

Let's Do Science

Grade One

Building Things



Science Alberta Programs for Your Classroom



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Building Things Before You Begin

Children love building! It allows them to imagine, design, create, manipulate and explore. This unit provides an opportunity for students to build objects using a variety of materials and construction techniques. There are opportunities to test building materials and to solve problems related to structure and design. Children will be able to relate their building structures to those in their environment and, with guidance, begin to recognize the component parts that make up the whole.

Topic C: Building Things

(Suggested time: 4-6 weeks)

This unit can be completed in early fall or spring if field trips to a construction site are planned, otherwise it could be taught during the winter. A suggestion of four to six weeks is made to allow for manipulation of materials, creation of structures, redesign work and comparisons to other models in the children's school and community environment.

At the beginning of this unit, allow the children uninterrupted free exploration with a choice of materials, and establish routines for taking out and putting away the material bins.

Children of different ages and grade levels can take part in some of the activities. Parents or older children will be needed to assist in some of the activities or to help monitor the ongoing progress students are making in their building projects. Because most of the children's constructions are easily broken, or because you may want to reuse the materials, consider photographing their completed projects and displaying these photos later.

This unit lends itself to centre activities. Before beginning, set up a centre consisting of different commercial materials, such as LEGO, Attribute, pattern blocks, wooden blocks and dominoes. Also, send a letter home requesting empty milk cartons, boxes of varying sizes, cans, straws, etc. These materials are needed for building various structures. Consider soliciting donations of materials from building and plumbing supply stores and collect large boxes from community stores for storing things.

This unit is the building block for the grade 3 units Building with a Variety of Materials and Testing Materials and Designs.

Background Information

The focus of the Building Things unit is *engineering*, the application of science to the design and creation of a desired product. This unit provides an introduction to the concepts of design, construction and product integrity, which are explored further in the grade 3 units Building with a Variety of Materials and Testing Materials and Designs. Construction skills are best acquired through hands-on experience. The basic steps in the design process can be tackled from a structured approach.

Purpose and Function

The first and most crucial step in the design process is determining the exact problem or problems your product is to overcome. What is the purpose or function of the object you are building? Do you need a structure that provides shelter or a bridge to connect two communities?

The designated function of your product-to-be dictates the nature of the components and features you will include in its design. For example, the primary function of a house is to provide shelter from inclement weather and predators. To this end, houses are usually enclosed structures that incorporate defensive walls and weather-resistant roofing systems as their essential components. In addition, these components are generally opaque (even though transparent glass walls are technically possible) because an important secondary function of a house is to ensure privacy.

Whereas function dictates the basic components required, the environment in which the object must fulfill its function dictates the materials these components must be made of. A house built with ice blocks works just fine in the Arctic but wouldn't last long in the desert. A scientific laboratory constructed of brick might function for many years in Red Deer but would not be expected to hold together in the vacuum of outer space or withstand the immense pressure on the bottom of the ocean floor.

Materials

The engineer has a wide array of solid materials from which to choose: metals and metal alloys, organic materials (such as wood, paper and natural rubber), glass, concrete, ceramics (fired clay products such as tiles, bricks and pottery), polymers (for example, plastics, synthetic fibers and synthetic rubber) and composites (strong, lightweight materials produced by embedding fibre in a matrix of plastic, metal or ceramic). The physical properties of each material are unique and help guide design considerations. Some important characteristics of materials that are taken into account include: strength, brittleness, flexibility, weight, density and resistance to heat, cold, fire, liquids, solids, gases, corrosive chemicals, sound or electricity. (For a more detailed discussion of these properties, see grade 3 Building with a Variety of Materials.)

Comparing Constructions

On occasion, the choice of materials used is influenced by factors other than optimal functional suitability. Economy, availability of resources, esthetics, cultural conventions and safety concerns can impact both the form and material makeup of the final product.

Product integrity—the ability of the finished product to fulfill the function for which it was designed and to continue doing so for an acceptable period of time—depends on both the design and the workmanship that goes into the execution of the design. If long-term durability is desired, materials must be chosen that will retain their original properties in the face of anticipated stress factors; for example, high winds, repeated blows or extreme temperature fluctuations. And even the strongest components cannot ensure the integrity of a product if they have been assembled without due care. A poorly executed joint or an improper alignment of parts can sabotage the best of designs.

Children playing with construction materials naturally introduces them to the scientific concepts of structural integrity. As children create structures based on observations made in their environments, they are quick to make links between their constructions and the shapes and buildings in the world around them. Children have many opportunities to develop their problem-solving skills as they build and reconstruct. By planning and building models, children learn about the three-dimensional forms of the structures they observe.

Elementary Science Program of Studies

General and Specific Learner Expectations

The following general and specific learner expectations have been taken directly from the 1996 Elementary Science Program of Studies. The specific learner expectations (SLEs) are referred to by number in the second column of the activities table.

