WeDo 2.0 in Curriculum

The LEGO® Education WeDo 2.0 projects combine LEGO® bricks with Next Generation Science Standards (NGSS). All of the WeDo 2.0 projects are designed to develop students' computational thinking skills.

Computational Thinking in Curriculum

The world is changing, and whether we realize it or not, technology and computer science shape nearly every aspect of our lives. Students are rapidly becoming active citizens, and equipping them with the right set of skills has become one of the nation's first priorities.

Computational thinking is a set of skills that is spreading worldwide, becoming a key practice to develop in relation to technology. Already identified by the NGSS as a practice essential to the Science and Engineering field, computational thinking has found roots in many other national curriculums both domestically and abroad.

Computational thinking has become the foundation of standards issued by the Computer Science Teacher Association (CSTA) and other associations such as ISTE, Code.org, and Computing at School (the British association responsible for a globally recognized computing curriculum). All of these organizations have aligned their curriculums with an emphasis on the development of computational thinking skills.

These important skills can be developed through engaging activities or projects that are rooted in real life problem-based situations. To support this development, LEGO® Education is adding a dedicated series of computational thinking projects to the science projects that are already available in WeDo 2.0.

Visual Overview of Guided Projects

1. Moon Base
This project is about designing a solution in which a robot would be able to assemble a base on the moon.

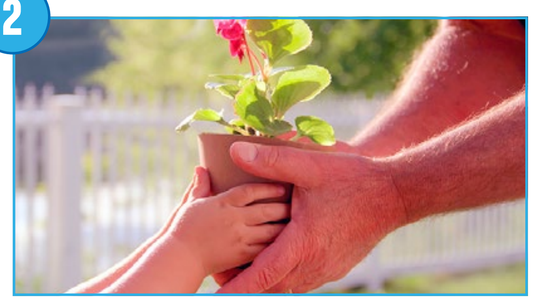
2. Grabbing Objects
This project is about designing a solution for a prosthetic arm that is able to move small objects around.

3. Send Messages
This project is about designing a solution for exchanging information using a system of signals organized in patterns.

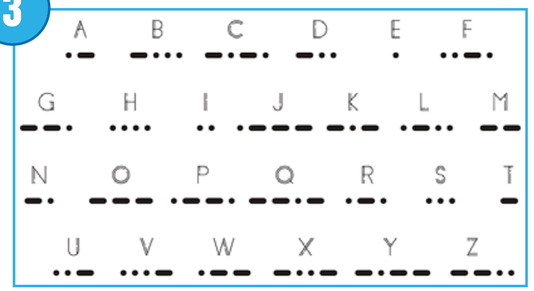
4. Volcano Alert
This project is about designing a device for improving the monitoring of volcanic activity in order to guide scientific exploration.

1

2



3

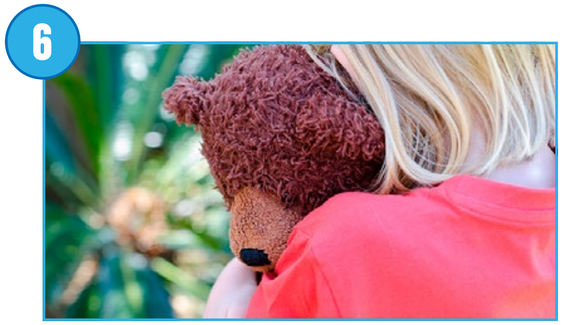


4

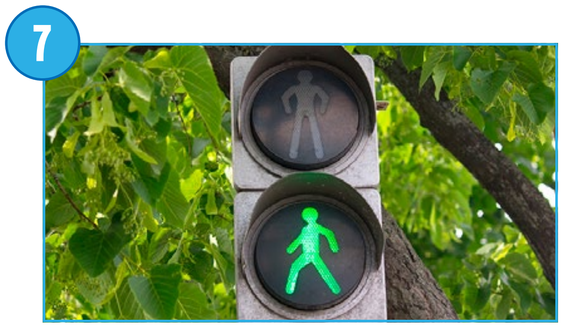
Visual Overview of Open Projects

5. Inspection
This project is about designing a solution in which a robot is able to inspect narrow spaces, guiding its motion with sensors.

