and Self Direction**
- Manage Goals and Time
- Work Independently
- Be Self-directed Learners

Media Literacy Integration

- Ask students to look for specific things when they view videos or read print material, and then ask questions about those items
- Use print materials to practice reading and comprehension skills

Career Education

Global Perspectives

• 21st Century Standards • 9.2 Career Awareness, Exploration and Preparation • Students will explore the importance of being knowledgeable about one's interests and talents, and being well informed about postsecondary and career options, career planning, and career requirements • • 9.3 Career and Technical Education • Architecture & Construction Career Cluster • Arts, A/V Technology, & Communications Career Cluster • Science, Technology, Engineering & Mathematics Career Cluster	• Black History Month • Week of Respect • Red Ribbon Week • Kindness Month •

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5th Grade STEAM Lab Units

5th Grade Coding
Unit Sequence

Introduction to Coding		**Timeframe:** 1 day
Concepts	**Lesson Sequence**	**Formative Assessments**
• Understanding the routines and system of accessing Code.org • Using sequencing to create code. • Cyberbullying	1. Logging into Code.org and setting up student accounts with the simple sign on feature. a. Students will then work on **Lesson 1: My Robotic Friends** to understand some basic concepts of computer science. b. Students will then work on **Lesson 13: The Power of Words**, a lesson that addresses cyberbullying.	Teacher Observation
Differentiation		
• **Special Needs** – see resources provided through Code.org • **ESL** – Use the translation feature provided through Code.org (at the the bottom right corner of each web page) • **Gifted Learners** – Continue with additional lessons through Code.org • **Students at Risk for Failure -**		

Beginning Lessons in Code.org		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Beginning code writing • Debugging • Creating art with code • Discussing patterns and loops in the real world	2. **Lesson 2: Coding with Comments** - In this lesson, you will learn how to write your very own programs! 3. **Lesson 3: Building a Foundation** - Build a structure that can hold a textbook. You might feel frustrated- remember to be persistent! 4. **Lesson 4: Debugging with Scrat** - Find problems in Ice Age puzzles and practice your debugging skills. 5. **Lesson 5: Creating Art with Code** - Create beautiful images by programming the Artist. 6. **Lesson 6: My Loopy Robotic Friends** - Turn your friends into robots and tell them what to do using loops!	

Differentiation
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Intermediate Lessons in Code.org		**Timeframe:** 6 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Introduction to loops • Nested loops • Conditions • Functions Extension Activities: • Variables	7. **Lesson 7: Drawing Shapes with Loops** - In this lesson, loops make it easy to make even cooler images with Artist! 8. **Lesson 8: Nested Loops in Maze** - Loops inside loops inside loops. What does this mean? This lesson will teach you what happens when you place a loop inside another loop. 9. **Lesson 9: Nested Loops with Frozen** - Anna and Elsa have excellent ice-skating skills, but need your help to create patterns in the ice. Use nested loops to create something super COOL. 10. **Lesson 10: Conditionals with Cards** - It's time to play a game where you earn points only under certain conditions! 11. **Lesson 11: Conditionals with the Farmer** - You will get to tell the computer what to do under certain conditions in this fun and challenging series. 12. **Lesson 12: Functions with Minecraft** - Can you figure out how to use functions for the most efficient code? Extension Activities: 14. **Lesson 14: Envelope Variables** - Envelopes and variables have something in common: both can hold valuable things. Here you will learn what variables are and the awesome things they can do. 15. **Lesson 15: Variables with Artist** - Don't forget to bring creativity to class! In these puzzles you will be making fantastic drawings using variables. 16. **Lesson 16: Changing Variables with Bee** - This bee loves variables!	Teacher Observation Completion of written offline assignments
Differentiation		

