Detroit Public School Community District
K-8 Computer Science

Grades 3 – 5
2023 – 2024

LEGO® Education Brings STEAM Learning to Life

At LEGO® Education, our mission is to develop the builders of tomorrow. We believe STEAM Learning has become Prime for preparing even the youngest students for their future and for in-demand careers. LEGO® Education offers hands-on learning systems that make abstract concepts more tangible for young minds, enabling them to experience joy as they master STEAM subjects. This playful approach helps spark curiosity and lifelong learning.

Learning Promise

This curriculum is designed to ensure that ALL students will be able to engage in project-based, hands-on computer science learning experiences with lessons facilitated by teachers who are confident they are delivering an outstanding learning experience.

This program is designed to:

- Provide all Detroit Public Schools K-12 students with access to high-quality, project-based Computer Science learning experiences.
- Increase student engagement and ensure that all DPS K-12 students will see the relevance of and a meaningful connection to Computer Science in their own lives.
- Enable DPS K-12 Computer Science Teachers to facilitate hands-on, project-based learning experiences confidently and effectively.
- Enable administrators to effectively support teacher practice.

Organization of the Units

The units in this document and the lessons within each unit follow a learning progression that will enable you and your students to explore the power of learning through play in both unplugged and digital environments, but please don't feel that they must be followed lock step. Use your professional judgement to make adjustments to accommodate the learning styles and needs of your students.

Getting Started Lessons – Use these lessons the first time you use your LEGO® Education Learning Solutions. These lessons will help you and your students become familiar with the software and intelligent hardware in the LEGO SPIKE Prime learning kits.

SPIKE Essential Lessons – These lessons follow a learning progression that increases in difficulty and complexity of both the model and the programming as you move through the unit. Follow the links to review a complete lesson plan, access video overviews, and review objectives and standards alignment.

Please leverage these plans when creating learning experiences for your students as they will provide the foundation you need to meet the needs of all your students.

Extension Activities – These activities are included at the bottom of this document. Consider these activities for the first time you use your LEGO® Education solution. These extensions will inspire you and your students to move beyond our inspiration lessons to ideate and iterate your own models and programs.

Organization of the Lesson

The lessons linked in this document follow the 5Es Inquiry Based Framework. This model progresses through 5 different stages of the learning process – Engage, Explore, Explain, Elaborate, Evaluate. Here are some suggestions for using this framework when delivering instruction and the corresponding ISTE standards.

- **Beginning of Class - Activate Prior Knowledge (Engage)** - Launch class by having students share/discuss their learning experience from the previous class session.
    - Where did you leave off? What obstacles did you encounter? In what ways did you overcome those challenges? What is the learning goal for today?
        - *ISTE 1.1a*: Empowered Learner: Students articulate and set personal learning goals, develop strategies, leveraging technology to achieve them, and reflect on the learning process itself to improve learning outcomes.
- **During Class – Collaboration and Communication (Explain)** - Ask students to share with one another their models and their programming for these models. Have them display their code to the class and then talk through the code, explaining what they expected to or observed happen and even demonstrating this using their model if possible.
    - What did you expect to happen with this program? Did your model perform as expected? What did you have to modify or change to improve the program or model?
        - *ISTE 1.6c:* Creative Communicator: Students communicate complex ideas clearly and effectively by creating or using a variety of digital objects such as visualizations, models or simulations.
- **End of Class** - **Reflection (Evaluate) -** Have students end the class each day by sharing with their partner/group/teachers the learning progress, accomplishments, and next steps.
    - What did you accomplish today? How did you collaborate with your partner? What could you do to improve your collaboration in the next class?
        - *ISTE 1.7c:* Global Collaborator: Students contribute constructively to project teams, assuming various roles and responsibilities to work effectively toward a common goal.

The Power of Iteration

Build, Rebuild, Iterate. There is more than one way to build any model. Students may experience these builds more than once during your program. When repeating a build, reflect on what was learned in previous building experiences and how learnings can be used to improve and possibly address new goals or questions that arise.

Cross-Curricular Integration

While the Extension Activities provide some cross-curricular integration ideas, the sky is the limit on using these materials in all areas of your classroom. Here are a few ideas to seed your brilliance:

Foster Collaboration and Integration – Plan with colleagues in other departments to integrate these learning experiences into a comprehensive Project Unit that explores multiple content areas through hands-on learning and computer science.

