MAKING & DESIGN THINKING AT HOME

SkillsCanada Alberta

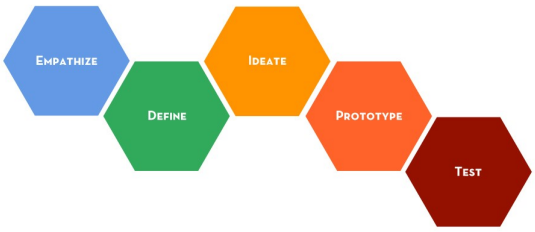
A VIRTUAL GUIDE

JOIN THE MAKER MOVEMENT

The Maker Movement is a social movement fueled by the human need to use "our hands and imaginations together to make things and then make those things better" (Hatch, 2014). Skills Canada Alberta (SCA) believes that making and tinkering are important building blocks for Alberta's youth to discover their own skills and passions. With some imagination, simple tools and materials, anyone can design and build a prototype that could solve a real life problem! (Note: The design challenges supplied in this virtual guide were originally designed to complement and support Alberta Education's Career and Technology Foundations (CTF) Program of Studies for grades 5-8 students.)

GET STARTED AT HOME

Step One: **Watch This Design Thinking Video** (4 mins) - Learn the 5 steps of the design thinking process and why the design thinking process is important to build a meaningful prototype.



Empathize: Learn about someone else

Define: Find out what is most important to that person

Ideate: Brainstorm & sketch ideas to solve their problem

Prototype: Build a representation of your ideas

Test: Test your prototype and get feedback from others

Step Two: **Pick a Design Challenge & Start Researching** - Choose a design challenge topic (below) that you are interested in! A design challenge is a real life problem that must be solved. It is important to take time to research and understand the concepts and vocabulary terms used in the challenge. The more background knowledge the students gain, the more successful and meaningful their prototype will be. Use the links in the design challenge to learn more!

Step Three: **Use the Design Thinking Activity to Create Ideas & Sketches** - Students must understand that they will **not** be designing a prototype for themselves, but must put themselves into the shoes of others to gain empathy and create ideas to help solve another person's problem. The final sketch will be the million dollar design that will solve the design challenge! Use the final sketch as a blueprint to build your prototype. Print the Design Thinking Activity on page 3 for each student (or use a blank piece of paper to create your own template.)

Step Four: **Get Building & Turn Your Sketches Into A Prototype** - Turn your ideas into a real life prototype! Gather simple hand tools and materials and start building a masterpiece! Below is a list of some simple tools and materials you might find laying around your house. Safety is #1 so ask an adult for help when using sharp or hot tools!

Cardboard	Glue Gun	Playdough or Clay	Wire
Boxes	Glue Stick	Tape (Variety)	String
Styrofoam	Scissors or Utility Knife	Straws	Zip Ties
Tin Foil or Saran Wrap	Markers	Skewers	Nails or Screws
Garbage Bag	Ruler or Measuring Tape	Toothpicks	Scrap Fabric & Notions
Small Pieces of Wood	Hammer or Power Drill	Popsicle Sticks	Computer Designs
Bottles or Cans	Handsaw	Pipecleaners	Anything You Can Find!

Step Five: **Test Your Prototype & Share It** - Once you're done building, test the prototype to see if it works properly to solve the problem. By testing it, you can see if there are any changes or modifications that can be made to make it better. Don't forget to share your prototype with us @skillsalberta or #ABisSkilled.

***A prototype is a model that demonstrates how an idea or design looks like and how it works in real life. It may be life sized or scaled to fit in your hand. A prototype needs to be as real looking as possible, using the materials available.**

Design Thinking Activity

1. EMPATHIZE: Learn about someone else

Gain empathy by having a conversation with someone to find out what they know about the topic.

What do important concepts or terms (in the design challenge) mean to them? Ask for examples they may have seen or heard. Find out what is most important to them by asking them to: "tell me stories, "tell me more about that", "tell me why you feel that way", or follow up on points that intrigue you. Write your notes here.

2. DEFINE: Find out what is most important to that person

_____

Person's name

needs a way to _____

What problem is most important to that person that you need to solve?
What are they most concerned about? What are they most passionate about?

because _____

_____

Explain why this problem is important to that person. Use facts or stories to help explain.

3. IDEATE: Brainstorm solutions to solve their problem

Brainstorm & sketch 4 ideas to help solve their problem

Add lots of detail. Use words and arrows to help describe your sketches

Share your sketches, gain feedback & redesign ONE idea

Redesign or create a new idea using feedback from the person. This final sketch is the best design that will solve their problem. Use this final sketch as a blueprint to build your prototype.

DESIGN CHALLENGES

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
1. **Designing a Healthy Lunch Experience**	• Affordable lunch options • Nutrition • Food integrity • Product design	• CTF Human Services • CTF Business • CTF Communications • Framework for Kindergarten to Grade 12 Wellness Education (Alberta)
2. **Using Simple Machines to Make Overly Complex Compound Machines**	• Simple and compound machines • Mechanical advantage • Aesthetics and quality	• CTF Communications • CTF Technology • Science—specifically Physics and Mechanical Advantage
3. **Considering Maslow's Hierarchy Through a Refugee Lens**	• Current events • Refugees • Psychology • Social Justice	• CTF Communications • CTF Human Services • Social Studies
4. **Inclusive Communities**	• Current events • Refugees • Citizenship	• CTF Communications • CTF Human Services • Social Studies

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
5. Froebel's Gifts: Building Blocks to Learning in Early Childhood and Primary Education *A Resource for Teachers and Parents*	• Imagination and creativity • Self-confidence and a feeling of accomplishment • Sense of responsibility for block care and clean-up	• CTF Business • CTF Technology • General early learning and readiness skills and abilities, including • Pre-number skills such as size, shape, matching and classification • Critical thinking and problem solving
6. Animal Care	• Animal care • Simple circuits • Environment	• CTF Business • CTF Communications • CTF Resources • Social Studies • Science
7. Frugal Innovation for a Sustainable, Happy Future	• Sustainability • Innovation • Globalization	• CTF Business • CTF Human Service • CTF Resources • CTF Technology • Social Studies • Science
8. *Chindogu*: Designing Purely for the Joy of Design	• Creativity • Design • Sociology • Imagination	• CTF Business • CTF Communications • CTF Technology • Fine Arts

