

The Playful Foundations of STEM

The title page appears on screen. Bright, colorful shapes overlap and shift. Upbeat music plays in the background throughout the video.

Text on screen: Ontario Science Centre; An Agency of the Government of Ontario

Animated graphics swipe away to reveal a title card with playful geometric shapes.

Text on screen: The Playful Foundations of STEM

Animated graphics sweep away again to reveal Jessica. She is standing in a brightly lit room with a red toy pedal car and KidSpark signage behind her.

Jessica: Welcome to KidSpark, the Ontario Science Centre's learn-through-play experience. This space is designed to foster STEM knowledge by engaging children in play- and inquiry-based exploration.

Overlaid text on screen: Jessica (she/her); Early Childhood Programming Specialist, Ontario Science Centre.

Jessica: I am Jessica Shearer, Early Childhood Programming Specialist at the Ontario Science Centre.

As a Kindergarten teacher, you are a curator of exploration, discovery, play and a love of learning.

We see an exterior view of Toronto's Harbourfront Centre; then a sequence of clips of children playing at various centres: a boy interacts with a light wall; girls play with blue foam blocks; two girls stack colorful wooden birds on a base; two children turn large interlocking gears; an educator reads from a picture book to a group of children seated on the floor.

Jessica: Using KidSpark as our backdrop, we'll share some of the ways that we promote STEM learning in an informal learning environment, with tips and strategies that you can bring into your classroom.

We see a diverse group of children building with blocks; children piece together a toy car from a toy building set.

Jessica: When we talk about STEM—Science, Technology, Engineering and Mathematics—in the context of young children, we like to focus on and prioritize the foundational skills of STEM:

Split screen: A series of children showing learned abilities through play corresponding to the text shown, as spoken by Jessica.

Jessica: Observation, collaboration, problem solving, critical thinking, creativity, communication, innovation and persistence.

Split screen: Jessica and text, as above.

Jessica: These are skills that children naturally use during play and that we, as educators, can help nurture and extend.

Animated graphics swipe away to reveal a title card with playful geometric shapes.

Text on screen: Model Curiosity

Animated graphics swipe away to reveal Jessica standing in front of a topographical map display.

Jessica: During play, children are making sense of their environments and the world around them. One of the most effective tools we have as educators is to model curiosity by asking guiding questions, following children's interests, using STEM language and being a participant—not a leader.

Split screen: Jessica and text, as spoken by Jessica.

Jessica: Guiding Questions are open-ended questions that focus on process and encourage critical thinking:

Split screen: Children play together solving a jigsaw puzzle; create patterns with brightly coloured building blocks; a child places an arrow on the floor to make a route for a toy dinosaur to escape a maze, then the next child takes her turn in placing an arrow, and text as spoken by Jessica.

Jessica: - "Why do you think that happened?"

- "How did you solve that problem?"

- "What is your plan?"

- "What are you seeing?"

- "What would you try next time?"

- "What do you see? Hear? Smell?"

Guiding questions never suggests a "correct" answer but rather allow children to focus on inquiry and making their own connections.

Split screen: Children make their way through a maze of building blocks on the floor marked by brightly coloured arrows, taking turns to place arrows or make their way through the maze, and text as spoken by Jessica.

Jessica: Never underestimate the power of "I wonder":

- "I wonder what would happen if..."

- "I wonder how..."

- "I wonder why..."

Whenever possible, use STEM language. When you model STEM language, you'll start to notice your students doing it, too, building their communication skills and vocabulary as they start to think scientifically.

Split screen: Educators guide a diverse group of children in various learning environments: making birdhouses outdoors with craft supplies; playing with colourful beads at a play table; eating snacks together, and text as spoken by Jessica. As Jessica speaks each word, a corresponding animated image appears with the text.

Jessica: You can introduce words and concepts like:

Wide/Narrow

Big/Small

Plan

Test

Predict

Design

Hypothesis

Measure

Heavy/light

As you do this, you'll also be supporting students to describe measurable attributes of objects in various ways as well as describe the scientific process, both of which align with the kindergarten learning expectations.

