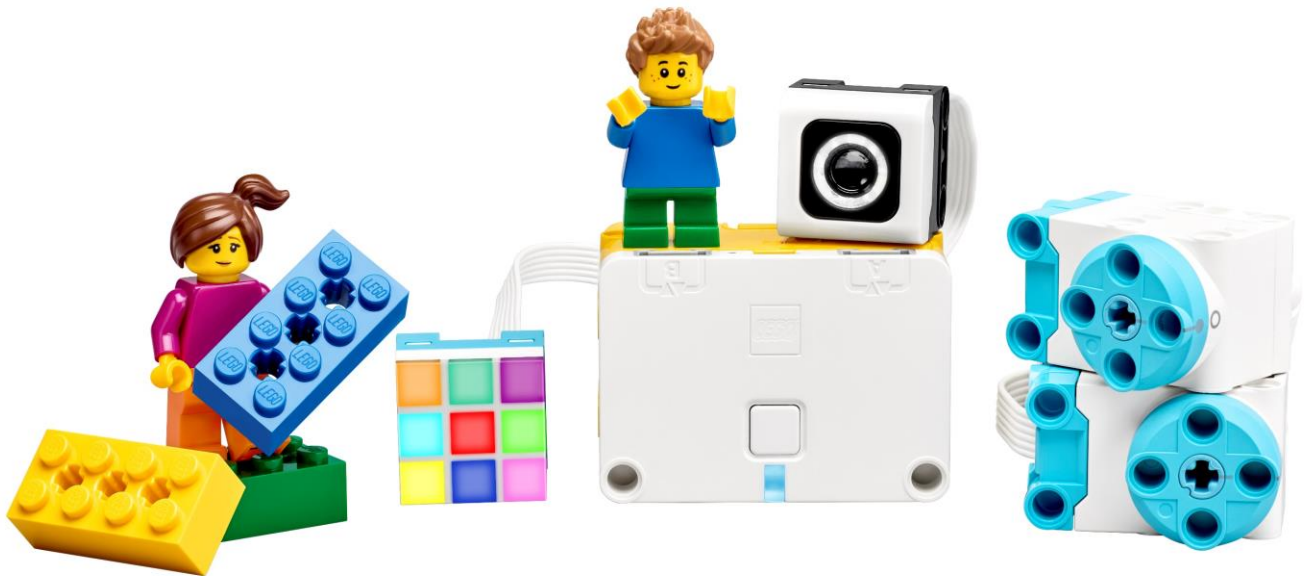**LEGO education**

Detroit Public Schools
K-8 Computer Science Program

Grades 1-2
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.

Unplugged Lessons – These lessons use the BricQ Motion Prime solution, LEGO Education's non-digital solution. You will not need devices to complete these lessons and the build instructions can be found in the booklets that come inside the kit. If students do have access to their own device, the build instructions can also be found online under the Student Online Resources.

SPIKE Prime 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.

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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.
    - o   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.
    - o   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.
    - o   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.
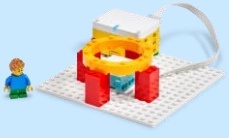
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Unit 1
Great Adventures and Science: See It! Hear It! Build It!

Time	Lesson Title	Lesson Summary	MI MITECS Standards	MI Computer Science and Science Standards
35-45 Min	**Getting Started Tutorials:** SPIKE™ App	Explore and learn to program the intelligent hardware		
35-45 Min	[Boat Trip](#) *in Great Adventures Unit*	Maria and Sofie are going on a boat trip! How will they get their boat into the water?	MITECS.5.b MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-12:** Develop plans that describe a program's sequence of events, goals, and expected outcomes. Subconcept: Program Development; Practice 5.1, 7.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2 **1A-AP-15:** Using correct terminology, describe steps taken and choices made during the iterative process of program development. Subconcept: Program Development; Practice 7.2
35-45 Min	[Arctic Ride](#) *in Great Adventures Unit*	Leo is going on an Arctic adventure to see polar bears. How can he use his snowmobile to get there?	MITECS.5.a MITECS.5.c MITECS.5.d MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-11:** Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions. Subconcept: Modularity; Practice 3.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2