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
9. Hand Shadows: Seeing is Believing	• Creativity • Design • Theatre • Imagination	• CTF Communications • CTF Human Services • Fine Arts • Drama • Citizenship
10. Geometrigraph and Polygraph Templates: Designing with Geometry	• Drawing geometric shapes • Creating ornamental shapes	• CTF Communications • Mathematics • Geometry • Fine Arts and Design
11. Automata	• Mechanical structures • Machines using cams, levels, linkages, connections, etc.	• CTF Communications • CTF Technology • Mathematics • Social studies • Language Arts • Fine Arts and Design
12. It's Never Black or White or Paper or Plastic	• Complexity inherent in recycling—why simple solutions are sometimes not the best options	• CTF Business • CTF Resources • Science • Social studies • Economics

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
13. Between a Number and a Person: Considerations of Identity and Respect	• Development of federal identification systems	• CTF Business • CTF Communications • CTF Human Services • CTF Technology • Social studies • Fine Arts and Design
14. Agricultural Automation	• Agricultural tool or process innovations • Economic diversification	• CTF Resources • CTF Technology • Social Studies • Science
15. Classroom Furniture	• 21st century learning • Ergonomic design • Aesthetics and functionality	• CTF Communications • CTF Technology • Fine Arts • Health, Career & Life management
16. Integrative Learning/ Integrative Living *A Resource for Teachers*	• Diversified economy • Diversified living • Ecology and ecosystems	• CTF Business • CTF Communications • CTF Human Services • CTF Resources • CTF Technology • Science • Social Studies
17. Waste Management	• Recycling • Trash reduction	• CTF Communications • CTF Resources • CTF Technology • Science

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
18. Defining the Components of Society Using Artist Trading Cards	• Belonging • Society and youth empowerment	• CTF Communications • CTF Human Services • Fine Arts • Health, Career & Life management
19. Apathy to Empathy	• Society and youth empowerment • Social issues	• CTF Communications • CTF Human Services • Health, Career & Life management
20. Displaced Students	• Belonging • Society and youth empowerment • Social issues	• CTF Communications • CTF Human Services • Health, Career & Life management
21. Growth Mindset: Electricity *A Resource for Teachers*	• Electricity—scientific principles • Electricity—safety	• CTF Resources • CTF Technology • Science
22. Developing Historical Empathy	• Social issues • Belonging • Social Injustice • Aboriginal issues	• CTF Communications • CTF Human Services • Social Studies • Health, Career & Life management
23. Eco-smart Recreation Facility	• Diversified economy • Diversified living • Ecology and ecosystems • Recreation	• CTF Communications • CTF Human Services • CTF Resources • CTF Technology • Physical Education • Health, Career & Life management

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
24. Water Conservation	• Water • Ecology • Conservation • Sanitation	• CTF Resources • CTF Technology • Science
25. Alternative Dwellings	• Housing • Architectural design • Interior design	• CTF Communications • CTF Technology • Fine Arts • Social Studies
26. Mars Shelter and Transportation	• Housing • Transportation • Space—interplanetary living	• CTF Communications • CTF Technology • Science
27. Stimulating Our Senses	• Sensory processing challenges • Sensory smarts	• CTF Communications • CTF Technology • Health, Career & Life management • Physical Education
28. Inclusive Playgrounds	• Inclusive • Play • Recreation	• CTF Communications • CTF Technology • Physical Education • Health, Career & Life management
29. Outdoor Classroom	• 21st century learning • Ergonomic design • Aesthetics and functionality	• CTF Communications • CTF Technology • Health, Career & Life management

Design Challenge	Topic	CTF Curricular Cluster with Suggested Interdisciplinary Connection(s)
30. Outdoor Learning Spaces	• 21st century learning • Ergonomic design • Aesthetics and functionality	• CTF Communications • CTF Technology • Health, Career & Life management • Physical Education
31. Up-cycling Fashion	• Clothing • Social justice • Fabric design	• CTF Communications • Fine Arts • Health, Career & Life management

1 Designing a Healthy Lunch Experience

Overview

Everyone knows that packing our own lunch on a regular basis saves money and gets us to eat healthier. But like other healthy things (e.g. exercise, personal wellness, time management, etc.), we often lose our way and forget to make the time it takes to do what is best for us.

Design Rationale

The busy world of work/life balance, combined with the ever increasing cost of good food, we need to pause and consider what might be a healthy and sustainable lunch experience.

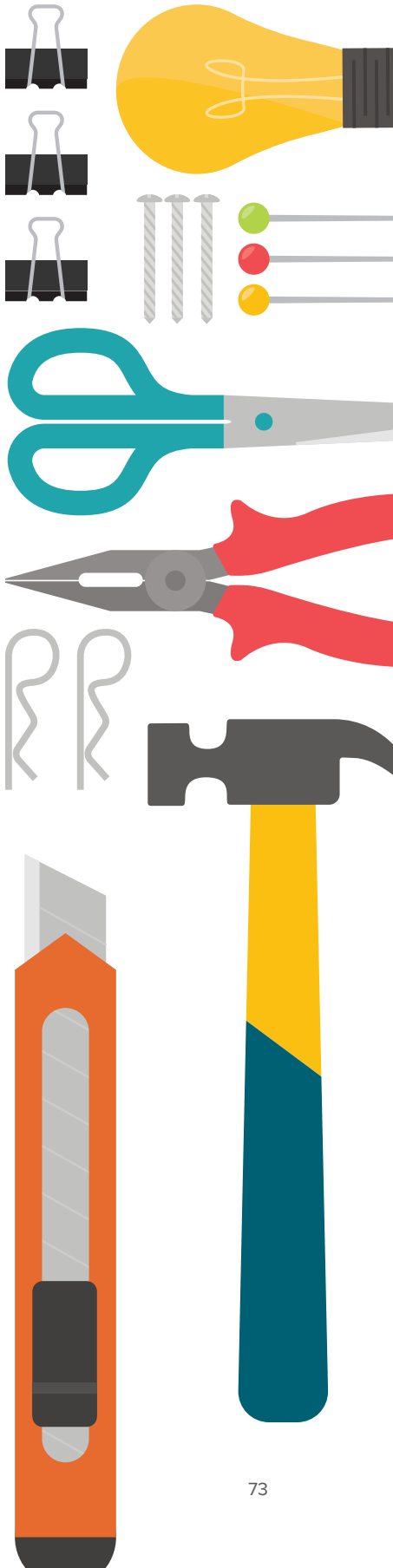
The website Lifehacker offers an interesting formula to help us to have a balanced, delicious box lunch experience (**http://lifehacker.com/pack-healthy-hearty-lunches-with-this-six-layer-formul-1752826181**).