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Integration of 21st Century Themes	**Media Literacy Integration**
• Creativity and Innovation • Critical Thinking and Problem Solving Communication and Collaboration Information Literacy • Media Literacy • Life and Career Skills • Global and Environmental Awareness • Problem Solving Skills • **Initiative and Self Direction** • Manage Goals and Time • Work Independently • Be Self-directed Learners	• Ask students to look for specific things when they view videos or read print material, and then ask questions about those items • Use print materials to practice reading and comprehension skills
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Resources	Links
• Course F - COMPLETE COURSE • Course F - Overview from Code.org • Course F - Standards • Course F - Vocabulary	

• Course F - Other Resources	

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5th Grade STEAM Lab Units

5th Grade STEAM Challenges **Unit Summary**
In this unit, students will utilize the skills they've learned in the previous two STEAM challenge units from the prior grade levels and work to solve various problems. The level of critical thinking is heightened as students solve various problems that revolve or engineering, design, mathematics and science. Empathy is focused throughout the unit, not just in individual lessons.

Standards

2020 NJSLS - Computer Science and Design Thinking

Core Ideas

Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.
Often, several design solutions exist, each better in some way than the others.
Engineering design requirements include desired features and limitations that need to be considered.
Societal needs and wants determine which new tools are developed to address real-world problems.
A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.
Technology spurs new businesses and careers.
Technology innovation and improvement may be influenced by a variety of factors.
Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.
The technology developed for the human designed world can have unintended consequences for the environment.
Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.
Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Performance Expectations

8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.
8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.

8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.

8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.

NGSS Standards
PHYSICAL SCIENCE
Motion and Stability: Forces and Interactions
Students who demonstrate understanding can:
5-PS2-1. Support an argument that the gravitational force exerted by Earth on objects is directed down.

ENGINEERING DESIGN
Engineering Design
Students who demonstrate understanding can:
3-5-ETS1-1. Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
3-5-ETS1-2. Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
3-5-ETS1-3. Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Career Ready Practices:

CRP1. Act as a responsible and contributing citizen and employee.
CRP2. Apply appropriate academic and technical skills.
CRP4. Communicate clearly and effectively and with reason.
CRP6. Demonstrate creativity and innovation.
CRP7. Employ valid and reliable research strategies.
CRP8. Utilize critical thinking to make sense of problems and persevere in solving them.
CRP9. Model integrity, ethical leadership and effective management.
CRP11. Use technology to enhance productivity.
CRP12. Work productively in teams while using cultural global competence

Essential Questions	Enduring Understanding
• How do we solve a variety of problems using specific resources available?	• Throughout each of the units, students will be required to use limited materials to solve their problems. In the workforce, they will be required to do the same thing: solve a problem with what you have at your disposal.
• How do we effectively communicate our ideas to a group	• Being able to solve a problem starts with the ability to articulate ideas and strategies for success. Students must understand the importance of the process for solving problems, not just the solution.

• How can I apply what I learn and use what's created to help others in need?	• While specific lessons have a focus on empathy components, students throughout the course of the unit will be exploring ways to take what they're learning/working on and see how it can impact those around them.

Student Learning Objectives

NGSS Learning Objectives
ETS1.A: Defining and Delimiting Engineering Problems Possible solutions to a problem are limited by available materials and resources (constraints). The success of a designed solution is determined by considering the desired features of a solution (criteria). Different proposals for solutions can be compared on the basis of how well each one meets the specified criteria for success or how well each takes the constraints into account.
ETS1.B: Developing Possible Solutions Research on a problem should be carried out before beginning to design a solution. Testing a solution involves investigating how well it performs under a range of likely conditions. At whatever stage, communicating with peers about proposed solutions is an important part of the design process, and shared ideas can lead to improved designs. Tests are often designed to identify failure points or difficulties, which suggest the elements of the design that need to be improved.
ETS1.C: Optimizing the Design Solution Different solutions need to be tested in order to determine which of them best solves the problem, given the criteria and the constraints.