General Learner Expectations

Students will be able to:

- Use a variety of different materials in constructing objects and models of objects.
- Identify the purpose of different components of a personally constructed object or model, and identify corresponding components in a related object or model.

Specific Learner Expectations

Students will be able to:

1. Select appropriate materials, such as papers, plastics, woods, and design, and build objects based on the following kinds of construction tasks.
 - Construct model buildings; for example, homes from other cultures, homes of animals, garages, schools
 - Construct model objects; for example, furniture, equipment, boats, vehicles
 - Construct toys; for example, pop-ups, figures
 - Create wind- and water-related artifacts; for example, dams, waterwheels, boats
2. Identify component parts of personally constructed objects and describe the purpose of each part.
3. Compare two objects that have been constructed for the same purpose, identify parts in one object that correspond to parts in another and identify similarities and differences between them.
4. Recognize that products are often developed for specific purposes, and identify the overall purpose for each model and artifact constructed.

Cross-curricular Connections

Mathematics

- Graph, sort and classify, patterning, using geometry, measuring

Social Studies

- Grade 1, General Outcome 1.1 My World: Home, School and Community
Construct a model of a school with prominent features (a whole class project)

Language Learning

- General Outcome 1:
Students can write “experience” stories after doing many of the building activities. They also can illustrate the steps involved in building a house in cartoon form, labelling each step.
- General Outcome 3: Record information
Students build structures with a variety of materials. They record their structures in journals and name their structures.

Drama

- Students build a variety of structures together in small groups. Students represent walls, foundations and bridges, and position their bodies accordingly. They can then verbalize their part and purpose, i.e. their role in the construction of the structure.

Children’s Alternative Frameworks

A common alternative framework children bring to this unit is the notion that structures don’t require bases or support. Involve your children in a number of activities requiring them to design and build structures. Focus on the importance of building a solid base or support first.

Many children believe that only animate or living objects can exert a force. Few children in primary grades understand that a freestanding structure they may build on the floor has forces acting upon it.

Activities

Classroom teachers have identified the following activities that address the Specific Learner Expectations (SLEs) in the Program of Studies. The list is not prescriptive and teachers may select activities that are most appropriate for their students.

Activities have been listed under two headings: Key Activities and Extension Activities. Key activities are supported by authorized resources and identify “powerful and practical” means for achieving learner expectations. Extension activities represent alternative ways of achieving or supporting learner expectations.

Key Activities

Key Activity	SLE	Print Resources	Essential Materials	Comments
Introducing building through manipulation of materials and using related literature		<i>Explorations in Science, Level 1, Under Construction (Free Exploration)</i> , p. 6 <i>Innovations in Science, Level 1, Building Things (Let's Build)</i> , p. 5 and Theme Card 20 – <i>And I Mean It Stanley</i>	collected building materials (e.g., bins of commercial building toys and blocks, bins of large and small cartons, a bin of straws, toothpicks, modelling clay, large blocks, cardboard boxes, paper rolls, egg cartons)	This initial exploration of materials will allow children to determine properties of various materials. Teachers may want to provide a criterion, such as build the tallest free-standing tower. Allow time for sharing. Consider using photographs to make a record of students' work.
Building cooperatively using simple building blocks	1, 2, 4	<i>Innovations in Science, Level 1, Building Things (Building Blocks)</i> , p. 8 <i>Explorations in Science, Level 1, Under Construction (Cooperative Building)</i> , p. 13	variety of building blocks	
Building toys		<i>Windows on Beginning Science: Constructions (Westley) (Toys on Wheels)</i> , p. 56 <i>Bright Ideas: Design and Technology (Newton & Newton) (Moving Toys)</i> , p. 94	drawing paper, toilet paper rolls, wood, fabric, dowels, brass pins, glue, paper, wool, thread, boxes of various types	Parent volunteers may be required to assist in the Jack-in-the-Box activity. Print the problem-solving challenges onto paper strips and put into a pocket chart for children or helpers to refer to: e.g., “Build something that uses only 10 blocks and is wide at the bottom and narrow at the top.”
Building tall structures using blocks	1, 4	<i>Innovations in Science, Level 1, Building Things (Build It Up)</i> , p. 11 <i>Explorations in Science, Level 1, Under Construction (Towering Towers)</i> , p. 12	building blocks of different sizes, shapes and thicknesses (cones, pyramids, cylinders, spheres, rectangular solids, cubes), drawing paper	Through the completion of these activities, children test the strength and support of their structures.

