Grade 3 How does the design of a structure and materials used impact its stability?

Experience 3: How might we build a winter shelter for a plant?

Long Range Plan Grade 3 Model 2

Overview:

This series of learning experiences invites students to engage with the definition and characteristics of structures through meaningful reflection, hands-on building, and authentic connections with the world around them.

Three specific experiences are outlined in detail:

- Experience 1: Concept attainment approach and reflection on structures
- Experience 2: Building challenges to explore what makes a structure strong and stable
- Experience 3: Applying learning to build a winter shelter for a plant

Students will use a concept attainment approach to explore the meaning of “structure” and address any misconceptions. They will reflect on how their thinking has changed.

Building on their understanding of the definition of a structure, students will use recycled materials to complete a series of challenges and encourage scientific discussion and the use of specific scientific vocabulary.

Students will apply these terms - and their understanding of what a strong and stable structure is - to a specific issue in their own community. Through outdoor education, they will identify a perennial plant that could benefit from a shelter to protect it during the winter. Students will design and build a model of a shelter, integrating three strands of the Science curriculum: Strong and Stable Structures, Forces and Motion, and Growth and Changes in Plants.

Extensions and cross-curricular opportunities are provided throughout the series, encouraging teachers to tailor the experiences to the strengths and needs of their students. Assessment for, as, and of learning is a key component of the series as well.

In the real world, scientists and engineers need to record their thinking and keep records of their scientific processes and engineering designs for a number of different reasons. In these experiences, students will be using a science journal as a way of tracking their scientific thinking as they emulate scientists and engineers while engaging in the learning to make predictions, record processes, and observations, and draw conclusions about scientific phenomena. The journal will also be used during STEM investigations as a place for working through solutions to

real-world problems (brainstorming, describing plans, and drawing designs for prototypes) and will be an evidence-based source of assessment information.

Overview of learning experiences – why these activities	In this, third experience, students apply the terms they have learned - and their understanding of what a strong and stable structure is - to design and build a model of a structure to protect a plant through the winter months. These learning experiences relate to the Grade 3 long-range plans (October/November and December): Long Range Plan Grade 3 Model 2
Prior Knowledge / Prior Skill Set(s)	**Teachers:** Teachers should be familiar with the concepts included in these experiences, such as strength and stability. Definitions for specific terms are provided later in this document. Teachers should be aware of structures in their communities, as well as needs that could be addressed through the construction of new structures. For this particular experience, they should have some familiarity with outdoor plants on the school grounds or in the immediate area around the school. **Students:** From previous learning experiences, students should be familiar with the definition of a structure and other related terms. Consider reviewing the vocabulary board or sheet prior to the investigation.
Strand A - STEM Investigation and Communication Skills	**A1. STEM Investigation and Communication Skills** use a scientific research process, a scientific experimentation process, and an engineering design process to conduct investigations, following appropriate health and safety procedures **A1.1** use a scientific research process and associated skills to conduct investigations **A1.3** use an engineering design process and associated skills to design, build, and test devices, models, structures, and/or systems

	A1.4 follow established health and safety procedures during science and technology investigations, including wearing appropriate protective equipment and clothing and safely using tools, instruments, and materials **A1.5** communicate their findings, using science and technology vocabulary and formats that are appropriate for specific audiences and purposes **A3. Applications, Connections, and Contributions :** demonstrate an understanding of the practical applications of science and technology, and of contributions to science and technology from people with diverse lived experiences **A3.1** describe practical applications of science and technology concepts in their home and community, and how these applications address real-world problems **A3.2** investigate how science and technology can be used with other subject areas to address real-world problems
Overview / Big Ideas/Fundamental Concepts	These experiences are designed to help students engage with the concepts of form and function in relation to structures - and, specifically, what makes structures strong and stable. The goal is for students to understand and apply some key scientific terms while thinking generally about structures and also applying their learning and taking an activism approach by designing a specific structure to meet a need in their community. **Big Ideas:** ● Relationships ● Cause & Effect ● Systems & Structures Students will focus on the interrelationship between the function of a natural or human-made object and the form it takes. The goal is for students to understand that the properties of structures affect their function. As they investigate how best to build structures for specific purposes and how to help them withstand forces, students will gain a deeper understanding of cause and effect. Students will explore the