6. Emotional Design
This project is about designing a solution in which a robot can display positive emotions when interacting with people.



7. City Safety
This project is about designing a solution to improve safety in a city.



8. Animal Senses
This project is about modeling how animals use their senses to interact with their environment.

Potential Flow to develop Computational thinking skills

You can organize the projects as you wish. Each project highlights opportunities for developing computational thinking skills, and it is it up to you to focus on the ones that are most relevant to you and your students. Here is one suggested sequence, which is based on an increasing level of complexity in the programming concepts covered:

Getting Started

Use two lessons of 45 minutes each to introduce your students to WeDo 2.0.
Lesson 1, Milo, the Science Rover
Lesson 2, combine Milo's Motion Sensor, Milo's Tilt Sensor, and Collaborating

Guided Projects

Use two lessons of 45 minutes each, during which students will program a sequence of actions.
Lesson 3, Moon Base (Explore and Create phase)
Lesson 4, Moon Base (Test and Share phase)

Use two lessons of 45 minutes each, during which students will use sensors (inputs).
Lesson 5, Grabbing Objects (Explore and Create phase)
Lesson 6, Grabbing Objects (Test and Share phase)

Use two lessons of 45 minutes each, during which students will use sensors (inputs), loops, and parallel programming.
Lesson 7, Send Messages (Explore and Create phase)
Lesson 8, Send Messages (Test and Share phase)

Use two lessons of 45 minutes each to introduce your students to conditions, and how to integrate all of the other programming principles.
Lesson 9, Volcano Alert (Explore and Create phase)
Lesson 10, Volcano Alert (Test and Share phase)

Open Projects

Use two or three lessons of 45 minutes each to make you own project based on one of the suggested Open Projects. This project should integrate all of the programming principles, as well as the computational thinking skills developed during the Guided Projects.

Potential Flow to develop Computational thinking skills

Getting Started

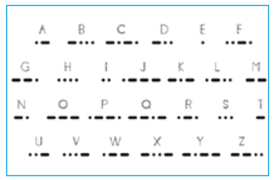
Introduce your students to WeDo 2.0




45 minutes — 45 minutes

Guided Project - Send Messages

Students will use sensors (inputs), loops, and parallel programming.



Using a condensed lesson flow
2 x 45 minutes

Guided Project - Moon Base

Students will program sequences of actions.

Using a condensed lesson flow
2 x 45 minutes

Guided Project - Volcano Alert

Students will be introduced to conditions, and to other programming principles.

Using a condensed lesson flow
2 x 45 minutes

Guided Project - Grabbing Objects

Students will use sensors (inputs).

Using a condensed lesson flow
2 x 45 minutes

Open Projects




Curriculum Overview of Guided Projects Organized by NGSS Disciplinary Core Ideas

	1 Moon Base	2 Grabbing Objects	3 Send Messages	4 Volcano Alert
Life Sciences				
Earth and Space Sciences				4-ESS3-2.
Physical Sciences			4-PS4-3.	
Engineering, Technology, and Applications of Science	K-2-ETS1-3. 3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.	3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.	3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.	3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.

Curriculum Overview of Open Projects Organized by NGSS Disciplinary Core Ideas

	5 Inspection	6 Emotional Design	7 City Safety	8 Animal Senses
Life Sciences				4-LS1-2.
Earth and Space Sciences				
Physical Sciences				
Engineering, Technology, and Applications of Science	K-2-ETS1-3. 3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.	K-2-ETS1-3. 3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.	K-2-ETS1-3. 3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.	K-2-ETS1-3. 3-5-ETS1-1. 3-5-ETS1-2. 3-5-ETS1-3.

NGSS Performance Expectations: Grade Two

Life Science

2-LS2-1. Plan and conduct an investigation to determine if plants need sunlight and water to grow.
2-LS2-2. Develop a simple model that mimics the function of an animal in dispersing seeds or pollinating plants.
2-LS4-1. Make observations of plants and animals to compare the diversity of life in different habitats.

Physical Science

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 wholly new object.
2-PS1-4. Construct an argument with evidence that some changes caused by heating or cooling can be reversed and some cannot.