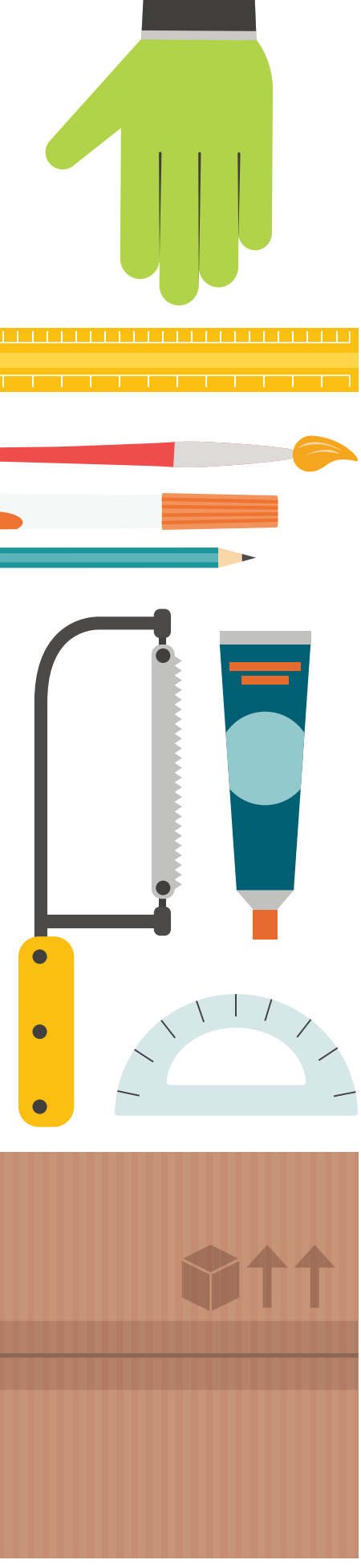
Central to the formula is the notion of the six-layer lunch experience which consists of the following elements:

- **Grains:** Anything from rice to quinoa, this will act as the foundation of your meal and be integral to staying full the whole afternoon. Obviously optional if you're watching your carbs.
- **Seasonal vegetable:** You can throw in more than one veggie, whichever ones you happen to have on hand. This is a great layer to use up roasted veggies from last night's dinner.
- **Leafy greens:** Raw or cooked, greens will bulk up your lunch, and if you're cutting out grains or watching your carbs, switch these out as the base of your lunch for a fibrous, healthy alternative.
- **Protein:** Tons of ways you can go here, from sliced chicken, cured meats, tofu cubes, beans, or a hard boiled egg.
- **Sour/acidic flavor:** Lighten things up and pull your dish together with an acidic dressing, sauce, or even just a squeeze of lemon.
- **Healthy fats:** This is your chance to really customize each day's lunch, from olive oil to avocado to nuts.

Of concern is how to "pack" and "transport" our healthy lunches in a way that looks good, trendy, and keeps all the food elements in an appetizing way that maintains the integrity and goodness of each of the food elements. Globally, there are many great solutions to this concern. Examples include:

- Tiffin boxes (**http://www.indian-tiffin.com/information.php?info_id=7**)
- Bento boxes (**http://en.bentoandco.com/collections/bento-boxes-newest-oldest**)





The foodie site, Bon Appétit offers some excellent food examples packed away in a Bento box (**http://www.bonappetit.com/trends/article/bento-box-lunch-recipe**).

Problem Scenario

Your team has been selected to develop the perfect lunch box that addresses the problems we face in packing and transporting a healthy lunch. Currently, we see the use of brown bags, throw away containers, and generally unappetizing lunch solutions. Your task is to make a solution to this problem that is different from those already available on the market.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Addresses the design challenge
- ❒ Addresses an identifiable need for the end-user
- ❒ Uses the provided materials, resources, and tools
- ❒ Is a helpful and unique option for those of us considering packing and transporting our increasingly healthy lunches

Parameters

- ❒ Plan how to use something of every consumable item in the participant group kit provided.
- ❒ You can use items from the pantry.
- ❒ You can use any of the tools that have been provided.
- ❒ Your prototype could be a scale version rather than actual size.

Suggestions for Use

- The Healthy Lunch Experience design challenge has been used successfully with students Grades 7–12 and with teachers. Obvious curricular connections can be in both Alberta and British Columbia learning outcomes. Specifically, content found in the British Columbia Applied Design, Skills, and Technologies K-12 curriculum (**https://curriculum.gov.bc.ca/sites/curriculum.gov.bc.ca/files/pdf/applied-skills.pdf**). The Framework for Kindergarten to Grade 12 Wellness Education attends to Physical Wellness, focusing on healthy growth, development, nutrition and care of the body (**https://archive.education.alberta.ca/media/1124068/framework_kto12well.pdf**).
- The importance of eating healthier lunches has prompted an Indiegogo campaign—Prepd Pack: The Lunchbox Reimagined—which includes containers as well as a smart app to help you purchase food and organize menus (Indiegogo campaign: **https://www.indiegogo.com/projects/prepd-pack-the-lunchbox-reimagined-app-food#/** and Prepd website: **https://www.getprepd.com/**).

2 Using Simple Machines to Make Overly Complex Compound Machines

Overview

Einstein is quoted as saying, “Everything should be made as simple as possible, but not simpler.” Simple machines are classic examples of what Einstein claims. They are classified in six types, and they can be found everywhere—often in some very surprising places and things. Simple machines offer mechanical advantages, which makes it easier to do work. The six simple machines are levers, inclined planes, wedges, screws, wheels and axles, and pullies.

Design Rationale

It is important to understand the principles, functions and application of simple machines. The workings of simple machines are central to most of our significant accomplishments in buildings, tools, and technologies.