Evidence of Learning (Assessments)

Formative Assessments:

- Exit Tickets
- Daily Check-Ins
- Teacher observation
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Summative Assessments:

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- Creativity and Innovation
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- Media Literacy
- Life and Career Skills
- Global and Environmental Awareness
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- **Initiative and Self Direction**
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- Work Independently
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- 9.3 Career and Technical Education

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5th Grade STEAM Lab Units

5th Grade STEAM Challenges
Unit Sequence

Basic STEAM Challenges - Focus on Empathy		**Timeframe:** 1 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Empathy • Design Thinking process • Friction • Simple Machines • Engineering	1. **Design to Shine (2 days)** - An activity where students will need to prototype a costume for a student with disabilities for a school play. a. Empathy Focus - Students must imagine the disability and the student that they'll be helping and must focus on their needs throughout this entire challenge. 2. **How Egg-citing!** - Create a nest into which you will drop a plastic egg from different heights, trying not to crack it. 3. **Team Marble: Friction** - Create a luge for marbles. Find a surface that lets the marbles go fastest. 4. In the Wind - Create a wind chime that can be heard from about 6 feet away. 5. **Keep Me in Suspense!** - Create a suspension bridge that can hold a canned soft drink. Use the box sides as the ends to which you connect the bridge. 6. **Going for a Ride: Simple Machines** - Create a miniature catapult that will send a bead or ball of paper into a nearby bowl. 7. **Come On In!** - Create a picket fence with a gate that can open and close. 8. **The Last Parachute** - Create a parachute that takes the longest amount of time to reach the ground. Be sure to use identical weights and the same amount of string and tape when testing different designs. 9. **Test the Wind** - Create a weather vane. 10. **Don't Lose Your Marbles!** - Create a marble run that includes at least one tunnel, one jump, and one domino-related activity. Time the runs as you use different marbles.	Teacher observation Worksheets associated with each lesson STEM Performance Rubric

	11. **Move It: The Human Body** - Create two models of human body joints- a ball and socket joint and a hinge joint. Move your knee and shoulder to compare them with the joints you create. a. Empathy Focus - You need to help someone design a new prosthetic limb for a patient, but you first must understand how they function. 12. **A Table for Two** - Use the fewest amount of craft sticks needed to create a mini-table that can support a canned soft drink.	

Differentiation

- **Special Needs** – Printed visuals, multisensory objects, teachers can provide a printed vocabulary list
- **ESL** – Alternate responses (verbal instead of written response), Online Translators for words or phrases, teachers can provide a printed vocabulary list
- **Gifted Learners** – Students can create "bugs" in their creations and have other students solve the problems

Seasonal STEAM Challenges		5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Basic engineering • Buoyancy • Practicing the design model	These seasonal lessons can be used during their appropriate season to supplement or in lieu of the above engineering lessons 1. <u>Autumn Challenges</u> a. **The Art of the Leaf** - Create a leaf structure at least 20 cm high. b. **Chucking Pumpkins challenge** - Design a catapult that will launch a candy pumpkin through the air. c. **Dancing Ghosts** - Use the balloon to make your "ghosts" dance. d. **Weave a Web** - Create a strong realistic spider web that will hold a plastic spider e. **Tepee Me!** - Create a tepee that one person can find inside of. f. **Help! Hide me!** - Create a hideout to help a turkey escape from the farmer on Thanksgiving Day. 2. <u>Winter Challenges</u> a. **Zippy's Zip Line** - Zippy the elf is stuck on a shelf. Create a zip line and trolley that will carry the elf safely down from the shelf to the floor. 3. <u>Spring/Summer Challenges</u>	Teacher observation Worksheets associated with each lesson STEM Performance Rubric

	a. **To Catch a Leprechaun** - Create a trap to catch a leprechaun. b. **My Scream Machine** - Build a roller coaster with ramps and turns for the table tennis ball to travel over. c. **Up a Creek with a Paddle** - Build a boat that can paddle across a container of water on its own. d. **Cargo Hold** - Design a paper airplane that will hold the most "cargo" while gliding more than eight feet in the air. e. **Terrific Turbines** - Use materials to make a working windmill (turbine)	