	purpose of structures and the interrelationship between stability and forces.
Learning Goals / Success Criteria	Students will be gaining an understanding of the definition of a structure through a concept development approach. They will be applying this to a series of engineering challenges, using recycled materials. Students will be consolidating their learning by considering the needs in their community and designing a structure to meet one of them. Educators are encouraged to co-create success criteria with students and share “I Can Statements” based on the curricular expectations. Opportunities to do so are addressed throughout this series of lessons. Further evidence for assessment can be gathered and observed through ● Scientific journals ● Student conferences ● Community walks ● Peer discussions (in breakout rooms if online) ● Teacher documentation ○ Anecdotal notes ○ Photographs **Ministry of Education Key Points:** ● STEM Skills & Connections ● Research & Experimentation Processes ● Engineering Design Process ● Hands-On Experiential Learning ● Coding ● Contributions to Science and Technology ● Climate Change ● Food Literacy
Learning Experience(s)	**Experience 3: How might we create a structure that contributes to our community?** **Guiding questions:** What are some careers in design and building? How do forces impact a structure? How can you build a structure to be strong and more stable?

A3.1, A3.2	This experience provides students with the opportunity to apply their learning about structures as they consider how to make a tangible improvement in their community. The goal is to design, build, and evaluate a structure to protect a plant through the winter months. **Minds On (45 min):** **Provocation:** How might we use what we've learned about structures to protect nature in our community? Community circle: Gather students on the carpet or signal to them in another way that everyone will have an opportunity to share their answer to this question: Name a structure that you think makes our community a better place. Explain your thinking. Sample responses: - mailbox - slide at playground Share with students that plants are also something that makes our community a better place by keeping our air clean and providing shade and a home for animals. They create an environment that makes people feel happy. Plants hold an important healing role for many FNMI people and communities. Structures and plants often have an important relationship. For example, growing food can be enhanced by structures (e.g. greenhouses). **Possible connections:** - Invite an FNMI elder or other community member to speak to the class about traditional uses of plants in the area and how these plants have been protected and preserved over time. - Discuss the important role of edible plants. Identify some edible plants that grow in your area and in which form they are used for food (fruit, vegetable, herb). We are going to identify plants in our area that may need some protection during the winter months so that they thrive again in the spring. Plants that come back year after year are called perennials. We can improve our community by helping to protect them. Lead students on a walk down the street or around the schoolyard OR use Google Maps or a similar application to get a sense of the locations

	of some plants in your area. Be sure that you are looking at perennial plants (see vocabulary definitions) as it is important that these plants will be thriving again in the spring. - Hand out clipboards, paper, and pencils/markers before the walk so that students can keep track of what they see and where. **Action (45 min x2):** Engage students in a read-aloud related to architecture, such as **Iggy Peck, Architect**. If you don't have access to hard copies of these books, consider finding videos of them online. - Before reading, give students this mission: Listen for clues about how and why architects make their plans. Invite volunteers to share their responses to their mission. Summarize their ideas and explain that architects carefully consider many things as they make their plans. They first create a sketch and then a model. Architects then share their ideas with colleagues. Model the process of designing and building a model of a structure to protect an indoor plant in the classroom from a force of your choosing, such as a draft from the window or door - select as realistic a scenario as possible. - Use chart paper or a document camera so students can get a good sense of how to complete a quick sketch and include labels. - Remind students that the definition of a structure involves supporting a load. This will be important for their structures because snow and ice can often pile up on structures during the wintertime. Use a think-aloud to model for students how to reflect on reinforcing their structures so that they don't collapse under this load. Tell students that their job is to follow a similar process to protect an outdoor plant during the winter. Think, pair, share: What forces and/or elements might we be protecting outdoor plants from? (e.g. wind, ice, snow, humans). Ask students to use their science journals to make a quick sketch of their idea for their own structure. After students conference with you, instruct them to build a model of their structure, using materials that you have selected and supplied (recycled materials OR Lego OR straws and Play-Doh OR other
 **A1.1, A1.3**	