Engage Curiosity – Use an experience at the beginning of a unit of study to inspire curiosity about the subject.

Explore Content Concepts – Use an experience to help students get hands on to explore the real-world application of science, technology, engineering, art, and mathematics.

Elaborate Understanding – Use an experience as a unit capstone or a culminating project, allowing students to transfer learning from multiple different content areas to demonstrate understanding and progress with skills and concepts.

Unit 1

Happy Traveler and Animals and Their Environments

Time	Lesson Title	Lesson Summary	MI MITECS Standards	MI Computer Science Standards
10 min	Getting Started Tutorials: The Motor	Explore and learn to program the intelligent hardware		
35-45 min	River Ferry *in Happy Traveler Unit* 	Help Daniel reach the Spike Tower by programming the river ferry to move!	MITECS.4.a,b,c; MITECS 5.c; MITECS 6.b,c; MITECS 7.b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
35-45 min	Taxi! Taxi! *in Happy Traveler Unit* 	Leo needs help getting to the art museum. Hail a taxi, and let's go!	MITECS.4.a,b,c; MITECS 5.c; MITECS 6.b,c; MITECS 7.b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
90 min	Rebuild the World with Racing 	Meet Aurora Straus, one of Hannah's STEAM Heroes and professional race car driver.		**MI Career Development Model: Career Awareness** Target 2: Contextualized Academics • Introduce Career Zones through Academic Subject Matter Target 3: Career Awareness • Engage Students in Career Awareness Activities

35-45 min	Hovering Helicopter *in Happy Traveler Unit* 	Help Maria get to Spike Mountain for a hike!	MITECS.4.a,b,c; MITECS 5.c; MITECS 6.b,c; MITECS 7.b,c,d	**1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2 **1B-AP-16** Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. Subconcept: Program Development; Practice 2.2 **1B-AP-17** Describe choices made during program development using code comments, presentations, and demonstrations. Subconcept: Program Development; Practice 7.2
45-90 min	Preparing for the Weather *in Animals and Their Environment Unit* 	Daniel learned that strong storms can damage pet houses. Help him design a pet house that keeps animals safe even in storms.	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**3-ESS3-1** Make a claim about the merit of a design solution that reduces the impacts of a weather-related hazard. **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.
10 min	Getting Started Tutorials: The Color Sensor	Explore and learn to program the intelligent hardware		
35-45 min	Swamp Boat *in Happy Traveler Unit* 	Sofie found crocodile eggs! Could there be crocodiles nearby?	MITECS.4.a,b,c; MITECS 5.c; MITECS 6.b,c; MITECS 7.b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others'

				perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-14** Observe intellectual property rights and give appropriate attribution when creating or remixing programs. Subconcept: Program Development; Practice 5.2, 7.3
45-90 min	Animal Behavior *in Animals and Their Environment Unit* 	Maria sees that African buffalo live in large herds. She wonders why they live in groups rather than on their own.	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**3-LS2-1** Construct an argument that some animals form groups that help members survive. **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.
10 min	Getting Started Tutorials: The Light Matrix	Explore and learn to program the intelligent hardware		
35-45 min	Cable Car *in Happy Traveler Unit* 	Leo is nervous about crossing Spike Lake in the cable car today. Can Maria help him conquer his fears?	MITECS 6.b,c; MITECS 7.b,c,d	**1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. Subconcept: Inference & Models; Practice 7.1 **1B-AP-09** Create programs that use variables to store and modify data. Subconcept: Variables; Practice 5.2 **1B-AP-10** Create programs that include sequences, events, loops, and conditionals. Subconcept: Control; Practice 5.2 **1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
45-90 min	Life Cycles *in Animals and Their Environment Unit* 	Leo learned that tadpoles are baby frogs. He wonders how other animals and plants change as they grow.	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**3-LS1-1** Develop models to describe that organisms have unique and diverse life cycles but all have in common birth, growth, reproduction, and death. **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.
90 min	Rebuild the World with Storytelling 	Meet Rachel Ryle, one of Hannah's STEAM Heroes, a storyteller and self-taught artist.		**MI Career Development Model: Career Awareness** Target 2: Contextualized Academics • Introduce Career Zones through Academic Subject Matter Target 3: Career Awareness • Engage Students in Career Awareness Activities
35-45 min	Big Bus *in Happy Traveler Unit* 	Today is going to be an awesome day! Help Daniel get to the sports stadium to see the big game.	MITECS. 5.b; MITECS 6.b,c; MITECS 7.a,b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **1B-AP-13**Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.