Key Activity	SLE	Print Resources	Essential Materials	Comments
Observing walls in the school and community and exploring how blocks can be used to create familiar structures	1, 2, 3, 4	<i>Explorations in Science, Level 1, Under Construction (Building Walls)</i> , p. 15 <i>Explorations in Science, Level 1, Under Construction (Cube Buildings)</i> , p. 18	Plasticine, clay, soil and water, sand and water, construction blocks, balls, building blocks, small cubes, cardboard, hole punch, paper fasteners, milk cartons	Children design a pattern wall using construction blocks or bricks that were made in a previous lesson. Children can be encouraged to test the wall for strength and durability. Encourage the children to explore staircase patterns using small blocks. Milk cartons, taped or glued together, can be made into a somewhat permanent wall to be decorated.
Building bridges	1, 2, 3, 4	<i>Innovations in Science, Level 1, Building Things (Bridging the Gap)</i> , p. 18 <i>Explorations in Science, Level 1, Under Construction (Building Bridges)</i> , p. 16	a variety of building materials such as blocks, pieces of cardboard, stir sticks, straws, string, newspaper, long cardboard strips, bean bags, small toy car, building blocks, blue construction paper, marbles, books about bridges, pictures of bridges, scrap wood	Children are encouraged to test the strength and durability of their bridges. The <i>Three Billy Goats Gruff</i> is an excellent story to read with this particular activity. Gather a picture collection of different types of bridges: arch bridges, beam bridges, cantilever bridges, suspension bridges and bridges being used for pedestrians, automobiles and trains.
Creating and testing structures using toothpicks and straws	1, 2, 3, 4	<i>Explorations in Science, Level 1, Under Construction (Toothpick Buildings)</i> , p. 19 <i>Explorations in Science, Level 1, Under Construction (Straw Buildings)</i> , p. 20 <i>Innovations in Science, Level 1, Building Things (Standing Tall)</i> , p. 14	cardboard, toothpicks, straws, modelling clay, pieces of stiff paper, pipe cleaners chart paper, drinking straws (100), Plasticine, cardboard, Popsicle sticks	Children construct models for stability and then record their efforts in their science journals. This can be used as an evaluation lesson. Teachers can encourage students to compare two structures as a means of testing structures for stability.
Building model homes	1, 2, 3, 4	<i>Innovations in Science, Level 1, Building Things (Building Houses)</i> , p. 21	construction blocks, straws, sticks, Plasticine, boxes, material, cling wrap, brass pins, scissors, glue, paint, chart paper, building tools such as hammers, saws, nails, screwdrivers, cement, bricks, wood, wires, pipe, milk cartons, cardboard boxes, shoeboxes, construction paper, light cardboard, Popsicle sticks, toothpicks, wallpaper samples	This activity can be used to develop an awareness of the construction process, including both the processes that children use and ones that are used on construction sites in the community. The <i>Three Little Pigs</i> is an excellent story to use to show the purposes of using different building materials when building homes. Volunteers would be of assistance with this activity.

Extension Activities

Extension Activity	SLE	Print Resources	Essential Materials	Comments
Designing and constructing unusual buildings	1, 2	<i>Innovations in Science, Level 1, Building Things (Weird and Wonderful)</i> , p. 26 and Theme Card 22 – <i>Wonderful Buildings Explorations in Science, Level 1, Under Construction (My Very Own)</i> , p. 23	paper plates, glue, Plasticine, toothpicks, straws of different lengths, Popsicle sticks, cotton batting, construction paper, light cardboard, paper muffin-cups, pipe cleaners, wallpaper samples, interesting or unusual art materials, glue, tape, light cardboard	Children construct a variety of unusual buildings. This activity enables children to demonstrate what they have learned about balance and support.
Working cooperatively to build a model of a chosen site	1, 2	<i>Explorations in Science, Level 1, Under Construction (Building a Site)</i> , p. 21	boxes, containers, paper rolls, straws, toothpicks, modelling clay, art materials, tissue paper, felt and material scraps, Popsicle sticks	Children work cooperatively to design and create a playground, school or fantasy land.
Building a gingerbread house			gingerbread, icing, decorations	It takes a lot of time and help to construct. Work through it in stages. You may want to start by making a frame of straws, (you can use a 250 ml milk carton for support), measuring it and then making a pattern from it. Graham wafers may be used in place of gingerbread.
Building structures from recyclable materials	1	<i>Explorations in Science, Level 1, Under Construction (Recycling Together)</i> , p. 22	junk materials collected by students	It may take several days for the children to complete their structures. You will need to arrange space for their projects.
Building fences	1	<i>Explorations in Science, Level 1, Under Construction (Building Fences)</i> , p. 17	Popsicle sticks, straws, tongue depressors, modelling clay, glue	

Assessment

For a broader discussion of science classroom assessment techniques see *Assessing Student Learning* in the introduction of this publication on p. 15. Good places to begin looking for the unit-related ideas are the *Explorations in Science* assessment handbooks, *Innovations in Science* teaching notes, Unit tests and Portfolio ideas, Alberta Education sample tests at www.education.gov.ab.ca and Alberta Assessment Consortium at www.aac.ab.ca

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