	materials of your choosing).
A1.4	Review safety procedures with students. They should work safely in a designated area. Because they have another period in which to build, you may wish to ask them to build on the lid of a shoebox or similar container so that they can move their structure off their desk or table to make space for other work in the meantime.
A1.1	Consider providing students with a Lego plant or a plant made of green pipe cleaners or a similar material. This will make the experience more tangible for them and will also give them an idea of an appropriate size for their model. Possible extension: Invite students to research famous world structures to gain ideas about form, function, and materials that they may wish to apply to their plant shelters (e.g. The Colosseum is rounded, which mitigates the force of the wind).
A1.5	**Consolidation (45 min):** Hold an architectural symposium in which students share their structures. Each student should have an opportunity to describe what they created and why. Remind them to focus not only on the product itself but also on the process. Model and encourage probing questions (e.g. What did you do to improve your structure's stability? How did you make your structure stronger?) Sample responses: - I taped pairs of popsicle sticks together instead of using just one when I created the framework. - I used triangle shapes in my design to make my structure stronger. Consider whether you would like students to set up their models at their own desks - in this case, have one group stay at their desks and the other group circulate, then switch. Another option is to invite one student at a time to present their model to the whole class. Students should reflect in their journals about their own process and also about classmates' ideas that stood out to them. **Extension Possibilities:** Using Google My Maps or a similar mapping application, create a shared map and use virtual pins to show the location of each structure in the community. You may choose to include just the name of the structure or you may add a photo and/or

	description. This map could be shared with families and/or the school community to inform them of the design ideas and invite them to appreciate plants in the area. Additional career links: landscape architect, city planner Continue discussion of plants and structures by reflecting on development plans in balance with environmental and food growth needs (e.g. Brazil's current deforestation). This could be an opportunity to engage students in oral debate or persuasive writing. **What the students do:** Initiating and Planning ● Brainstorm and share ideas about plants and structures Performing and Recording ● Explore and record locations of perennial plants Analyzing and Interpreting ● Test structure and apply concepts learned to make it more strong and stable Communicating ● Share their product by participating in an architectural symposium ● Share their observations, conclusions, and further wonderings in their science journal
Science and Technology Expectations	**B - Life Systems: Growth and Changes in Plants** B1.2 assess ways in which human activities have an impact on plants and plant habitats, and identify personal actions that they could take to minimize harmful effects and enhance positive ones B2.3 describe changes that different plants undergo in their life cycles B2.4 describe ways in which a variety of plants adapt and/or react to their environment and to changes in their environment **D. Structures and Mechanisms**

	Strong and Stable Structures D1. Relating Science and Technology to Our Changing World assess the importance of form, function, strength, and stability in structures to society and the environment D1.1 assess the effects on society and the environment of strong and stable structures How do I test a structure to improve it using form and function? D1.2 assess the environmental impact of structures built by various animals including structures built by humans **D2. Exploring and Understanding Concepts** **demonstrate an understanding of the concepts of strength and stability as they relate to structures with various forms and functions, and of the factors that affect structures' strength and stability** D2.1 describe a structure as **a supporting framework that holds a load and has a definite size, shape and function** and identify structures in the natural environment and in the built environment D2.2 demonstrate an understanding of the relationship between form and function for various structures D2.3 identify the strength of a structure and its ability to support a load D2.4 describe the stability of a structure and its ability to keep its shape, maintain balance, float/and or stay fixed in one spot when a force is applied to the structure, and provide ways to improve a structure's stability D2.5 identify properties of materials that need to be considered when building structures D2.6 describe ways in which different forces can affect the shape, balance or position of structures D2.7 explain the role of struts and ties in structures under load

	C. Matter and Energy - Forces and Motion **C2. Exploring and Understanding Concepts** **demonstrate an understanding of how forces cause motion and changes in motion** C2.1 describe different types of contact forces and non-contact forces C2.2 describe different ways a force can be exerted on an object C2.4 identify ways in which forces are used in their daily lives
Science and Technology Vocabulary	**Key concepts and vocabulary** **Balance:** stability produced by even distribution of weight on each side of the vertical axis **Force** (contact and non-contact)**:** strength or energy exerted or brought to bear; cause of motion or change; active power - often characterized as a push or a pull ● **Contact force:** a force applied by objects in contact with each other ● **Non-contact force:** a force applied to an object by another body that does not make direct contact with it **Form:** the shape and structure of something as distinguished from its material **Function:** the action for which a person or thing is specially fitted or used or for which a thing exists - its purpose **Material:** the elements, constituents, or substances of which something is composed or can be made; or an act, process, or instance of changing place - movement **Perennial:** living from year to year - a perennial plant **Stability:** the strength to stand or endure - firmness; or the property of a body that causes it when disturbed from a condition of equilibrium or steady motion to develop forces or moments that restore the original condition **Strength: the** power to resist force - solidity or toughness **Structure:** a supporting framework that holds a load and has a definite size, shape, and function **Strut:** a structural piece designed to resist pressure in the direction of its length