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- Project Evaluations
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- *Subgroup Accommodations and Modifications*
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- *Highlight text*
- *Small group setting*

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- *Personal agendas*
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- *Problem-based learning*
- *Stations/centers*
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Resources	Links
• 5th Grade Empathy Lesson • Main STEAM Seasonal Challenges ○ Supplemental Seasonal STEAM Challenges • 5th Grade STEAM Challenges	• STEM to STEAM Resources - Edutopia • STEAM Resources - Edutopia • STEAM Resources and Downloads • Resources for Maker Spaces

Differentiation for All Students (special education students, English Language Learners, students at risk of school failure and gifted students)

5th Grade Engineering - Vex Robotics
Unit Summary

Robotics is taught to all 5th grade students at Brooklake Elementary School. The course will introduce the field of robotics to students with an emphasis on engineering through problem solving, critical thinking, efficient design, and computer programming. Students will be placed in small groups of 2-3 and will work through a variety of units that include an introduction to the VEX IQ Robot, basic programming, electronic control, programming using variables and sensors, mechanics, engineering design, and the scientific process. The course will challenge students' problem solving, teamwork, and time management skills. Integral to the module will be the interrelationship of science, technology, engineering, and math in the modern digital world. Students will also have the opportunity to apply skills and knowledge from previous integrative STEM courses and begin to apply scientific and mathematical concepts learned throughout their educational careers to this real-world, hands on experience. The Vex Robotics unit is meant as a culmination of prior 5 years of programming and setting the stage for the 6-8 technology courses.

Standards

2020 NJSLS - Computer Science and Design Thinking
Core Ideas
Software and hardware determine a computing system's capability to store and process information. The design or selection of a computing system involves multiple considerations and potential trade-offs.
Engineering design is a systematic and creative process of communicating and collaborating to meet a design challenge.
Often, several design solutions exist, each better in some way than the others.
Engineering design requirements include desired features and limitations that need to be considered.
Societal needs and wants determine which new tools are developed to address real-world problems.
A new tool may have favorable or unfavorable results as well as both positive and negative effects on society.
Technology spurs new businesses and careers.
Technology innovation and improvement may be influenced by a variety of factors.
Engineers create and modify technologies to meet people's needs and wants; scientists ask questions about the natural world.
The technology developed for the human designed world can have unintended consequences for the environment.
Technology must be continually developed and made more efficient to reduce the need for non-renewable resources.
Technological choices and opportunities vary due to factors such as differences in economic resources, location, and cultural values.

Performance Expectations
8.1.8.CS.2: Design a system that combines hardware and software components to process data.
8.2.5.ED.1: Explain the functions of a system and its subsystems.
8.2.5.ED.2: Collaborate with peers to collect information, brainstorm to solve a problem, and evaluate all possible solutions to provide the best results with supporting sketches or models.
8.2.5.ED.3: Follow step by step directions to assemble a product or solve a problem, using appropriate tools to accomplish the task.
8.2.5.ED.4: Explain factors that influence the development and function of products and systems (e.g., resources, criteria, desired features, constraints).
8.2.5.ED.5: Describe how specifications and limitations impact the engineering design process.
8.2.5.ED.6: Evaluate and test alternative solutions to a problem using the constraints and trade- offs identified in the design process.
8.2.5.ITH.1: Explain how societal needs and wants influence the development and function of a product and a system.
8.2.5.ITH.2: Evaluate how well a new tool has met its intended purpose and identify any shortcomings it might have.
8.2.5.ITH.3: Analyze the effectiveness of a new product or system and identify the positive and/or negative consequences resulting from its use.