When simple machines are combined into another machine, they are called compound machines. For example, a bicycle is made up of levers (shifters, derailleurs, handlebars, freewheel assembly, brakes); wheels and axles (the wheels, pedals, crankset); pulleys (parts of the shifting mechanisms, braking mechanisms, and the chain on gears); screws that hold parts together; and wedges (the teeth on the gears). When all the simple machines on a compound machine like a bicycle work well together, riders gain a mechanical advantage of traveling faster then they could if they were walking.

Compound machines can be highly technical like airplanes or relatively simple such as a hand powered can opener. The master of making compound machines profoundly complicated, highly whimsical, quirky, and fun was Rube Goldberg (1883–1970), an engineer and cartoonist who invented contraptions that made every day, simple tasks more complicated. His contraptions are the absolute opposite of Einstein’s idea!

To this day, Rube Goldberg Contraptions delight us (**https://www.rubegoldberg.com/**). However, at the heart of every contraption is a collection of interdependent simple machines.

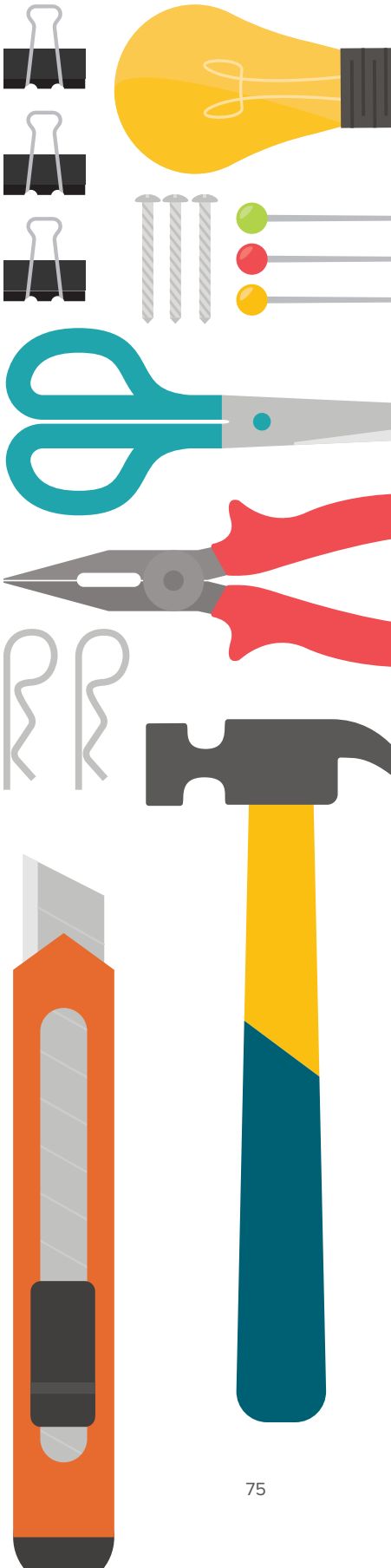
Problem Scenario

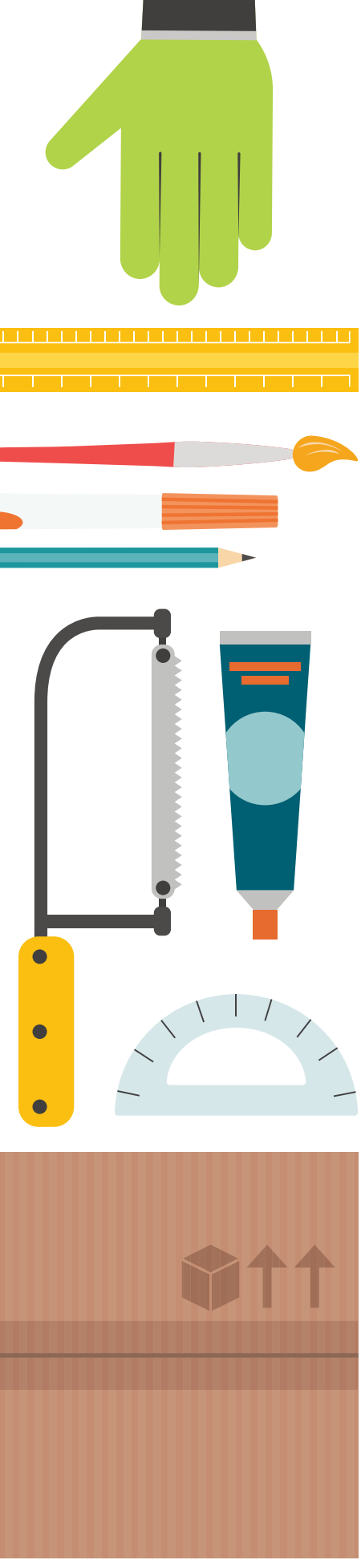
Your team has been selected to develop the ultimate Rube Goldberg contraption capable of moving the marble—found in the participant group kit provided—the furthest distance, over the longest period of time, in the most complex manner.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Is accompanied by a highly elaborate sketch illustrating functionality
- ❒ Addresses the design challenge
- ❒ Uses the provided materials, resources, and tools





- ❒ Shows evidence of your group's understanding of the mechanical advantage provided by the six simple machines
- ❒ Is whimsical and makes us smile
- ❒ Has a clear theme or story (i.e. maybe the marble is a metaphor for a creature that is trying to escape)
- ❒ Has a high degree of absurd complexity (very, very unnecessarily complicated)
- ❒ Is aesthetic and well constructed
- ❒ Is reliable—the marble can be put on its journey multiple times

Parameters

- ❒ Plan how to use something of every consumable item in the participant group kit provided.
- ❒ You can use items from the pantry.
- ❒ You can use any of the tools that have been provided.
- ❒ Your contraption can be no larger than 2 feet x 2 feet x 2 feet square.
- ❒ You must use all six simple machines at least once within your contraption.