Jessica stands in front of a topographical map display.

Jessica: While you do this, aim to be a play participant, not a director. Get curious, messy and creative with your students. Pay attention to their natural interests and create opportunities for them to explore them further.

Animated graphics swipe away to reveal a title card with playful geometric shapes.

Text on screen: Real World Connections

Animated graphics swipe away to reveal Jessica standing in front of play space made to look like a doctor's office. There is a weight scale, bins for patient's files, and screens with X-rays displayed.

Jessica: Play is a great way for children to connect real experiences to STEM skills.

We see a series of clips of children: a girl plays with toy cars; boys build with blocks; a group of children use large wooden blocks to build a bridge-like structure; children use scoops in a sensory bin; an educator leads children on a nature walk.

Jessica: Your classroom's learning centres are the perfect places for your students to bridge play and STEM. When your students play with cars and ramps, they are exploring speed, motion, gravity and momentum. When they build with blocks, they are learning about structure, stability and engineering. Sensory tables connect to measurement and cause and effect. A nature walk can lead to classification, biology and patterns. These experiences also help children develop critical thinking, problem solving, collaboration and creativity.

Jessica stands in the doctor's office play space.

Jessica: Here in KidSpark, our play areas reflect spaces children might encounter in their day-to-day lives. For example, in our Doctor's Office, children can explore anatomy and the human body.

Children explore various medical equipment like a blood pressure cuff and a stethoscope, look at an X-ray of ribs, and interact with a medical scanning station.

Jessica: They can discover medical tools and equipment, make observations, ask questions, and build communication skills with their peers as they play.

Children are playing in a toy kitchen; children using magnifying glasses while seated on the floor of a classroom.

Jessica: Look for opportunities to mirror real-world environments in your classroom.

Jessica stands in the play space made to look like a doctor's office.

Jessica: By connecting STEM learning to real-life situations and experiences, you make it meaningful, engaging, exciting, and memorable. Science is all around us!

Animated graphics swipe away to reveal a title card with playful geometric shapes.

Text on screen: Growth Mindset

Animated graphics swipe away to reveal Jessica standing in front of a topographical map display.

Jessica: Along the way, things probably won't always go according to plan. A structure may break, our seeds may not grow, or a pattern may not turn out the way we intended. Failure is just as important as success, sometimes, even more so.

There is so much students can learn from why something didn't succeed or turn out the way they had planned. Some of the most important scientific discoveries were purely accidental.

Split screen: Children building a tall tower of large foam blocks. The tower begins to lean and then collapses. The children work together to rebuild the tower.
Text, as spoken by Jessica.

Jessica: When students hit those roadblocks, we go back to those guiding questions.

"Why do you think that happened?"

"What would you try next time?"

"What did you notice happening?"

When nurturing the growth mindset, it's not always the end result or destination that matters most, but the journey that students take to get there. We will talk more about the growth mindset in our next video.

A diverse group of children play together on the floor stacking large foam building blocks, and at a play table with smaller wooden blocks.

Jessica: By not giving children an immediate solution or assistance, we allow them to build their persistence, creativity, and critical thinking. It's also a great opportunity to encourage teamwork and collaboration. Maybe another student chose a different building material, and their structure did not fall.

Your approach to failure can teach students that they are safe to share mistakes and that failures are a natural part of the process, not something they should avoid.

Jessica stands in front of a topographical map display.

Jessica: Children who learn in growth mindset focused environments see challenges and obstacles as a natural part of learning, making them more resilient problem-solvers.

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Text on screen: Open-Ended Challenges

Animated graphics swipe away to reveal Jessica standing in front of a topographical map display.

Jessica: Open-ended challenges have no “right” answers and often have multiple solutions.

Children play on the floor building bridges from blocks and construction paper. They test their bridge’s strength by placing a block on top.

Jessica: When children are presented with open-ended activities and challenges, they have the freedom to use their imaginations, test different ideas and find unique solutions.

Children use magnetic toy fishing rods from child-size boats in the pond area on the floor. They cast their lines and catch toy fish from the pond.