	Tie: a structural element (such as a rod or angle iron) holding two pieces together - a tension member in a construction

Equipment and Materials	• Journal pages or journal notebook - see Appendix A: Science Journals
	• Vocabulary wall or chart paper
	  ○ Create as you introduce structures definition and new vocabulary
	• A book and/or read-aloud video featuring a story about architecture
	• Clipboards, paper, pencils/markers
	• A classroom plant of any kind
	  ○ If this is difficult to access, you can ask students to imagine one
	• Model-building materials of your choosing, such as recycled materials OR Lego OR straws/popsicle sticks and Play-Doh OR something else that may work best for your class
	• Shoebox lids (one for each student) or a similar material that could be used to contain and carry their models as needed
	• Completed permission forms for a neighbourhood walk, if applicable
	• Optional: Lego plants (1 per student) or small plants made of green pipe cleaners or another material
	• Optional: Collection of books or other resources about famous world structures (if learning online, you may wish to use Epic or a similar resource to curate a virtual collection for students)

Timeline and Preparation	**First steps** If including a neighbourhood walk, be sure that you have sent/checked permission forms for excursions at least a week in advance. If including a walk, ensure that you have enough clipboards to distribute one to each student. If not, consider pairing students to take shared notes on the walk. Gain familiarity with locations and varieties of perennial plants in the area. If using Lego plants or plants of another material for the models, gather/create one per student.

	Next Steps Consider facilitating a way for students to build prototypes of their plant shelters in time for winter weather, if possible. Look into learning opportunities that build on the ones explored in these learning experiences. Build on the interests that students have expressed throughout and invite them to suggest future directions. **Approximate time for the learning experience:** 45 minutes x 4 These experiences can be extended based on student engagement/interest/driving questions/inquiry.
Safety Considerations	**Personal Protective Equipment (PPE)** -none **What does the teacher do?** ● Be aware of up-to-date safety information ● Plan activities with safety as a primary consideration ● observe students to ensure that they are following safe practices ● Explain and review appropriate use of modeling materials ● Wash or sanitize hands before and after working with materials ● Ensure that students dress for the weather if participating in a neighbourhood walk **What do the students do?** ● Carefully follow the instructions and example of the teacher ● Consistently show care and concern for their safety and that of others ● Follow established safety procedures ● maintain a well-organized and uncluttered workspace ● follow established safety procedures ● identify possible safety concerns ● Utilize tools and materials in a safe manner ● Wash or sanitize hands after investigations Refer to these safety documents

	• Safety in Elementary Science and Technology (STAO) • Safe Activity Foundations in Education Document (SAFEdoc) Science and Technology, Grades 1-8 (OCTE) • Ontario Curriculum Program Planning – Health and Safety
Opportunities For Assessment	**Assessment FOR Learning** • Community circle (use checklist and/or anecdotal notes) • Notes from schoolyard/neighbourhood walk **Assessment AS Learning** As students progress through the challenge, use anecdotal notes and/or a checklist to record evidence of how they engage with the materials and each other, as well as the scientific vocabulary that they use. The students' journal pages can be used as an example of student thinking and understanding. This is a good opportunity to use photography as a form of documentation, if possible. **Assessment OF Learning** The final product of a shelter to protect a plant serves as an assessment of learning. Students should be able to describe the form and function of their shelter and articulate how the two are related. They are encouraged to follow the engineering design process, making changes to their shelter if need be. Work with students to co-create success criteria for evaluating their structures. This is a good opportunity to review the previous learning experiences and celebrate all that students have learned to understand and do. The success criteria can be used as an assessment in which the students and/or teacher reflect on the learning (see Appendix B: Sample Co-Created Success Criteria which includes blank spaces for written reflections).