Suggestions for Use

- *The Kids' Book of Simple Machines: Cool Projects & Activities That Make Science Fun* by Kelly Doudna is a terrific resource for this design challenge (**https://www.amazon.ca/The-Kids-Book-Simple-Machines/dp/1938063597?ie=UTF8&*Version*=1&*entries*=0**).
- Rather than a Rube Goldberg machine, think about designing a vending machine for a specific purpose. The Japanese are recognized as being the best of vending machines.
  - **http://kotaku.com/5988536/the-wild-and-wonderful-world-of-japanese-vending-machines**
  - **https://www.google.ca/search?q=japanese+vending+machines+%2B+best+in+the+world&tbm=isch&tbo=u&source=univ&sa=X&ved=0ahUKEwjygaOk2uHLAhUS0mMKHY9ZCEIQsAQIIQ&biw=1107&bih=1022**
  - *40 Things You Don't Expect to Find in Vending Machines*—including live crabs and fresh baguettes **http://www.hongkiat.com/blog/bizarre-vending-machines/**
- Obvious curricular connections can be in both Alberta and British Columbia learning outcomes—science and physics. The CTF Program of Studies incorporate curricular areas drawing on simple and compound machines and mechanical advantages within its occupational clusters.
- Please use the rubric on the following pages for summative assessment of the machine. This rubric was generated using Rubistar and is available online as #2614115 (**http://rubistar.4teachers.org/index.php**).

Rube Goldberg Rubric	4	3	2	1
Function	Structure functions extraordinarily well, holding up under atypical stresses.	Structure functions well, holding up under typical stresses.	Structure functions pretty well, but deteriorates under typical stresses.	Fatal flaws in function with complete failure under typical stresses.
Scientific Knowledge	Explanations by all group members indicate a clear and accurate understanding of scientific principles underlying the construction and modifications.	Explanations by all group members indicate a relatively accurate understanding of scientific principles underlying the construction and modifications.	Explanations by most group members indicate relatively accurate understanding of scientific principles underlying the construction and modifications.	Explanations by several members of the group do not illustrate much understanding of scientific principles underlying the construction and modifications.
Plan	Plan is neat with clear measurements and labeling for all components.	Plan is neat with clear measurements and labeling for most components.	Plan provides clear measurements and labeling for most components.	Plan does not show measurements clearly or is otherwise inadequately labeled.
Construction, Materials	Appropriate materials were selected and creatively modified in ways that made them even better.	Appropriate materials were selected and there was an attempt at creative modification to make them even better.	Appropriate materials were selected.	Inappropriate materials were selected and contributed to a product that performed poorly.
Construction, Care Taken	Great care taken in construction process so that the structure is neat, attractive and follows plans accurately.	Construction was careful and accurate for the most part, but 1–2 details could have been refined for a more attractive product.	Construction accurately followed the plans, but 3–4 details could have been refined for a more attractive product.	Construction appears careless or haphazard. Many details need refinement for a strong or attractive product.
Evidence of 6 simple machines	Evidence of use of all 6 machines, at least once in the contraption.	Evidence of use of 5 machines, at least once in the contraption.	Evidence of use of 4 machines, at least once in the contraption.	Evidence of limited use of fewer than 4 machines in the contraption.

Rube Goldberg Rubric	4	3	2	1
Participant Group Kit	Evidence of use of something of everything from the participant group kit.	Evidence of use of something of almost everything from the participant group kit.	Limited use of the majority of items from the participant group kit.	Relevance on only a few items from the participant group kit.
Shared Pantry	Evidence of thoughtful use of shared pantry items.	Evidence of use of shared pantry items.	Evidence of over use of shared pantry items.	Excessive or wasteful use of shared pantry items.
Whimsy and Aesthetics	High degree of whimsy and aesthetics.	Good degree of whimsy and aesthetics.	Moderate degree of whimsy and aesthetics.	Little or no whimsical or aesthetic values.
Absurdity and Narrative	Contraption is absolutely absurd in its illustration of a good story.	Contraption is adequately absurd in its illustration of a good story.	Contraption is marginally absurd in its illustration of a good story.	Contraption has little or no absurd qualities told in an unclear story.

3 Considering Maslow's Hierarchy Through a Refugee Lens

Overview

Imagine making the decision with your family to leave your home and walk in the pursuit of a better life. Globally, refugee families are making the decision to leave what they know and walk through dangerous terrain, often taking only the clothes on their backs and a few personal items. In 2015, the United Nations reported that one in every 122 humans is now either a refugee, internally displaced, or seeking asylum (**http://www.un.org/apps/news/story.asp?NewsID=51185#.VvXL9PHDlyV**).

Design Rationale

In 1943, Maslow created a hierarchy of needs to better understand what motivates people to do what they do. His model is depicted in five stages, suggesting the bottom or basic needs most strongly motivate people to take action. Self-actualization is the top of Maslow's hierarchy, and he felt that only "one in a hundred people become fully self-actualized because our society rewards motivation primarily based on esteem, love and other social needs," (**http://www.simplypsychology.org/maslow.html**).

Maslow also stated, "It is quite true that man lives by bread alone—when there is no bread..." (1943, p. 375). In the case of refugees, one can only assume that they make the decision to leave their homes because the risk or threat to their families' needs is so significant that the pursuit of an uncertain alternative is better than where they are.

While Syrian refugees were top of mind in 2016, refugees are situated globally with the majority originating in Syria, Afghanistan and Somalia (**http://unhcr.org/556725e69.html#_ga=1.225701913.2095888809.1417795315**).