8.2.5.ITH.4: Describe a technology/tool that has made the way people live easier or has led to a new business or career.
8.2.5.NT.1: Troubleshoot a product that has stopped working and brainstorm ideas to correct the problem.
8.2.5.NT.2: Identify new technologies resulting from the demands, values, and interests of individuals, businesses, industries, and societies.
8.2.5.NT.3: Redesign an existing product for a different purpose in a collaborative team.
8.2.5.NT.4: Identify how improvement in the understanding of materials science impacts technologies.
8.2.5.ETW.1: Describe how resources such as material, energy, information, time, tools, people, and capital are used in products or systems.
8.2.5.ETW.2: Describe ways that various technologies are used to reduce improper use of resources.
8.2.5.ETW.3: Explain why human-designed systems, products, and environments need to be constantly monitored, maintained, and improved.
8.2.5.ETW.4: Explain the impact that resources, such as energy and materials used to develop technology, have on the environment.
8.2.5.ETW.5: Identify the impact of a specific technology on the environment and determine what can be done to increase positive effects and to reduce any negative effects, such as climate change.
8.2.5.EC.1: Analyze how technology has contributed to or reduced inequities in local and global communities and determine its short- and long-term effects.

Career Ready Practices:

Essential Questions	Enduring Understanding
● What is a robot? ● Where are robots used? ● What are the differences between actual robots and fictitious ones? ● What is an automated system ● How do people communicate, and control, computers?	● The use of robotics and computer systems in education, industry, and medical applications has revolutionized the changed the modern world ● There are many variations of programming languages, each with a different purpose ● A Robot is any man-made machine that can perform work or other actions normally performed by humans. ● Robotics is the type of specialized engineering that deals with the design, construction, operation, and application of robots.

Student Learning Objectives

● Define STEAM and the purpose of the course
● Define “robot”
● Identify places robots are utilized in our world
● Compare and contrast the pros and cons of the use of robots
● Distinguish between the content areas and professions within STEM

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5th Grade STEAM Lab Units

5th Grade Engineering
Unit Sequence

Intro to Engineering - Vex Robotics		**Timeframe:** 2 days
Concepts	**Lesson Sequence**	**Formative Assessments**
● Define STEM, identify the outline of the course ● Define "robot" ● Identify places robots are utilized in our world ● Compare and contrast the pros and cons of the use of robots	● Unit A: It's Your Future – Learn about STEM, engineering, and robotics ● Unit B: Let's Get Started – Learn about VEX IQ, the Controller, and the Robot Brain	● Students will be assessed based upon their participation and completion for group lead discussion activities
Differentiation		
● **Special Needs –** ● **ESL –** ● **Gifted Learners –**		

Beginning Engineering		**Timeframe:** 5 days
Concepts	**Lesson Sequence**	**Formative Assessments**
● Learn about the six types of simple machines, a seventh machine called a pendulum, and all of the scientific concepts and terms that go along with these machines. ● Simple machines are the basis for all mechanical systems, no matter how complex they may become. ● Use computer programming language methods to complete a task	Unit C: Your First Robot – Build and test Clawbot IQ Unit D: Simple Machines & Motion – Explore Levers, Pulleys, Pendulums, & more Unit E: Chain Reaction Challenge – Design fun devices using Simple Machines Unit F: Key Concepts – Explore and apply science and math that engineers use	● Teacher Observations ● Assessment Rubrics ● Student Led Assessments
Differentiation		
● **Special Needs –** ● **ESL –**		

- **Gifted Learners –**

Intermediate Engineering		**Timeframe:** 6 days
Concepts	**Lesson Sequence**	**Formative Assessments**
• Feel the excitement of robotics competition as you apply your skills and knowledge from previous units • Build a challenge-ready autonomous robot capable of completing Programming Skills matches in the VEX IQ Challenge game.	• Highrise Programming Challenge – Build a challenge-ready autonomous robot	Teacher Observations Assessment Rubrics Student Led Assessments
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Resources	Links
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