Instructional Strategies and Adaptability	This learning experience makes use of a variety of instructional strategies. You are encouraged to become a co-learner with students when uncovering science content with them. Look for ways to embed culturally responsive and student-centred instructional practices, celebrating diverse voices and perspectives and inviting students to share their thinking in ways that are meaningful to them. Offer flexibility in how students access material, engage with concepts, and demonstrate their learning. These learning experiences look different in different settings. Some specific suggestions for supporting student learning needs: ● Break down instructions step-by-step and/or ask students to repeat them as needed ● Scribe ideas and/or offer assistive technology for students who require extra support with written output ● Offer the vocabulary and definitions on a handout sheet to students who may benefit from being able to see and refer this information (in addition to the anchor chart) - include visuals as much as possible) ● Include some pre-organized scaffolded statements for students to use in their science journals, particularly those who struggle with literacy (e.g. I noticed _____ about the building). Consider also providing examples of ways to express curiosity and wonder (e.g. I wonder how tall I could build this using my technique?)
Additional Supporting Resources	**Resources:** Teachers can print or link to the following scientific blog post to encourage students to consider how the form and function of carnivorous plants are related: Canadian Museum of Nature **Lovely to Meat You: An Introduction to the Carnivorous Plants of Canada** https://nature.ca/en/lovely-to-meat-you/ Consider expanding the investigation of plants on school grounds through the following project:

	EcoSchools Canada **Greenbelt Biodiversity** https://ecoschools.ca/greenbelt-biodiversity/ You may wish to include this hands-on challenge to deepen students' understanding of natural forces acting on structures: Canada Science & Technology Museum **Jell-o Earthquake** https://ingeniumcanada.org/scitech/education/try-this-out/jell-o-earthquake Scientific vocabulary definitions adapted from Mirriam-Webster: https://www.merriam-webster.com/ Learning games and activities for support: ● Building materials: ○ Lego or Duplo ○ K'NEX ● Virtual building experiences: ○ Minecraft ○ Roblox
Cross-Curricular Opportunities	**Social Studies:** A2. use the social studies inquiry process to investigate some of the major challenges that different groups and communities faced in Canada from around 1780 to 1850, and key measures taken to address these challenges What structures did people in the past in Canada create for shelter? How did they handle different weather conditions? How do these structures compare to the structures we use for shelter in Canada today? **Language:** **Oral Communication**: listen in order to understand and respond appropriately in a variety of situations for a variety of purposes Work in small groups to create models of structures from the past and prepare a presentation **Reading**: read and demonstrate an understanding of a variety of literary, graphic, and informational texts, using a range of strategies to construct meaning Read informational non-fiction texts about famous world structures

	The Arts: **Dramatic Arts** engage in dramatic play and role play, with a focus on exploring themes, ideas, characters, and issues from imagination or in stories from diverse communities, times, and places
Future Opportunities / Next Steps	Further moving forward opportunities for students: ● Consider facilitating a way for students to build prototypes of their plant shelters in time for winter weather ● Investigate the importance of using sustainable materials in the construction of new buildings ● Expand their investigation of plants on the school grounds by joining EcoSchools Canada's Greenbelt Biodiversity action (link in Resources section) What will learners do when the work is completed/if they finish early? ● Use Scratch or a similar coding application to animate the name or a description of their structure - to be shared during the architectural symposium ● Extend their thinking by learning about carnivorous plants in Canada and how their form impacts their function - read the scientific blog post linked in the Resources section and prepare a poster or slide to share their learning with the class ● Engage in the following activism and design challenge: ○ Investigate an element of climate change in the community (e.g. a heat wave or flood). How might you design a structure to withstand these changing forces? ■ OR adapt your current plant shelter for the same purpose Contributions to Science and Technology ● Connect with members of the local community to learn more about careers connected with this set of learning experiences (architect, engineer, city planner, landscape architect)

Appendix A: Science Journals

Name: _____ Date: _____

Data/Observation Recording

What Did You Notice? (Draw, Write, Record, Paste, etc.)

What Do You Wonder? (Draw, Write, Record, Paste, etc.)

Appendix B: Sample Co-Created Success Criteria

Name: _____

Sample Co-Created Success Criteria
Grade Three: How does the design of structure and materials used impact its stability?

Knowledge and Understanding

I Can:	**Not Yet**	**Met**
Build a shelter for a plant by following scientific design and safety procedures.		
Describe what makes my structure strong and stable.		

Thinking

I Can:	**Not Yet**	**Met**
Identify strategies for creating and revising my designs.		
Use creative thinking processes, skills, and strategies to solve a real-life problem.		

Communication

I Can:	Not Yet	Met
Express and organize my thinking to communicate my understanding to my peers and teacher.		
Justify the process that I used and explain how my shelter protects a plant and withstands forces.		

Application

I Can:	Not Yet	Met
Apply the engineer's design process to build a structure that can withstand external forces using the techniques I've learned.		
Transfer my knowledge and skills to solve real-world problems by making connections between other subject areas.		

Descriptive Feedback:

_____

_____

_____