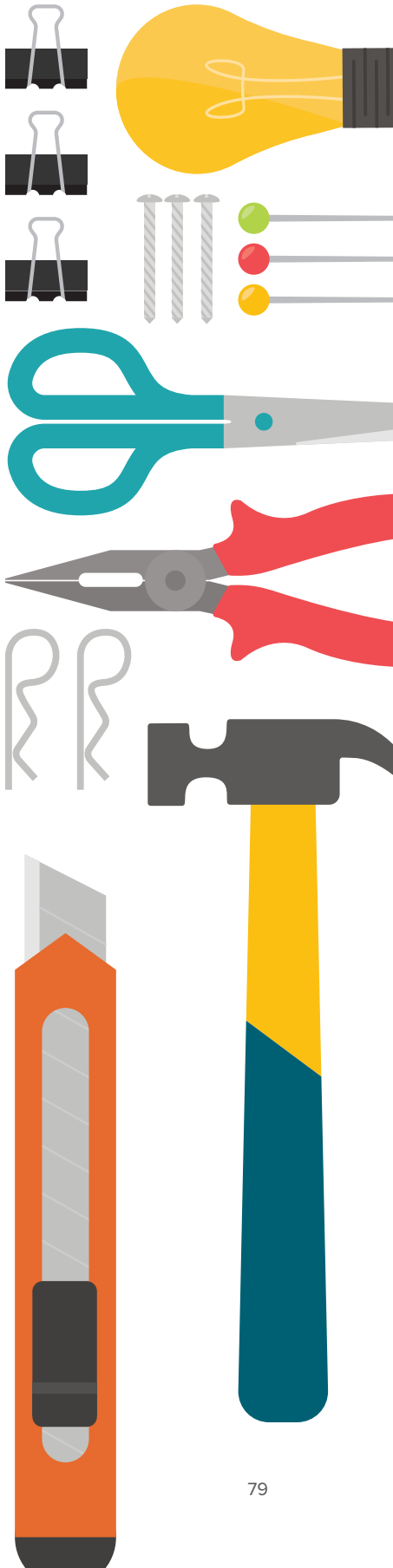
Problem Scenario

Your team has been selected to develop something wearable or portable that would help refugees on their travels. Backpacks are a fairly common solution to this challenge, but typically they are not available, so maybe think more creatively. Currently, we see many refugees walking with a shopping bag or small suitcase. Your team needs to design something that would address some of the basic needs and help families to make their walk to a better future.

Success Determinants

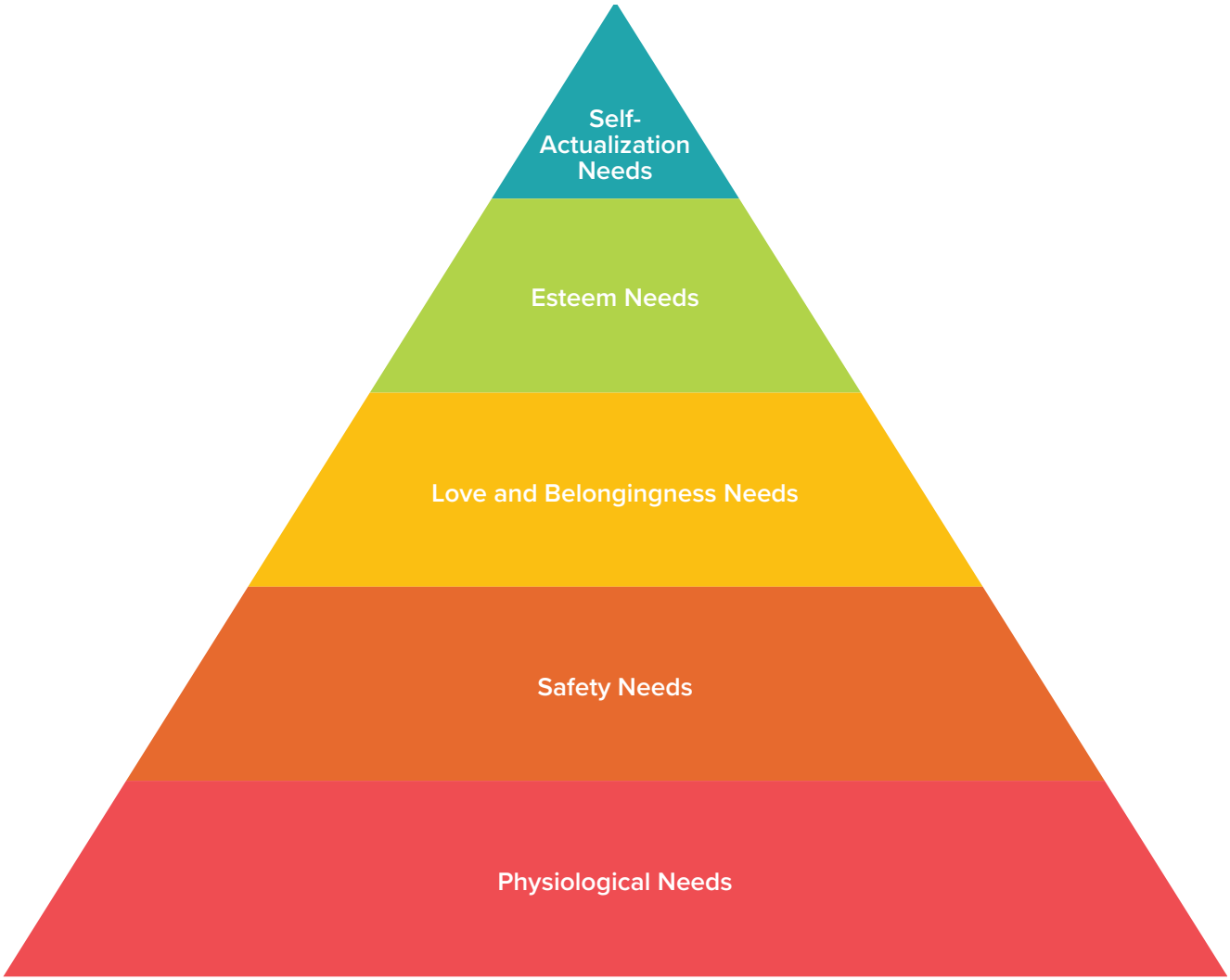
Success will be determined by the degree to which your design solution:

- ❒ Addresses the design challenge
- ❒ Addresses an identifiable need
- ❒ Uses the provided materials, resources, and tools
- ❒ Is helpful and unique for refugees, specifically those currently entering Europe



Parameters

- ❒ You must use something of everything in the bag provided to you.
- ❒ You can use items from the pantry and share the tools.
- ❒ Your prototype can be a scale version rather than actual size.



4 Inclusive Communities

Overview

Canadian Parliament is calling for between 280,000 and 305,000 permanent residents to be allowed into Canada in 2016, including more refugees from war-torn Syria. This will be our country's largest intake of immigrants into Canada since immediately following World War II.

Design Rationale

Canada prides itself on being inclusive. With the anticipated influx of Syrian refugees arriving, how can we draw people together and design ways in which we can make the immigrants feel welcome—both here in school and our larger community—and help people to become comfortable getting to know one another and become tolerant, accepting and interested in the diversity?