				Subconcept: Program Development; Practice 6.1, 6.2 **1B-AP-16** Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. Subconcept: Program Development; Practice 2.2 **1B-AP-17** Describe choices made during program development using code comments, presentations, and demonstrations. Subconcept: Program Development; Practice 7.2 **1B-IC-19** Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users. Subconcept: Culture; Practice 1.2 **1B-IC-20** Seek diverse perspectives for the purpose of improving computational artifacts Subconcept: Social Interactions; Practice 1.1
45-90 min	Get Around Town *in Happy Traveler Unit*	The team is headed to Spike Castle! How can you help them get there?	MITECS.4.a,b,c; MITECS 5.c; MITECS 6.b,c; MITECS 7.b,c,d	**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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-14** Observe intellectual property rights and give appropriate attribution when creating or remixing programs. Subconcept: Program Development; Practice 5.2, 7.3 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
45-90 min	Solving Problems When Environments Change *in Animals and Their Environment Unit*	Sofie learned that people will put a building in the wetland near her home. She's worried it will hurt the birds and other animals that live there.	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**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. **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.
90 min	Rebuild the World with Ocean Advocacy 	Meet Danni Washington, one of Hannah's STEAM Heroes and an ocean advocate and science communicator.		**MI Career Development Model: Career Awareness** Target 2: Contextualized Academics • Introduce Career Zones through Academic Subject Matter Target 3: Career Awareness • Engage Students in Career Awareness Activities
45-90 min	Animals in Their Habitats *in Animals and Their Environment Unit*	Sofie, Daniel, Maria, and Leo visit a desert. They wonder how the animals and plants survive where it is so dry.	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**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-LS4-2** 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. **3-5-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.

Unit 2

Crazy Carnival Games and *Science Connections*

Time	Lesson Title	Lesson Summary	MI MITECS Standards	MI Computer Science Standards
15 min	Getting Started Tutorials: The Motor and the Light Matrix	Explore and learn to program the intelligent hardware		
35-45 min	Mini Mini Golf *in Crazy Carnival Games* 	Test your skills with Sofie's mini-golf game!	MITECS.3.d; MITECS 4.a,b,c; MITECS 5.b; MITECS 6.b,c; MITECS 7.b,c,d	**1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. Subconcept: Inference & Models; Practice 7.1 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
45-90 min	How Eyes See *in Science Connections* 	Daniel finds something while exploring a dark cave. Can you help him see it better?	MITECS.3.d; MITECS 4.a,b,c; MITECS 5.b; MITECS 6.b,c; MITECS 7.b,c,d	**1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. Subconcept: Inference & Models; Practice 7.1 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
35-45 min	Bowling Fun *in Crazy Carnival Games* 	Have fun with Daniel's bowling game! Can you get a strike?	MITECS.3.d; MITECS 6.b,c; MITECS 7.b,c,d	**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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1

				1B-AP-14 Observe intellectual property rights and give appropriate attribution when creating or remixing programs. Subconcept: Program Development; Practice 5.2, 7.3 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
35-45 min	High Stick Hockey – Math Extension *in Crazy Carnival Games* 	Have your students record ten scoring attempts and compare their results. Tell them to write the number of goals as one fraction, and the number of saves as another fraction.	MITECS.3.d; MITECS 4.a,b,c; MITECS 5.b; MITECS 6.b,c; MITECS 7.b,c,d	**1B-AP-09** Create programs that use variables to store and modify data. Subconcept: Variables; Practice 5.2 **1B-AP-10** Create programs that include sequences, events, loops, and conditionals. Subconcept: Control; Practice 5.2 **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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
45-90 min	Animal Structures *in Science Connections* 	Maria sees an elephant eating. She wonders about ways elephants can use their trunks. Help her learn.	MITECS.3.d; MITECS 4.a,b,c,d; MITECS 5.a	**4-LS1-1** Construct an argument that plants and animals have internal and external structures that function to support survival, growth, behavior, and reproduction. **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.