Earth and Space Science

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 physical shape of the land.
2-ESS2-2. Develop a model to represent the shapes and kinds of land and bodies of water in an area.
2-ESS2-3. Obtain information to identify where water is found on earth and understand that it can be solid or liquid.

Engineering

K-2-ETS1-1. Ask questions, make observations, and gather information about a situation people want to change in order 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 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.

NGSS Performance Expectations: Grade Three

Physical Science

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.

Earth and Space Science

3-ESS2-1. Represent data in tables and graphic displays to describe typical weather conditions expected during a particular season.
3-ESS2-2. Obtain and combine information to describe climates in different regions of the world.
3-ESS3-1. Make a claim about the merit of a design solution that reduces the impact of a weather-related hazard.

Engineering

3-5-ETS1-1. Define a simple design problem reflecting a need 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 meets 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.

Life Science

3-LS2-1. Construct an argument that some animals form groups that help members survive.
3-LS4-1. Analyze and interpret data from fossils to provide evidence of organisms and the environments in which they lived long ago.
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 that is caused when the environment changes and the types of plants and animals that live there may also change.
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-LS3-1. Analyze and interpret data to provide evidence that plants and animals have traits inherited from parents and that variations of these traits exist within a group of similar organisms.
3-LS3-2. Use evidence to support the explanation that traits can be influenced by the environment.
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.

NGSS Performance Expectations: Grade Four

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 each meets 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.

Curriculum Overview of Guided Projects Organized by NGSS Practices

	1 Moon Base	2 Grabbing Objects	3 Send Messages	4 Volcano Alert
Practice One: Ask questions and define problems	●	●	●	●
Practice Two: Develop and use models				
Practice Three: Plan and carry out investigations				
Practice Four: Analyze and interpret data				
Practice Five: Use mathematics and computational thinking	●	●	●	●
Practice Six: Construct explanations and design solutions	●	●	●	●
Practice Seven: Engage in argument from evidence	●	●	●	●
Practice Eight: Obtain, evaluate, and communicate information	●	●	●	●

Curriculum Overview of Open Projects Organized by NGSS Practices

	5 Inspection	6 Emotional Design	7 City Safety	8 Animal Senses
Practice One: Ask questions and define problems	●	●	●	●
Practice Two: Develop and use models				●
Practice Three: Plan and carry out investigations				
Practice Four: Analyze and interpret data				
Practice Five: Use mathematics and computational thinking	●	●	●	●
Practice Six: Construct explanations and design solutions	●	●	●	
Practice Seven: Engage in argument from evidence	●	●	●	●
Practice Eight: Obtain, evaluate, and communicate information	●	●	●	●

Curriculum Overview of Guided and Open Projects Organized by CSTA Standards

Identifier		Interim CSTA K–12 CS Standard	1 Moon Base	2 Grabbing Objects	3 Send Messages	4 Volcano Alert	5 Inspection	6 Emotional Design	7 City Safety	8 Animal Senses
K–2	1A-A-3-7	Construct and execute algorithms (sets of step-by-step instructions) that include sequencing and simple loops to accomplish a task, both independently and collaboratively, with or without a computing device.	●	●	●	●	●	●	●	●
K–2	1A-A-6-8	Analyze and debug (fix) an algorithm that includes sequencing and simple loops, with or without a computing device.	●	●	●	●	●	●	●	●
K–2	1A-C-7-9	Identify and use software that controls computational devices (e.g., use an app to draw on the screen, use software to write a story or control robots).	●	●	●	●	●	●	●	●
K–2	1A-C-7-10	Use appropriate terminology in naming and describing the function of common computing devices and components (e.g., desktop computer, laptop computer, tablet device, monitor, keyboard, mouse, printer).								
K–2	1A-C-6-11	Identify, using accurate terminology, simple hardware and software problems that may occur during use (e.g., app or program not working as expected, no sound, device won't turn on).	●	●	●	●	●	●	●	●
K–2	1A-D-7-12	Collect data over time and organize it in a chart or graph in order to make a prediction.								
K–2	1A-D-4-13	Use a computing device to store, search, retrieve, modify, and delete information and define the information stored as data.								
K–2	1A-D-4-14	Create a model of an object or process in order to identify patterns and essential elements (e.g., water cycle, butterfly life cycle, seasonal weather patterns).	●	●	●	●	●	●	●	●