Jessica: For example, if we were to give a child an open-ended challenge in our Pond area, we might ask them how they would sort the fish that they have caught. When we add new materials to an area, we can build on a challenge.

Jessica stands in front of a topographical map display.

Jessica: For example, by inviting them to create their own fishing tool or to try catching a fish without touching the water.

Those are just some challenge examples in one of our learning spaces. Maybe something works different, or better in one of your spaces.

Children continue to perfect their skills at building bridges from blocks and construction paper; two children create art at a play table with coloured markers, construction paper, and scissors.

Jessica: Students could be challenged to build something that helps a toy car to cross over a “river”, for example, or to create a self-portrait using cut outs of different shapes.

A diverse group of children create musical instruments from cardboard boxes and tubes, pipe cleaners and tape.

Jessica: What you do is less important than how you do it. The key is to find an activity that targets specific STEM areas (like structure, engineering, geometry, in our examples) but where the “problem” can be solved in several ways.

Jessica stands in front of a topographical map display.

Jessica: These kinds of open-ended challenges target differentiated learning, as each student can be engaged at their own level. Independence is encouraged by giving students the flexibility

to choose their own materials and make their own decisions about the process, rather than focusing on the product. Fostering a sense of agency nurtures the growth mindset.

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Text on screen: Opportunities to Reflect

Animated graphics swipe away to reveal Jessica standing in front of a topographical map display.

Jessica: Reflection and documentation are integral to the scientific process—and you can get your kindergarten students involved!

A child draws with markers as an educator looks on and asks questions about what the child is drawing.

Jessica: Drawing pictures, taking photos and asking process-based questions are all great ways to collaboratively reflect on student experiences.

Split screen: Children create a drawing together at a play table; a child hands his tally sheet on a clipboard to the educator. They point out suggestions of things for him to check.

Text, as spoken by Jessica.

Jessica: Some process-based questions could include:

- What was tricky about that?
- How did you solve the problem?
- What are you most proud of?
- What would you try next time?
- Who could you work with to make it even better?

Split screen: Children gather in a semi-circle on child-size chairs. An educator is speaking with the children; children dump brightly coloured toys into a storage box. Text, as spoken by Jessica.

Jessica: Reflection helps strengthen communication, encourages persistence and builds critical thinking. It helps children to understand why something did or did not work and turns every experience, whatever the outcome, into learning.

Jessica stands in front of a topographical map display.

Jessica: Reflection is an integral part of the real scientific process and it's one that even the youngest of students can participate in.

Animated graphics swipe away to reveal a title card with playful geometric shapes.

Text on screen: Conclusion

Animated graphics swipe away to reveal Jessica standing beside a red toy pedal car with the KidSpark signage behind her.

Jessica: As Kindergarten teachers, you're already experts in creating joyful, hands-on experiences.

We see a series of clips: children sit in a semi-circle on the floor and clap their hands along with their educator; a child shows his educator an art creation he has made from construction paper; a group of children are seated on the floor listening to an educator. A child raises her hand to ask a question; an educator interacts with his students at the sensory table; children work together to stack large foam blocks; one child tries stacking toy dinosaurs. She laughs as they fall over.

Jessica: By embedding foundational STEM skills into moments children naturally love—pretending, exploring, playing, and building—you're empowering them to be critical-thinkers and problem-solvers. STEM in Kindergarten is about nurturing creativity and curiosity.

Jessica stands beside a red toy pedal car.

Jessica: Thank you for creating spaces where children can investigate, follow their curiosity, explore how the world works, make discoveries, test ideas and learn to persevere. Your dedicated work instills a lifelong love of learning in the next generation and a better world for all of us – thank you for all that you do.

Animated graphics sweep away to reveal text.

Text on screen: We hope you enjoyed this video, which is part of a series developed to support Ontario's kindergarten teachers in STEM education.

Be sure to check out other videos in this series along with additional classroom-ready resources and professional learning resources at OntarioScienceCentre.ca.

Animated graphics sweep away to reveal text.

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