45-90 min	Information Transfer *in Science Connections*	Maria, Leo, Daniel, and Sofie use a special code to share ideas. Make your own code to communicate with your friends!	MITECS.3.d; MITECS 4.a,b,c,d; MITECS.5.a	**4-PS4-3** Generate and compare multiple solutions that use patterns to transfer information. **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.
45-90 min	Prepare for Natural Hazards *in Science Connections* 	Leo knows some places have earthquakes. To keep people safe, help him design buildings that won't be destroyed by earthquakes.	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**4-ESS3-2** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on humans. **4-ESS3-2MI** Generate and compare multiple solutions to reduce the impacts of natural Earth processes on Michigan's people and places. **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.
10 min	Getting Started Tutorials: Built-in Gyro Sensor	Explore and learn to program the intelligent hardware		
35-45 min	A-MAZE-ing – Math Extension *in Crazy Carnival Games* 	Using the information gathered from the Bar Graph Block, ask your students to write a paragraph comparing their results to another group's results. Tell them to use more than, less than, and equal to statements.	MITECS.3.d; MITECS 4.a,b,c; MITECS 5.b; MITECS 6.b,c; MITECS 7.b,c,d	**1B-DA-07** Use data to highlight or propose cause-and-effect relationships, predict outcomes, or communicate an idea. Subconcept: Inference & Models; Practice 7.1 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended.

				Subconcept: Program Development; Practice 6.1, 6.2
10 min	Getting Started Tutorials: The Color Sensor	Explore and learn to program the intelligent hardware		
35-45 min	Avoid the Edge – Math Extension *in Crazy Carnival Games* 	As your students play the Avoid the Edge game, have them measure and record the length of each trial with the chosen bat(s). Ask them to record their measurements in a two-column table.	MITECS.3.d; MITECS 6.b,c; MITECS 7.b,c,d	**1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate. Subconcept: Algorithms; Practice 6.3, 3.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
35-45 min	Junior Pinball *in Crazy Carnival Games* 	Try Sofie's junior pinball game and upgrade it to make it more unpredictable!	MITECS.3.d; MITECS 4.a,b,c; MITECS 6.b,c; MITECS 7.b,c,d	**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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-14** Observe intellectual property rights and give appropriate attribution when creating or remixing programs. Subconcept: Program Development; Practice 5.2, 7.3 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
45-90 min	Energy Resources *in Science Connections* 	Sofie finds a wind turbine. She wonders how it gets energy. What are other ways to get energy from nature to use again and again?	MITECS.3.d; MITECS 4.a,c,d; MITECS 5.a	**4-ESS3-1** Obtain and combine information to describe that energy and fuels are derived from natural resources and their uses affect the environment. **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.
45-90 min	Creative Carnival Games *in Crazy Carnival Games*	It's time to create a new game for the school carnival!	MITECS.4.a,b,c; MITECS 6.b,c; MITECS 7.b,c,d	**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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-14** Observe intellectual property rights and give appropriate attribution when creating or remixing programs. Subconcept: Program Development; Practice 5.2, 7.3 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2

Unit 3

Quirky Creations and *Science We Cannot See*

Time	Lesson Title	Lesson Summary	MI MITECS Standards	MI Computer Science Standards
10 min	Getting Started Tutorials	Explore and learn to program the intelligent hardware		
35-45 min	Good Morning Machine *in Quirky Creations* 	Help Leo say "good morning" to his friends!	MITECS.4.a,b,c; MITECS.6.b,c; MITECS.7.b,c,d	**1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2 **1B-AP-16** Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. Subconcept: Program Development; Practice 2.2 **1B-AP-17** Describe choices made during program development using code comments, presentations, and demonstrations. Subconcept: Program Development; Practice 7.2
45-90 min	Matter *in Science We Cannot See* 	Maria notices that when she opens the window, her papers blow around the room. How does that happen?	MITECS.3.d; MITECS.4.a,c, d; MITECS.5.a	**5-PS1-1** Develop a model to describe that matter is made of particles too small to be seen. **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.
45-90 min	Gravity *in Science We Cannot See*	Daniel loves the way birds stay balanced, even when a branch	MITECS.3.d; MITECS.4.a,c, d; MITECS.5.a	**5-PS2-1** Support an argument that the gravitational force exerted by Earth on objects is directed down.