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Time	Lesson	Description	Standards	Standards
35-45 Min	Cave Car *in Great Adventures Unit*	Daniel wonders what lives inside a dark cave. What do you think is hiding in the dark?	MITECS.5.b MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
45-90 min	Illumination *in Science: See It! Hear It! Build It! Unit*	Sofie thinks something is under her bed. Can you help her see it?	MITECS.4.a MITECS.4.c	**1-PS4-2:** Make observations to construct an evidence-based account that objects can be seen only when illuminated. **1-PS4-3:** Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**
35-45 Min	Animal Alarm *in Great Adventures Unit*	Leo doesn't want to miss any of the animals walking by his campsite while he's asleep. How can his animal alarm help him?	MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-10:** Develop programs with sequences and simple loops, to express ideas or address a problem. Subconcept: Control; Practice 5.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
45-90 min	Musical Vibration *in Science: See It! Hear It! Build It! Unit*	Maria plays piano. She wants to make more	MITECS.4.a MITECS.4.c	**1-PS4-1:** Plan and conduct investigations to provide evidence that vibrating

		music. Can you build her something to play on?		materials can make sound and that sound can make materials vibrate. **1-PS4-4:** Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**
35-45 Min	[Underwater Quest](#) *in Great Adventures Unit* 	Maria is curious to explore life below the sea. How can she get the submarine in and out of the water?	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.5.b MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-10:** Develop programs with sequences and simple loops, to express ideas or address a problem. Subconcept: Control; Practice 5.2 **1A-AP-12:** Develop plans that describe a program's sequence of events, goals, and expected outcomes. Subconcept: Program Development; Practice 5.1, 7.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2 **1A-AP-15:** Using correct terminology, describe steps taken and choices made during the iterative process of program development. Subconcept: Program Development; Practice 7.2
35-45 Min	[Treehouse Camp](#) *in Great Adventures Unit* 	Sofie is looking forward to seeing the moon from her treehouse! How can she open the treehouse roof for a great view of the sky?	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.5.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c	**1A-AP-10:** Develop programs with sequences and simple loops, to express ideas or address a problem. Subconcept: Control; Practice 5.2 **1A-AP-11:** Decompose (break down) the steps needed to solve a problem into a

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			MITECS.7.d	precise sequence of instructions. Subconcept: Modularity; Practice 3.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
45-90 Min	[The Great Desert Adventure](#) *in Great Adventures Unit*	It's time for another great adventure. Help the team reach the pyramids!	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.5.b MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-12:** Develop plans that describe a programís sequence of events, goals, and expected outcomes. Subconcept: Program Development; Practice 5.1, 7.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2 **1A-AP-15:** Using correct terminology, describe steps taken and choices made during the iterative process of program development. Subconcept: Program Development; Practice 7.2
45-90 Min	[Transparency](#) *in Science: See It! Hear It! Build It! Unit*	Leo wants to make some shade on a sunny day. What materials should he use? Help him find out.	MITECS.4.a MITECS.4.c	**1-PS4-3:** Plan and conduct an investigation to determine the effect of placing objects made with different materials in the path of a beam of light. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**

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45-90 min	Communicate with Light and Sound *in Science: See It! Hear It! Build It! Unit*	Daniel lives across the street from Sofie. What can he build to send messages to her?	MITECS.3.d MITECS.4.c MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**1-PS4-4:** Use tools and materials to design and build a device that uses light or sound to solve the problem of communicating over a distance. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**
45-90 min	Using Ideas from Nature *in Science: See It! Hear It! Build It! Unit*	Daniel, Sofie, Leo, and Maria learned that some lightbulbs were made using ideas from how fireflies make light. Help them learn about other ideas we get from nature.	MITECS.3.d MITECS.4.c MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**1-LS1-1:** materials to design a solution to a human problem by mimicking how plants and/or animals use their external parts to help them survive, grow, and meet their needs. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**

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Unit 2
Amazing Amusement Park and *Science in Nature in our Daily Life*

Time	Lesson Title	Lesson Summary	MI MITECS Standards	MI Computer Science and Science Standards
35-45 Min	**Getting Started Tutorials:** SPIKE™ App	Explore and learn to program the intelligent hardware		
35-45 Min	The Fast Lane *in Amazing Amusement Park Unit*	Help Leo enter the amusement park with the Fast Lane!	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-10:** Develop programs with sequences and simple loops, to express ideas or address a problem. Subconcept: Control; Practice 5.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
35-45 Min	Classic Carousel *in Amazing Amusement Park Unit*	Create a new spinning ride for Sofie to try!	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
45-90 Min	Redesigning to Make New Objects *in Science in Nature and Our Daily Life Unit*	Leo wants to make something for his dog to eat. Help him build the tools he needs in the kitchen.	MITECS.3.d MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**2-PS1-1:** Plan and conduct an investigation to describe and classify different kinds of materials by their observable properties. **2-PS1-2:** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. **2-PS1-3:** Make observations to construct an evidence-based account of how an object made of a small set of pieces can be disassembled and made into a new object. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**

