Weather

LEGO® Education Unit for

LEGO® Education Coding Express and LEGO® Education STEAM Park

Unit Introduction

This unit allows students to explore the weather, how it changes, and how humans try to predict it. They will model what humans and animals need in different types of weather. They will show how forecasts can help people in times of severe weather.

The lessons are designed in an order that allows students to progress in their skills and knowledge in the following areas:

- Exploring different types of weather
- Determining what humans and animals need in different weather conditions
- Working with probability and making predictions
- Finding ways humans can prepare for severe weather
- Creating models of shelters
- Using communication, problem-solving skills, collaboration, and creativity

Unit Learning Promise

In this unit, students will work collaboratively to explore weather and sunlight through observing and investigating the world around them, collecting data to identify and describe patterns and building models to communicate ideas. After completing this unit, students will be able to identify activities and dress for different weather and seasons. They will understand how to use data to make weather predictions and different ways people can prepare for possible severe weather. They will begin to understand the effects of sunlight on objects, then use their knowledge to create a shelter to protect an animal from the sun. Along the way, students will develop and apply skills in engineering, creativity, and math.

Investigation Questions:
How does weather change during the year? How can we use patterns to predict weather? How do animals and people meet their needs when the weather changes?

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Unit Lessons

Lesson 1	Lesson 2	Lesson 3	Lesson 4	Lesson 5
Four Seasons Time: 30–45 min.	Probability Time: 30 min.	Mr. Bear's Forecast Time: 60–90 min.	Playground Time: 30–45 min.	Animal Shelter Time: 30–45 min.

Assessment

We recommend assessing students on various skills throughout the unit.

- Use the progression of lessons as an opportunity to provide on-going feedback to prepare students for success for the open-ended project at the end of the unit.
- Each lesson includes a recommendation for teacher observations, student self-assessment, evaluation of success, along with one or more rubrics.

Unit Standards

NGSS

- K-ESS2-1 Use and share observations of local weather conditions to describe patterns over time
- K-ESS3-2 Ask questions to obtain information about the purpose of weather forecasting to prepare for and respond to severe weather
- K-PS3-1 Make observations to determine the effects of sunlight on Earth's surface
- K-PS3-2 Use tools and materials to design and build a structure that will reduce the warming effect of sunlight on an area
- K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- K-2-ETS1-2 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

Science and Engineering Practices	Disciplinary Core Ideas	Crosscutting Concepts

○ Analyzing and Interpreting Data
○ Planning and Carrying Out Investigations
○ Asking Questions and Defining Problems
○ Constructing Explanations and Designing Solutions
○ Obtaining, Evaluating, and Communicating Information
○ Connections to Nature of Science:
  ○ Science Knowledge Is Based on Empirical Evidence
  ○ Scientific Investigations Use a Variety of Methods
	○ ESS2.D: Weather and Climate
	○ PS3.B: Conservation of Energy and Energy Transfer
	○ ESS3.B Natural Hazards
	○ ETS1.A Defining and Delimiting Engineering Problems
	○ ETS1.B Developing Possible Solutions
		○ Patterns
		○ Cause and Effect
		○ Structure and Function
		
		Connections to Engineering, Technology and Applications of Science:
		○ Influence of Science, Engineering, and Technology on Society and the Natural World
		○ Interdependence of Science, Engineering and Technology

Integrated Standards

CSTA

- 1A-DA-06 Collect and present the same data in various visual formats.
- 1A-DA-07 Identify and describe patterns in data visualizations, such as charts or graphs, to make predictions.

CCSS ELA

- W.K.7 Participate in shared research and writing projects (e.g., explore a number of books by a favorite author and express opinions about them).
- SL.K.1 Participate in collaborative conversations with diverse partners about kindergarten topics and texts with peers and adults in small and larger groups.
- SL.K.3 Ask and answer questions in order to seek help, get information, or clarify something that is not understood.
- SL.K.4 Describe familiar people, places, things, and events and, with prompting and support, provide additional detail.
- SL.K.5 Add drawings or other visual displays to descriptions as desired to provide additional detail.
- SL.K.6 Speak audibly and express thoughts, feelings, and ideas clearly.
- L.K.5.a Sort common objects into categories (e.g., shapes, foods) to gain a sense of the concepts the categories represent.
- L.K.5.c Identify real-life connections between words and their use (e.g., note places at school that are colorful).