		moves. Help him make a model bird that can stay balanced too.		**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.
35-45 Min	Big Little Helper *in Quirky Creations* 	Daniel's locker is overflowing. How can he get all his things home?	MITECS.4.a,c; MITECS.6.b,c; MITECS.7.b,c,d	**1B-AP-08** Compare and refine multiple algorithms for the same task and determine which is the most appropriate. Subconcept: Algorithms; Practice 6.3, 3.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
35-45 Min	High-Tech Playground *in Quirky Creations* 	What do you think a high-tech playground would look like? Help Maria design something new for her friends!	MITECS.4.a,b,c; MITECS.6.b,c; MITECS.7.b,c,d	**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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-14** Observe intellectual property rights and give appropriate attribution when creating or remixing programs. Subconcept: Program Development; Practice 5.2, 7.3 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2

45-90 min	Daytime and Nighttime *in Science We Cannot See* 	Sofie wants to light the path near her campsite for safety. Help her set an overhead lamp to be on at night when it's dark.	MITECS.3.d; MITECS.4.a,c, d; MITECS.5.a	**1B-DA-06** Organize and present collected data visually to highlight relationships and support a claim. Subconcept: Collection, Visualization & Transformation; Practice 7.1 **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.
35-45 Min	Trash Monster Machine *in Quirky Creations* 	Help Sofie create a new way for her friends to throw out their trash.	MITECS.4.a,b,c; MITECS.6.b,c; MITECS.7.a,b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2 **1B-AP-16** Take on varying roles, with teacher guidance, when collaborating with peers during the design, implementation, and review stages of program development. Subconcept: Program Development; Practice 2.2 **1B-AP-17** Describe choices made during program development using code comments, presentations, and demonstrations. Subconcept: Program Development; Practice 7.2 **1B-IC-19** Brainstorm ways to improve the accessibility and usability of technology products for the diverse needs and wants of users. Subconcept: Culture; Practice 1.2

				1B-IC-20 Seek diverse perspectives for the purpose of improving computational artifacts Subconcept: Social Interactions; Practice 1.1
45-90 min	Protect the Environment *in Science We Cannot See* 	Leo takes good care of Spike Town. How can you care for the environment in your community?	MITECS.3.a,c,d; MITECS.4.a,c,d; MITECS.5.a	**5-ESS3-1** Obtain and combine information about ways individual communities use science ideas to protect the Earth's resources and environment. **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.
45-90 min	Energy Flow *in Science We Cannot See*	Daniel, Maria, Leo, and Sofie know that plants use sunlight to grow bigger. Do animals also need it to grow bigger? Build a model to show the team the relationship between sunlight and animal growth.	MITECS.3.d; MITECS.4.a,c,d; MITECS.5.a	**5-PS3-1** Use models to describe that energy in animals' food (used for body repair, growth, motion, and to maintain body warmth) was once energy from the sun. **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.
35-45 Min	Winning Goal *in Quirky Creations* 	How can Maria's soccer game be more like a computer game?	MITECS.4.a,b,c; MITECS.5.c; MITECS.6.b,c; MITECS.7.b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1

				1B-AP-15 Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
35-45 Min	Literary Randomizer *in Quirky Creations* 	How can Daniel's literary randomizer make picking a book more exciting?	MITECS.4.a,b,c; MITECS.6.b,c; MITECS.7.b,c,d	**1B-AP-09** Create programs that use variables to store and modify data. Subconcept: Variables; Practice 5.2 **1B-AP-10** Create programs that include sequences, events, loops, and conditionals. Subconcept: Control; Practice 5.2 **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. Subconcept: Modularity; Practice 5.3 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2
45-90 min	Your School Creation *in Quirky Creations*	It's time to create your very own invention for the team's classroom!	MITECS.4.a,b,c; MITECS.5.c; MITECS.6.b,c; MITECS.7.b,c,d	**1B-AP-11** Decompose (break down) problems into smaller, manageable subproblems to facilitate the program development process. Subconcept: Modularity; Practice 3.2 **1B-AP-13** Use an iterative process to plan the development of a program by including others' perspectives and considering user preferences. Subconcept: Program Development; Practice 1.1, 5.1 **1B-AP-15** Test and debug (identify and fix errors) a program or algorithm to ensure it runs as intended. Subconcept: Program Development; Practice 6.1, 6.2

Extension Activities

Build to Launch
Modules 1-3 (10-12 days)

Taking STEAM Learning to new heights! LEGO® Education partnered with NASA and the Artemis I team to bring students and teachers an out-of-this-world STEAM learning series. Build to Launch is an exploration of the technology, STEAM concepts and careers behind the Artemis I mission to the Moon. Join the LEGO® Space Team and their Artemis I team counterparts for an interactive digital learning adventure. Each episode students will find themselves in the shoes of NASA engineers, scientists, and of course astronauts. Through open ended lessons students will get hands-on and solve similar problems the Artemis I team faces as they build towards launch.

