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

Experience 1: What is a structure?

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 first experience, students use a concept attainment approach to explore the meaning of "structure" and address any misconceptions. They then reflect on how their thinking has changed. The goal is to build students' curiosity and wonder about both natural and human-made structures. 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 in the Science and Technology Vocabulary section. Teachers should be open to using thinking routines (like See, Think, Wonder, and "I used to think… but now I think…" with their classes - the more you use these routines, the more comfortable and reflective students will be with them. **Students** Students will likely have some prior experience with structures and materials, which are also explored through the Grade 1 Science curriculum. It is important to consider each student's schema regarding structures and also to be aware of possible misconceptions. For instance, students may think at first that structures have to be buildings and/or that they have to be human-made. They will come to understand that the definition of a structure is broader. Students may come into this series of learning experiences believing that bigger is better when it comes to structures. They will realize that there are certain design principles, like a wide base, that supersede size.

Strand A - STEM Investigation and Communication Skills	**A1. STEM Investigation and Communication Skills**  **A3. Applications, Connections, and Contributions** A3.1 describe practical applications of science and technology concepts in their home and community, and how these applications 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. 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 (see Appendix B: Science 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 ● Emerging Technology ● Skilled Trades ● Contributions to Science and Technology
Learning Experience(s)	**Experience 1: What is a structure?** **Guiding question:** What is a structure and how are they used in different societies? Optional activity (if you have longer than 45 minutes for this experience): Engage students in a Four Corners activity. Label each corner of the room with one of the following: Strongly Agree, Agree, Disagree, and Strongly Disagree. Say and display one of the following statements: A structure is always a building OR All structures are built by people. Give students a minute to think about the statement and their position on it. Then ask them to go to the corner with the label that matches their thinking. While in their corners, they should discuss their thinking with classmates in the same location. Each group will then have a representative who summarizes and shares their key discussion points with the rest of the group. **Minds On (15 min):** Provocation: Project or show a hard copy of an image of a structure that will capture your students' attention. You may wish to choose to show a familiar structure that will inspire students to make

A3.1	connections right away OR you may wish to choose a structure that they have not likely seen before that will generate curiosity. ● This could be an opportunity to incorporate an FNMI perspective - teachers could select an image of a traditional dwelling or other structure from their area (e.g. a longhouse). ● Another opportunity would be including emerging technologies by selecting an image relating to rammed earth (an old building technique being revived as a sustainable choice) and discussing the field of structural science Give students a set amount of time (2 minutes or so) to consider the image silently. You may wish to set and show a timer to highlight this reflection time. Encourage students to observe like scientists. Then invite them to share their reactions, using a whole-class See, Think, Wonder template (see Appendix A: I used to think… but now I think…). Model for students the process of observing the image closely, interpreting it, and asking questions. Use either dot-jot notes or full sentences - you may wish to decide based on what your goals with respect to modeling research skills. Encourage students to differentiate between their actual observations (See) and what they believe those observations mean (Think). Encourage students to consider the form, function, and material of the structure. Where possible, encourage students to think about real-world problems that are addressed or solved by structures, especially with regard to forces (e.g. A longhouse protects people from the elements, in addition to providing a sense of community). Use a blank student checklist or another method to take anecdotal notes, focussing on what students already know, any misconceptions they may have, and questions about structures you can address later. **Action (15 min):** Explain to students that they are embarking on a new learning area. Using Google Slides or a related application OR hard copies, share images of items that are and are not structures (see this Google Slides document for an example). If adapting the slideshow for your own context, including mostly familiar images is recommended -

	students should be able to recognize and discuss each image with confidence. Use a concept development approach by assigning a “yes” or “no” in order to help students see a pattern. Do not reveal the categories yet, but know that the “yes” and “no” indicate whether an image shows a structure according to the following definition from the curriculum: A structure is “**a supporting framework that holds a load and has a definite size, shape, and function**.” When you have shown 10 or so images and their corresponding “yes” or “no” category, invite students to suggest items that they believe could be either a “yes” or a “no”. Give them feedback related to their items (e.g. “Good thinking but, in fact, slime is a ‘no’. Let’s take a moment to think about what makes it different from some of the items we’ve seen in the ‘yes’ category.”) **Consolidation (15 min):** Reveal the “yes” category by showing and explaining the definition of a structure. Teachers are encouraged to post this definition somewhere in the classroom in the form of an anchor chart and refer to it throughout these learning experiences. Invite students to share what surprised them in terms of fitting into the “yes” category (e.g. structures built by animals, structures that are not buildings). Ask students to complete an “I used to think… but now I think…” ticket-out-the-door reflection (see Appendix A: I used to think… but now I think…), either online or in hard copy. You may choose to invite students to share their statements with the class. Sample responses: - “I used to think that a structure had to be a building, but now I think it can be something found in nature.” - “I used to think that structures had to be tall, but now I think that they can be many different shapes and sizes as long as they hold a load and have a purpose.” Summarize by explaining that scientists are always open to revising their thinking as a result of careful observations. We will have further opportunities to try out our ideas and revise our thinking when we complete some building challenges next time. There is still time to

	bring in your recycled materials if you have not done so already! Time permitting, students can record their own reflections and/or sketch some structures in their science journals (see Appendix B: Science Journals). **Possible extensions:** Invite students to build on the concept attainment approach by completing a Frayer model about structures. They should record the definition of a structure and 2-3 of the examples and non-examples, then list some characteristics of structures (e.g. must be strong enough to hold a load). Further explore scientists and how they work, making connections with skilled trades. Give students a blank outline of a person and ask them to turn that person into a scientist by drawing on things like clothing and facial features and writing verbs outside the outline (e.g. questioning, experimenting). Invite students to share their thinking and to discuss what their ideas have in common with skilled trade professionals (e.g. a carpenter tries to find solutions to problems). Engage students in a community circle to think about and answer the question, "What is an important structure in our community and why?" **What the students do:** Initiating and Planning ● Make observations and share conclusions about structures and what they have in common Performing and Recording ● Use an 'I used to think… but now I think…' approach to reflect on and record how their thinking has changed Analyzing and Interpreting ● Use a concept attainment approach to form a definition of structures Communicating ● Participate in a whole-class See, Think, Wonder thinking routine