CCSS Math

- K.CC.A.1 Count to 100 by ones and by tens.
- K.CC.B.4 Understand the relationship between numbers and quantities; connect counting to cardinality.
- K.CC.B.5 Count to answer "how many?" questions about as many as 20 things arranged in a line, a rectangular array, or a circle, or as many as 10 things in a scattered configuration; given a number from 1-20, count out that many objects.
- K.CC.C.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.
- K.MD.A.1 Describe measurable attributes of objects, such as length or weight. Describe several measurable attributes of a single object.
- K.MD.A.2 Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference.
- K.MD.B.3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count

LEGO® Education Coding Express

Four Seasons

Build a model to share an activity that a character does in a particular season.

STEM, Creative Exploration, Early Math and Science

K	30–45 min.	Beginner

Prepare

- Prior to the lesson, make sure the LEGO® Education Coding Express app has been loaded to a compatible device. Visit the LEGO® Education website for a list of devices and a link to the software download.
- Locate an age-appropriate picture book about the four seasons.
- **Vocabulary:** summer, fall, winter, spring

Engage

Ignite a discussion:

- Ask students to share some observations they had made about the sun.
- Encourage students to think about weather where you live. Is it hot outside every day? At certain times of the year, is it cold or rainy?
- Tell students they are going to explore the four seasons–summer, fall, winter and spring.
- Share an age-appropriate picture book with students about the four seasons, updating it to reflect *your* community.

KEY OBJECTIVES

Students will:

- Use and share observations about weather conditions at different times of the year.
- Build a model to show a season and select or build an accessory for a character to use in that season.

STANDARDS

- NGSS K-ESS2-1 Use and share observations of local weather conditions to describe patterns over time.
- CCSS Math K.MD.B.3 Classify objects into given categories; count the number of objects in each category and sort the categories by count.

ASSESSMENT

See Rubric in the lesson.

Explore

- Share several accessories from the Coding Express set.
- For each, ask students in what season people might use it.
- As a group, classify the objects by seasons and then count the number of objects in each category.
- Organize students in groups of three or four and assign each group a season.

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- Explain that the passengers on the Coding Express train will make four stops; summer, fall, winter and spring.
- Each group will build something fun for the passengers to do or see that relates to that season in your community or other places familiar to students (Depending on your region, prompt students with ideas like these:
  - Winter: cold-weather activities like sledding and jumping in puddles or warmer weather activities like bicycling
  - Spring: outdoor activities like planting and sports; rainy day activities like crafts
  - Summer: outdoor water activities like swimming or indoor activities to escape heat
  - Fall: finding a pumpkin on a farm or in the neighborhood, hikes and walks, or visits to the park/playground
- Have students work together to build their models and include an accessory, if possible, for the stop.

Explain

- Have students explain why they chose the activity they did for that season. How did they use observations about the weather to make their decision?
- Ask questions like:
  - What type of weather typically happens during this season where we live?
  - Using your model, tell me why this activity is something you might do this time of year.
  - Tell me about a part of your model that I can't see. What should I know about it?

Elaborate

Have students think about a part of the world that is different from their local weather conditions. If the train were traveling in that area, would the models they built change?

Evaluate

Evaluate the students' skills development by observing if they can:

- Identify local weather conditions at different times of the year.
- Build a model to share their ideas.
- Communicate how their model fits in the selected season.

Assessment Rubric: Four Seasons									
Student Name can	**Identify local weather conditions at different times of the year**			**Build a model to share their ideas**			**Communicate how their model fits into the selected season**		
	Rarely	Sometimes	Always	Rarely	Sometimes	Always	Rarely	Sometimes	Always

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LEGO education

LEGO® Education STEAM Park

Probability

Learn about probability, making predictions, and recording data.

Early Math and Science

K	30 min.	Intermed.

Prepare

- Prior to the lesson, make sure the LEGO® Education STEAM Park sets are ready to use.
- Consider the abilities and backgrounds of all your students and decide when and how to introduce and differentiate lesson content, activities, or concepts.
- If necessary, pre-teach these related **vocabulary words**: predict, probability.
- If desired, download the printable inspiration card for use in Connect and Construct.
- **The Math behind the Play:** Probability is a measure of how often a particular event will happen if something is done repeatedly. For example, the probability of a coin coming up heads is 1 out of 2.

KEY OBJECTIVES

Students will:

- Practice making predictions
- Record data using graphs or charts

STANDARDS

- CCSS.MATH.K.MD.B.3 Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.

Extension:

- CCSS.MATH.K.CC.C.6 Identify whether the number of objects in one group is greater than, less than, or equal to the number of objects in another group, e.g., by using matching and counting strategies.