Problem Scenario

Your team has been selected to develop the prototype of a structural element or component or tool that will help recent immigrants to begin to create a sense of inclusion in their new community. Your prototype should be:

- small scale,
- easy to maintain and use,
- accessible to and for all community members, and
- realistic for a community to be able to recreate and use on their own.

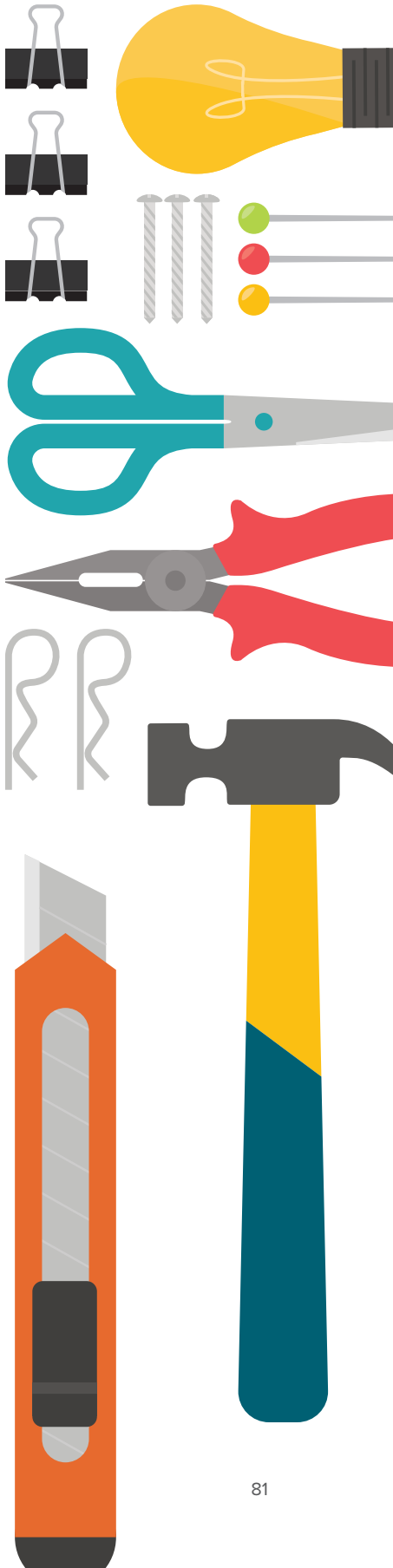
Parameters

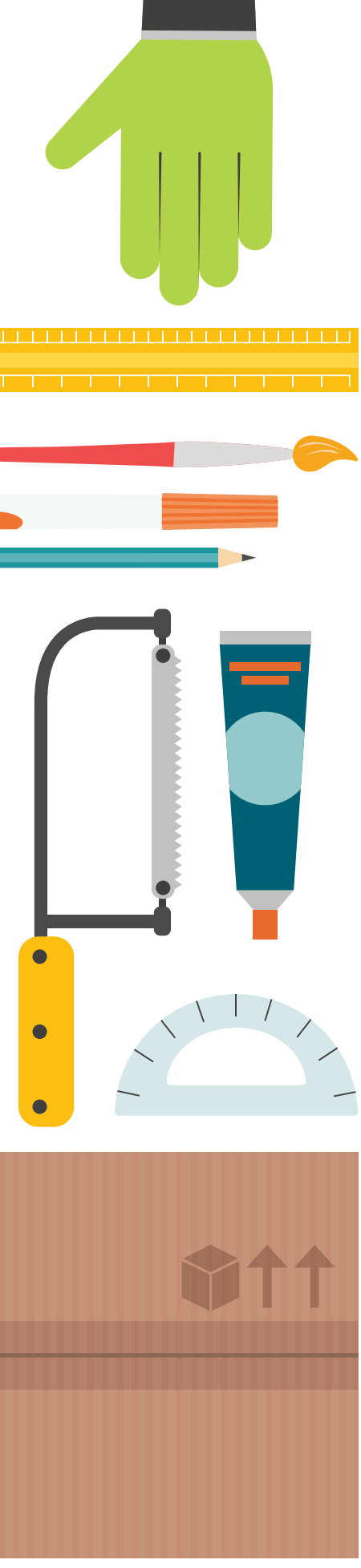
- ❒ You must use some of all of the items in your group kit in some way.
- ❒ You may make a pitch to use materials on the share tables.
- ❒ You should use the tools located in the shared tool area.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Is unique and usable
- ❒ Aligns with your design sketch
- ❒ Interests community members and newcomers
- ❒ Aligns to the design motto: "make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener"





Note

This design challenge was developed by teachers at St. Margaret School in Victoria, BC. The school librarian had experienced a Maker Day that used sample design challenge 3: Considering Maslow's Hierarchy Through a Refugee Lens. To help students stay on task and understand the flow of the day, the teachers provided the following plan.

Maker Day 2016 Day Plan

8:30–8:45

Welcome & Ice Breaker: At your tables (groups of 4), find the pipe cleaners, tin foil and popsicle sticks. Get up and stand in a circle. Have one person grab the pipe cleaner. You have 60 seconds to make something with the pipe cleaner. Hand your object to the person next to you. Now, name the object you see. Use the popsicle stick to add on to the object your partner made. Hand the object to the next person. Name the object you see. Now, use the tin foil to add to the object. Hand the object to the next person. Name the object you see. Now, using the materials in your hands, make a new object. Have your team guess what the object is.

8:45–11:00

#1 Empathy Building with a Settlement Youth Worker for the InterCultural Association of Greater Victoria. Photo essay: Global Oneness Project.

#2 Design Thinking Process

11:00–11:30

Begin Making! Using the materials provided, prototype your designs.

11:30–12:00

Guest Speaker: Importance of Design Thinking when Engaging in Making

12:00–12:30

Lunch

12:30–2:30

Continue prototyping.

2:30–2:45

Clean up materials, finish up.

2:45–3:15

Gallery walk, test, and share your idea with your user group for feedback.

5 Froebel's Gifts: Building Blocks to Learning in Early Childhood and Primary Education

Resource for Teachers and Parents

Overview

What's common among many of the leading architects of the 20th century? They attended Montessori Schools and learned by playing with and exploring Froebel's Gifts.