	● Share their observations, conclusions, and further wonderings in their science journal
Science and Technology Expectations	**D. Structures and Mechanisms** **Strong and Stable Structures** **D1. Relating Science and Technology to Our Changing World** **Overall expectation:** 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 **D2. Exploring and Understanding Concepts** **Overall expectation:** 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 **C. Matter and Energy - Forces and Motion** **C2. Exploring and Understanding Concepts** **Overall expectation:** demonstrate an understanding of how forces cause motion and changes in motion C2.4 identify ways in which forces are used in their daily lives
Science and Technology Vocabulary	**Key concepts and vocabulary** **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 **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 **Structure:** a supporting framework that holds a load and has a definite size, shape and function
Equipment and Materials	• Journal pages or journal notebook (see Appendix B: Science Journals) • Vocabulary wall or chart paper (create as you introduce structures definitions and new vocabulary) • Markers • See, Think, Wonder activity guide (Google Slides or another application OR chart paper) (see Appendix C: See, Think, Wonder) • 'I used to think… but now I think…' activity guide (see Appendix A: I used to think… but now I think…) • Optional: Labels for Four Corners activity
Timeline and Preparation	**Before beginning this series of experiences:** Speak with the school caretaker and/or other teachers or office staff about sending recycled materials your way and/or invite students and their families to send in materials. Be sure to set a timeline for collection (2-3 weeks works well) and be clear about how much you'd like to collect, depending on your storage possibilities - e.g. one small grocery bag per family. Bring in some extra recycled materials of your own in case some students forget or are unable to contribute **First steps** If engaging in Four Corners activity, label each corner of the classroom (Strongly Agree, Agree, Disagree, and Strongly Disagree). Select an image of a compelling structure for See, Think, Wonder. Adapt or create a concept attainment slideshow as needed.

	Create a blank See, Think, Wonder anchor chart or slide. Create and introduce science journals. **Next Steps** Remind students to bring in recycled materials, as needed. If including a neighbourhood walk in Experience 3, be sure to send/check permission forms for excursions. **Approximate time for the learning experience** 45 minutes 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 **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
Opportunities For Assessment	**Assessment FOR Learning** During the whole-class See, Think, Wonder activity, you may choose to use anecdotal notes or an audio/video recording to capture a sense of students' interests, as well as patterns that are common within the class. Focus on what students already know, any misconceptions they may have, and questions about structures that you can address later. This information may guide you to adapt subsequent experiences to best support inquiry in your classroom. **Assessment AS Learning**

	The students' science journal pages can be used as means of assessing student thinking, application and communication. Follow up orally as needed. As students begin to engage with structures in a hands-on way, give them opportunities through their journals and class discussions to communicate all aspects of the scientific method, from hypothesis to conclusion. **Assessment OF Learning** The I used to think… but now I think… ticket-out-the-door reflection gives students an opportunity to share how their thinking has changed with regard to what a structure is. Circulate as students complete this and ask them follow-up questions, as needed, to better understand - and help them better understand - their conceptualization of a structure.
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: Scientific vocabulary definitions adapted from Mirriam-Webster: https://www.merriam-webster.com/ Information about skilled trades: Follow your passion. Find your skilled trade. Learning games and activities for support: Students can explore the concept of a structure in a hands-on way through ● Building materials such as ○ Lego or Duplo ○ K'NEX ● Virtual building experiences such as ○ Minecraft ○ Roblox
Cross-Curricular Opportunities	**Language** **Oral Communication:** 1. listen in order to understand and respond appropriately in a variety of situations for a variety of purposes **Writing:** 1. generate, gather, and organize ideas and information to write for an intended purpose and audience **Mathematics** Extension possibility: Sort the images from the slideshow into a Carroll diagram D. Data D1. Data Literacy: manage, analyse, and use data to make convincing arguments and informed decisions, in various contexts drawn from real life

	Social Studies: If selecting an image of a structure from the past for See, Think, Wonder: A1. Application: compare ways of life among some specific groups in Canada around the beginning of the nineteenth century, and describe some of the changes between that era and the present day (FOCUS ON: Continuity and Change; Perspective)
Future Opportunities / Next Steps	Further moving forward opportunities for students: ● Research a famous structure (past or present) and create a brochure or presentation about it What will learners do when the work is completed/if they finish early? ● Sketch in your journal different examples of natural and/or human-made structures and write a caption for each one Contributions to Science and Technology ● Investigate contributions made by Black and FNMI individuals or groups to design and building (e.g. Lonnie Johnson - invented the Super Soaker while working on a NASA mission)

Appendix A: I used to think… but now I think…

Name: _____ Date: _____

I used to think… but now I think…

Topic: Structures	
I used to think…	But now I think…
Reflection: What changed? What caused your thinking to shift?	

Appendix B: 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.)

Plan/Design

My Ideas (Draw, Write, Record, Paste, etc.)

What I Need (Draw, Write, Record, Paste, etc.)

Appendix C: See, Think, Wonder

Name: _____ Date: _____

What do you see? What do you think about that? What does that make you wonder?

SEE	THINK	WONDER