Connect

- Play a guessing game with students. Tell them you're thinking of a color, then ask them to guess the color.
- Consider giving clues, such as for the color red:
  - It's the color of a round fruit.
  - It's the color of a fire engine.
- After students guess the color, ask how they figured it out. Reinforce that the more clues you have, the easier it is to guess the correct answer.
- Select a red, yellow, and blue brick from the set and place them in front of you.
- Tell students that you're thinking of one of these colors and ask them to guess that color.
- After they guess the correct answer, ask them if it was easier or harder to guess the correct color in this game compared to the first game.
- Explain that in this game, they had only three choices. But, they got no clues.

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- Tell students that you're going to read the beginning of a story about some people who are visiting STEAM Park. You can show them the inspiration photo (below) or use figures from the LEGO® Education STEAM Park set to act out the scene.

Read the following story aloud:

Arty and Teresa were visiting STEAM Park with Arty's grandma, Ms. Engels. They saw their friend Parker, the park manager, operating the Spin to Win game.

"Step right up and spin to win! Which color do you think the wheel will land on?" Parker asked.

"I think it'll land on red because red is my favorite color!" Arty said.

"I think it'll land on turquoise because there are three turquoise spaces and only one red space, one yellow space, and one blue space," Teresa said.

"Ms. Engels, will you give the wheel a spin?" Parker asked.

Ms. Engels stepped up and spun the wheel with all of her strength.

Everyone watched as the wheel went round and round many times. It slowed down and ended up on the red space.

"Yes! Red is the best!" Arty cheered.

"Choose your prize from the red shelf!" Parker said.

Construct

- Ask students to build the wheel model on the inspiration card (see image above) Tell them that they will play a game using the wheel.
- Once the wheel is built, show the students that the flag at the top is the pointer, and ask them which color they think the wheel will land on if someone spins it.
- Explain that this is a game of chance. No one knows for sure where the wheel will stop.
- Tell students that they can try to predict where the wheel will stop by judging the power of the spin and the distance around the wheel, but that it's not possible to make a good prediction.

- Give each of the students one of the results graphs and ask them to take turns spinning the wheel and guessing which color the wheel will land on. After each spin, tell the students to place a mark in the box next to the color the wheel landed on.

Contemplate

- After spinning the wheel several times, ask the students to look at their graphs and count how many times the wheel landed on each color.
- Consider asking questions like:
  - Which color do you predict it will land on next?
  - If you spin the wheel three times, how many times do you predict it will land on turquoise? Why?
- Explain that there are more turquoise spaces on the wheel than other colors and that this means there is a better chance or probability that the wheel will land on a turquoise space instead of one of the other colors.

Continue

- Tell students that they will use the wheel to play another game.
- Explain that they will take turns spinning the wheel and that each time the spinner lands on a color, everyone will choose a brick or an element that is that color.
- Tell them that the wheel will be spun five times and at the end, they will try to build a prize using the bricks they choose.

Did you notice?

- Ask guiding questions to elicit students' thinking and their decisions while ideating and building: What do you wonder about...? What do you notice...?

Observation Checklist

- Review the learning objectives and success criteria addressed in this lesson (blue sidebar box).
- Use the following checklist to observe students' progress:
  - Their investigation plan includes a way to make observations and collect the data about which color the spinner lands on.
  - Students can make predictions about which color they expect to be landed on the most.
  - Students can count the marks they make in their graphs to find out how many times it landed on each color.
  - Students can discuss which color group was landed on more than the others.

LEGO® Education STEAM Park

Mr. Bear's Forecast

Help Mr. Bear prepare for and respond to possible severe weather.

STEM, Creative Exploration, Early Math and Science

K	60–90 min.	Intermed.

Prepare

- Prior to the lesson, gather additional consumable materials that students could use in conjunction with the LEGO® Education STEAM Park set to help Mr. Bear respond to severe weather. Prior to this lesson, you may consider reviewing want versus need with students.
- **Vocabulary:** forecast, severe weather, tornado, hurricane, flood, hail, data

Engage

Ignite a discussion:

- Share a weather forecast from the local newspaper or news.
- Ask students:
  - Why do you think being able to predict the weather is helpful?
  - Are there times when the weather forecast is not correct? Why do you think that is?
- Explain that weather forecasters look at different types of data (information) to make weather predictions. They also look for patterns.
- Sometimes the weather can become dangerous. Have students share weather conditions that require them to take shelter (thunderstorms, lightning, high wind).
- Share that Mr. Bear is learning about how to prepare and respond to dangerous, or severe, weather where he lives. He needs our help to investigate the types of severe weather and how he can best keep himself safe.

KEY OBJECTIVES

Students will:

- Ask questions about why forecasting the weather is helpful.
- Help Mr. Bear prepare for and respond to severe weather.