	Activity	Time	Objectives	Suggested Builds *Lessons in bold are covered in Units 1-3*
Module 1 Getting to Space Teacher Guide Student Lessons	Mini-Mission: Moving Objects	15 min	Ignite a discussion with students about moving objects	
	Mission: Operation Autopilot Career Connection: Maria, Flight Director	45-90 min	Design and build a prototype of an autonomous vehicle	SPIKE Essential: **Taxi! Taxi!**, Arctic Ride, **Big Little Helper**
	Mission: STEAM Work is Teamwork Career Connection: Daniel, Program Manager	45-90 min	Plan and design a Space Launch System rocket to be built in sections	SPIKE Essential: **Bowling Fun**
Module 2 Testing and Transport Teacher Guide Student Lessons	Mini-Mission: Testing	15 min	Ignite a discussion with students about testing	
	Mission: Building a Bullseye Career Connection: Avery, Engineer	45-90 min	Design and build a device to reach a target	
	Mission: The Path to the Pad Career Connection: Zach, Ground Systems Technician	45-90 min	Design and build a transport vehicle	SPIKE Essential: **Taxi! Taxi!, Swamp Boat, Big Bus, Big Little Helper**
Module 3 Working in Space Teacher Guide Student Lessons	Mini-Mission: Working in Space	15 min	Ignite a discussion with students on what they think it is like to work in space	
	Mission: Staying Safe in Space Career Connection: Leo, Safety Officer	45-90 min	Design and build an alert system	SPIKE Essential: Animal Alarm

	Mission: The Right Tool for the Job Career Connection: Sofie, Scientist	45-90 min	Design and build a tool that can be used in space	SPIKE Essential: Redesigning to Make New Objects

Extension Activities (as time allows)

The LEGO Group Build the Change Curriculum Series

Build the Change is all about giving children a voice and allowing them to express their hopes and ideas for a better future. Children use their creativity to solve real-world challenges with LEGO® bricks and other creative materials – and it is all achieved via Learning through Play.

The LEGO Group has created FREE Learning through Play materials designed to engage children in sustainability and the environment. These materials are designed for use in classrooms, with lesson plans, presentations, and printables. To get started, click on the link to Build the Change below and download the resource packs for educators for the course you wish to explore.

	Activity	Time	Objectives
Build the Change	Human Impact: Saving Today's Dinosaurs	1 day to 1+ month	A FREE learning through play resource introducing young learners to the concept of our human impact on nature, through the lens of "today's dinosaurs," birds.
	A Future Without Waste	1 day to 1+ month	A FREE learning through play Resource introducing young learners to a FUTURE WITHOUT WASTE – where people and planet can thrive together.
	Biodiversity and Climate Change	1 day to 1+ month	A FREE learning through play resource introducing young learners to the effects of climate change on animals and their habitats, and enlisting them to imagine solutions to these challenges.

Tufts University Robotics Playground

Tufts University has created a series of placemats to inspire engineering design and programming using the SPIKE Essential solution. Each placemat consists of 2 slides which present a challenge and suggestions on how to build and program a solution. The placemat also gives ideas on how students can iterate and elaborate on their solution. Use as time allows.

	Activity	Time	Objectives
SPIKE Essential Placemats	Clean Up	45 min	Create a device to clear the floor of small LEGO pieces – broom, plow, vacuum…
	Snow Plow	45 min	Create a device to clean up snow – scooper, sweeper, vacuum…
	Dance!	45 min	Create a robot that dances.

	Ball Launcher	45 min	Design a machine to throw a small plastic ball as accurately as possible.
	Build an Instrument	45 min	Create an instrument using SPIKE Essential.
	Silly Walks	45 min	Build a robot that moves forward – without using wheels!