Curriculum Overview of Guided and Open Projects Organized by CSTA Standards

Identifier		Interim CSTA K–12 CS Standard	1 Moon Base	2 Grabbing Objects	3 Send Messages	4 Volcano Alert	5 Inspection	6 Emotional Design	7 City Safety	8 Animal Senses
3–5	1B-A-2-1	Apply collaboration strategies to support problem solving within the design cycle of a program.	●	●	●	●	●	●	●	●
3–5	1B-A-7-2	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).	●	●	●	●	●	●	●	●
3–5	1B-A-5-3	Create a plan as part of the iterative design process, both independently and with diverse collaborative teams (e.g., storyboard, flowchart, pseudocode, story map).	●	●	●	●	●	●	●	●
3–5	1B-A-5-4	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).	●	●	●	●	●	●	●	●
3–5	1B-A-5-5	Use mathematical operations to change a value stored in a variable.				●				
3–5	1B-A-3-6	Decompose (break down) a larger problem into smaller sub-problems, independently or in a collaborative group.	●	●	●	●	●	●	●	●

Curriculum Overview of Guided and Open Projects Organized by CSTA Standards

Identifier		Interim CSTA K–12 CS Standard	1 Moon Base	2 Grabbing Objects	3 Send Messages	4 Volcano Alert	5 Inspection	6 Emotional Design	7 City Safety	8 Animal Senses
3–5	1B-A-3-7	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.	●	●	●	●	●	●	●	●
3–5	1B-A-6-8	Analyze and debug (fix) an algorithm that includes sequencing, events, loops, conditionals, parallelism, and variables.	●	●	●	●	●	●	●	●
3–5	1B-C-7-9	Model how a computer system works.(Clarification: only includes basic elements of a computer system, such as input, output, processor, sensors, and storage.)								
3–5	1B-C-7-10	Use appropriate terminology in naming internal and external components of computing devices and describing their relationships, capabilities, and limitations.								
3–5	1B-C-6-11	Identify, using accurate terminology, simple hardware and software problems that may occur during use, and apply strategies for solving problems (e.g., reboot device, check for power, check network availability, close and reopen app).								
3–5	1B-D-5-12	Create a computational artifact to model the attributes and behaviors associated with a concept (e.g., solar system, life cycle of a plant).	●	●	●	●	●	●	●	●
3–5	1B-D-5-13	Answer a question by using a computer to manipulate (e.g., sort, total and/or average, chart, graph) and analyze data that has been collected by the class or student.								

Curriculum Overview of Guided and Open Projects Organized by CSTA Standards

Identifier		Interim CSTA Standard	1 Moon Base	2 Grabbing Objects	3 Send Messages	4 Volcano Alert	5 Inspection	6 Emotional Design	7 City Safety	8 Animal Senses
3–5	1B-D-4-14	Use numeric values to represent non-numeric ideas in the computer (binary, ASCII, pixel attributes such as RGB).			●					
3–5	1B-I-7-15	Evaluate and describe the positive and negative impacts of the pervasiveness of computers and computing in daily life (e.g., downloading videos and audio files, electronic appliances, wireless internet, mobile computing devices, GPS systems, wearable computing).								
3–5	1B-I-7-16	Generate examples of how computing can affect society, and also how societal values can shape computing choices.								
3–5	1B-I-1-17	Seek out and compare diverse perspectives, synchronously or asynchronously, to improve a project.								
3–5	1B-I-1-18	Brainstorm ways in which computing devices could be made more accessible to all users.								
3–5	1B-I-1-19	Explain problems that relate to using computing devices and networks (e.g., logging out to deter others from using your account, cyberbullying, privacy of personal information, and ownership).								
3–5	1B-N-7-20	Create examples of strong passwords, explain why strong passwords should be used, and demonstrate proper use and protection of personal passwords.								
3–5	1B-N-4-21	Model how a device on a network sends a message from one device (sender) to another (receiver) while following specific rules.			●					