STANDARDS

- NGSS K-ESS3-2 Ask questions to obtain information about the purpose of weather forecasting to prepare for and respond to severe weather.
- NGSS K-2-ETS1-1 Ask questions, make observations, and gather information about a situation people want to change to define a simple problem that can be solved through the development of a new or improved object or tool.
- CSS ELA-Literacy.SLK.3 Ask and answer questions in order to seek help, gain information or clarify something that is not understood.

ASSESSMENT

See the Rubric in the lesson.

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Explore

- Support students as they investigate different types of severe weather. Ask what types of severe weather we should prepare for in your area.
- Encourage students to ask questions about severe weather and weather forecasting to further investigate.
- Model the types of questions we ask when we want specific information.
- Have students select one type of local severe weather they should prepare for.
- Then, have students help Mr. Bear prepare for this type of severe weather. Are there steps he should do before severe weather comes?
- Using the LEGO® Education STEAM Park set, have students build a story showing how Mr. Bear prepares for the severe weather.
- Ask students: In the case of a severe weather incident, what should Mr. Bear do?
- Have students add onto their story to show how Mr. Bear would respond safely to the severe weather.

Explain

- Have students explain how Mr. Bear prepared for and responded to the severe weather.
- Ask questions like:
  - What questions might Mr. Bear want to ask a weather forecaster to help him prepare for the weather?
  - What does Mr. Bear need to do to prepare for the severe weather?
  - Using your model, tell me what parts help keep Mr. Bear safe from the severe weather
  - Tell me about a part of your model that I can't see. What should I know about it?

Elaborate

- Have student groups share their severe weather stories with another group. Encourage students to ask their partner group questions about the way they helped Mr. Bear.
- Have students build a model of a tool or a device Mr. Bear could use to help keep safe in the case of severe weather.

Evaluate

Evaluate the students' skills development by observing if they can:

- Ask questions to gain information or clarify something about weather forecasting.
- Use information gathered about severe weather to help identify ways that Mr. Bear could prepare for severe weather.
- Use information gathered to help identify ways that Mr. Bear could respond to severe weather.
- Clearly communicate their ideas using the built model.

Assessment Rubric: Mr. Bear's Forecast									
Student Name can	**Ask questions to gain information or clarify something about weather forecasting**			**Use information gathered about severe weather to help identify ways Mr. Bear could prepare and respond for severe weather**			**Clearly communicate their ideas about their model build**		
	Rarely	Sometimes	Always	Rarely	Sometimes	Always	Rarely	Sometimes	Always

LEGO® Education STEAM Park

Playground

Investigate the effects of sunlight on the Earth's surface and build a model to share observations.

STEM, Creative Exploration, Early Math and Science

K	30–45 min.	Intermed.

Prepare

- Prior to the lesson, identify an area of the playground for students to investigate. It would be ideal for students to investigate the playground twice, including when the sun shines on it and when it does not or the day is cloudy.
- **Vocabulary:** sunlight, effect, observe, system

Engage

- Read the story aloud to students:

It was a beautiful, sunny day. Ms. Engles decided to take Matt and Teresa to play at the playground by her house. The playground has lots of fun things to explore! There is a sandbox, a small swimming pool, grassy areas to sit down under a tree, and even swings and slides.

When they got to the park, Matt and Teresa headed straight for the sandbox. The sand felt very warm against their skin! After a few minutes, they walked over to Ms. Engels who was sitting under a tree. It was shady under the tree's branches and leaves. As soon as Matt and Teresa sat down under the tree, they noticed the grass beneath them was not as warm as the sand in the sandbox. They began to wonder. Do other items on the playground feel warm or cool? Why?

- Encourage students to think about Matt and Teresa's playground experience. Why might the sand feel warm, but the grass feels cool? How do they think other items might feel?
- Explain that students will visit the playground to observe.

KEY OBJECTIVES

Students will:

- Make observations regarding the effects of sunlight on the playground.
- Build a model to share their observations and wonderings about sunlight.

STANDARDS

- NGSS K-PS3-1 Make observations to determine the effects of sunlight on Earth's surface.
- CCSS Math K.MD.A.2- Directly compare two objects with a measurable attribute in common, to see which object has "more of"/"less of" the attribute, and describe the difference

ASSESSMENT

See the Rubric in the lesson.

- Once on the playground, model for students how to collect information from observing.

Explore

- Allow students time to explore the playground. What areas feel warm? What areas feel cool?
- Have students make observations and collect data in a science notebook or using a graphic organizer. (See organizer provided at the end of the lesson.)
- If investigating at two separate times, have students make observations and take notes in their notebooks about how areas feel when the sun is shining on the playground and when it is not.