Time	Lesson	Description	MITECS	Standards
90 min	[Rebuild the World with Food Video Production](#) Rie McClenny Food Video Producer	Meet Rie McClenny, one of Hannah's STEAM Heroes and food video producer.		**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	[The Perfect Swing](#) *in Amazing Amusement Park Unit*	Maria doesn't want a ride that goes too fast. Do you think the swing will be a perfect fit?	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-10:** Develop programs with sequences and simple loops, to express ideas or address a problem. Subconcept: Control; Practice 5.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
35-45 min	[Snack Stand](#) *in Amazing Amusement Park Unit*	Oh, no! Daniel dropped his snack. Help him get a new one from the snack stand.	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.5.a MITECS.5.c MITECS.5.d MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-11:** Decompose (break down) the steps needed to solve a problem into a precise sequence of instructions. Subconcept: Modularity; Practice 3.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
45-90 min	[Classify and Choose Materials](#) *in Science in Nature and Our Daily Life Unit*	Daniel got some chickens. Help him build a chicken coop where they'll be safe and comfortable.	MITECS.3.d MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**1A-DA-06:** Collect and present the same data in various visual formats. Subconcept: Collection, Visualization & Transformation; Practice 7.1, 4.4 **1A-AP-09:** Model the way programs store and manipulate data by using numbers or other symbols to represent information. Subconcept: Variables; Practice 4.4

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Time	Lesson	Description	Standards	Objectives
35-45 min	Twirling Teacups *in Amazing Amusement Park Unit*	Round and round! Sofie and Leo are excited to try this new spinning ride today.	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-08:** Model daily processes by creating and following algorithms (sets of step-by-step instructions) to complete tasks. Subconcept: Algorithms; Practice 4.4 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
35-45 min	The Spinning Ferris Wheel *in Amazing Amusement Park Unit*	The team wants to ride the Ferris Wheel together. How can you help them?	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-10:** Develop programs with sequences and simple loops, to express ideas or address a problem. Subconcept: Control; Practice 5.2 **1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
35-45 min	Remix the Ride *in Amazing Amusement Park Unit*	It's time to help get an unfinished ride ready for the amusement park!	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2
45-90 min	The Most Amazing Amusement Park *in Amazing Amusement Park Unit*	It's time to create your very own amusement park ride!	MITECS.4.a MITECS.4.b MITECS.4.c MITECS.6.b MITECS.6.c MITECS.7.b MITECS.7.c MITECS.7.d	**1A-AP-14:** Debug (identify and fix) errors in an algorithm or program that includes sequences and simple loops. Subconcept: Program Development; Practice 6.2

45-90 min	**Habitats** *in Science in Nature and Our Daily Life Unit*	Sofie learned about the places giraffes live. She wonders about the other animals that live there. What about other places? Can you help her learn?	MITECS.3.d MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**2-PS1-2:** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. **2-LS4-1:** Make observations of plants and animals to compare the diversity of life in different habitats. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**
45-90 min	**Pollination**	Maria saw bees on the flowers of her apple tree. She wonders what they're doing. Can you help her learn?	MITECS.3.d MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**2-PS1-2:** Analyze data obtained from testing different materials to determine which materials have the properties that are best suited for an intended purpose. **2-LS2-2:** Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**
45-90 min	**Rebuild the World with Bee Rescue** Julie & Jeff Russell Bee Rescuers	Meet Julie and Jeff Russell, two of Hannah's STEAM Heroes and team who rescues and rehomes honeybees.		**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	**Protection from Wind** *in Science in Nature and Our Daily Life Unit*	Daniel, Sofie, Leo, and Maria felt a strong wind at the park. It blew a lot of the soil away. What could happen to the animals in the park? Can you help the team protect the soil?	MITECS.3.d MITECS.4.a MITECS.4.c MITECS.4.d MITECS.5.a	**2-ESS1-1:** Use information from several sources to provide evidence that Earth events can occur quickly or slowly. **2-ESS2-1:** Compare multiple solutions designed to slow or prevent wind or water from changing the shape of the land. **K-2-ETS1-1** **K-2-ETS1-2** **K-2-ETS1-3**

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Extension Activities (as time allows)

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!

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.

	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.
Build the Change	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.

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