  Teacher Note: *Absence of sun might be from the angle of the sun or from clouds.*

- Have students work in pairs or small groups to build a model to share their observations.

Explain

- Have students explain why they thought certain areas of the playground were warm. Have students include the role sunlight plays in heating areas of the Earth's surface.
- Ask questions like:
  - What did you observe on the playground?
  - Using your model, explain why you think this area of the playground is warm.
  - How does the sun make us warm?
  - Tell me about a part of your model that I can't see. What should I know about it?

Elaborate

- Have students think about another outside area of the playground or school.
- Have them predict the effect of sunlight on that area at different times of the day.
- Students can build a second model to share their ideas.

Evaluate

Evaluate the students' skills development by observing if they can:

- Participate in the observation of the playground
- Build a model to share their ideas
- Communicate how sunlight affects areas of the Earth's surface

NAME_____

Name _____

Draw a picture of the playground.
Make observations.
Color warm places red.
Color cool places blue.

Assessment Rubric: Playground									
Student Name can	**Participate in the observation of the playground**			**Build a model to share their ideas**			**Communicate how sunlight affects areas of Earth's surface**		
	Rarely	Sometimes	Always	Rarely	Sometimes	Always	Rarely	Sometimes	Always

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LEGO education

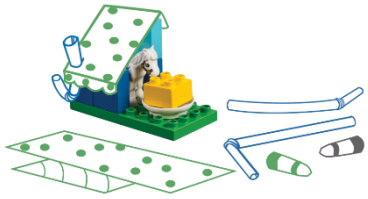
LEGO® Education STEAM Park

Animal Shelter

Make a safe shelter to protect an animal from the sun.

STEM, Creative Exploration, Early Math and Science

K	30–45 min.	Advanced



Prepare

- Prior to the lesson, gather additional consumable materials that students could use in conjunction with the LEGO® Education STEAM Park set to design their shelters.
- Optional: Locate a thermometer.
- **Vocabulary:** summer, fall, winter, spring

Engage

- Ignite a discussion:
  - Why do people want a place that is shady outside?
  - What are some ways too much sun can harm us?
  - Do you think too much sun can harm plants and animals, too?
- Explain that the animals living in the STEAM Park need a new shelter to protect them from the sun.
- Ask students: How will we know if our shelter is protecting our animal from the sun? (dark shadow on the animal, no light touching the animal)
- Optional: Ask students how we could measure the temperature inside our shelters? (thermometer)
- If the shelter is hot, what could be a possible reading on the thermometer? (a high number; a lot of red showing)

Explore

- Investigate different types of structures that help keep an area cool.
- Ask: What is special about the structure that protects the area from the sun?
- Organize students in groups of two or three.
- Have groups design a model for their animal structures.

KEY OBJECTIVES

Students will:

- Design and build an animal structure that will keep an animal cool

STANDARDS

- NGSS K-PS3-2 Use tools and materials to design and build a structure that will reduce the warming effects of sunlight on an area.
- K-2-ETS1-2 Develop a simple sketch, drawing or physical model to illustrate how the shape of an object helps it function as needed to solve a given problem.

ASSESSMENT

See the Rubric in the lesson.

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- Ask: What are the special features in the design that will help protect the animal from the sun?
- Next, have students construct the model using LEGO® Education STEAM Park elements and other consumable materials.
- Have students test the design by placing the shelters outside in the sun or in a sunny area of the classroom. Students can modify the build and make improvements.
- If using thermometers, students can record temperatures inside and outside of the shelter.

Explain

- Have students explain how the shelter protects the animals from the sun and keeps it cool on hot days.
- Ask questions like:
  - When do you think your animal would want to use the shelter?
  - Using your model, tell me what parts keep the sun off the zoo animal.
  - Tell me about a part of your model that I can't see. What should I know about it?

Elaborate

- Have students think about another type of weather the animal may need protection from (rain, snow, ice, wind).
- Have students modify their build to include the new weather constraint.

Evaluate

Evaluate the students' skills development by observing if they can:

- Design and build an animal structure with shade
- Clearly communicate their ideas using the built model
- Clearly communicate how their model reduces the warming effects of the sun for the animal.

Assessment Rubric Animal Shelter									
Student Name can	**Design and build an animal structure with shade**			**Clearly communicate their ideas about their model build**			**Clearly communicate how their model reduces the warming effects of the sun for the animal**		
	Rarely	Sometimes	Always	Rarely	Sometimes	Always	Rarely	Sometimes	Always