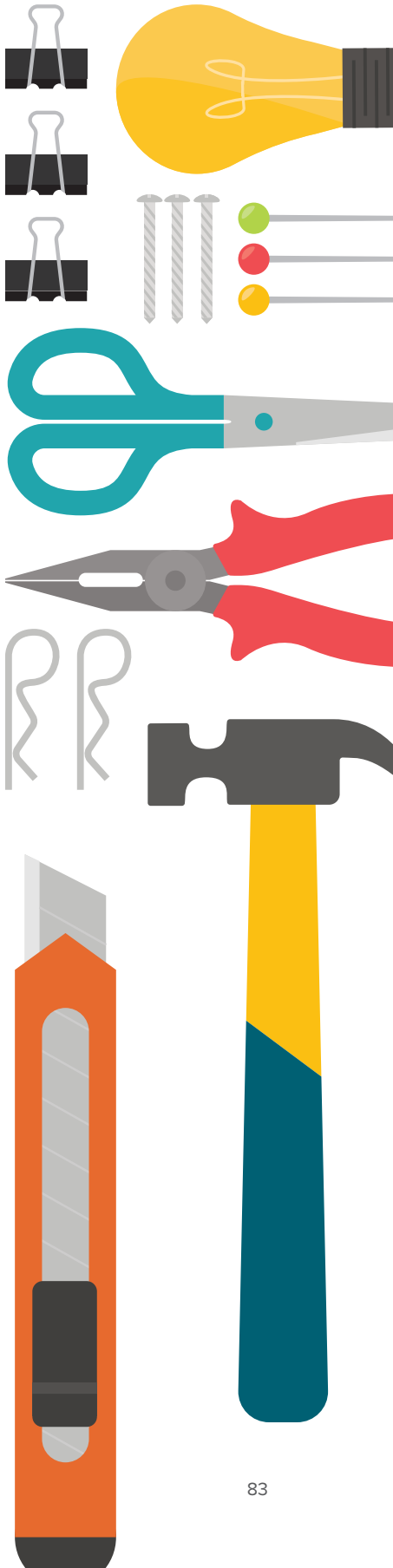
"'The maplewood blocks are all in my fingers to this day,' said Frank Lloyd Wright when he was 88 years old. The architect was referring to the elaborate set of children's building blocks designed in 1830 by the German educator Friedrich Froebel, the originator of the kindergarten system. He was among the first educators to recognize that play is the work of the child." (**http://www.nytimes.com/1985/10/13/style/the-froebel-gift-takes-form-again.html**)

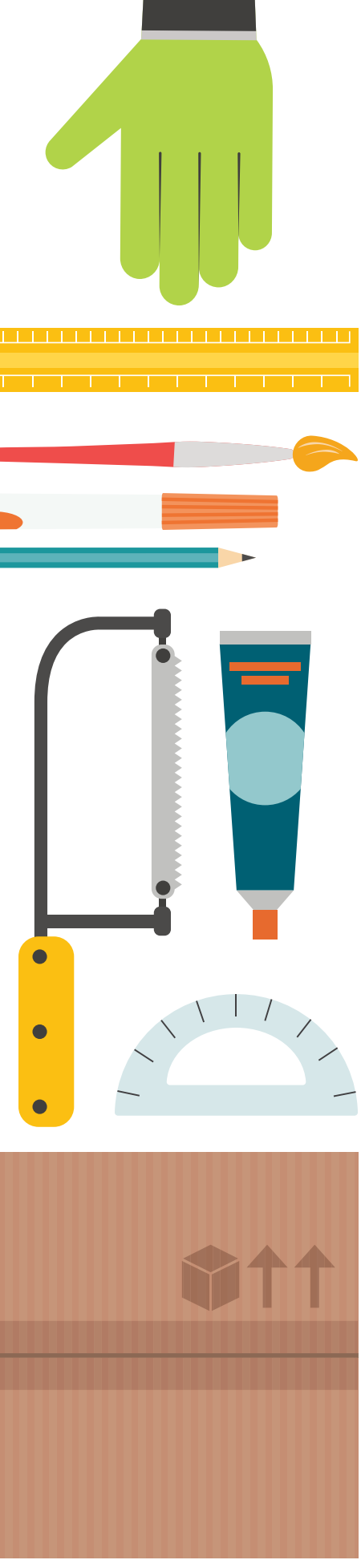
Froebel's Gifts had all but disappeared from schools until 1982 when they were discovered on display at the Frank Lloyd Wright Institute in Oak Park, Illinois. The gifts consist of a set of wooden blocks and a variety of materials such as yarn and Origami that he called vocations. The gifts and vocations were "designed to stimulate all five senses (which are considered the doors to the child's inner world) while aiding understanding and language through discussion and song... The ultimate idea is that all things—art (beauty), science (knowledge) and nature (the physical world)—are fundamentally related and interconnected." (Bultman, 2000, p. 4)

You can download a copy of The Republic of Childhood: Froebel's Gifts from **http://www.gutenberg.org/files/%2031097/31097-h/31097-h.htm**.

Froebel believed that when children play with blocks, they begin to think and imagine in concrete and tangible ways. It helps them to understand that one's thoughts can be actionable, and a provocation to reactions in others. It helps children to read, see, and negotiate their worlds.

"'The design of the Gifts reflects the way Froebel thought children learned, from the large object to the parts of the object,' said Leslie R. Williams, a professor of early-childhood education at Columbia University's Teachers College. 'They help children look into things instead of at things.'" (**http://www.nytimes.com/1985/10/13/style/the-froebel-gift-takes-form-again.html**)





Design Rationale

Janine Fraser, a primary educator and current President of the British Columbia Primary Teachers Association, sees value in introducing Froebel's Gifts to students from Kindergarten to Grade 12. She explains, the gifts can be used to:

- stimulate imagination and creativity
- contribute to self-confidence and a feeling of accomplishment
- develop a sense of responsibility for block care and clean-up
- explore pre-number skills such as size, shape, matching and classification
- foster critical thinking and problem solving that is inherent in block play
- develop visual discrimination which is a pre-reading skill
- learn concepts of inside/outside, open/closed
- develop language and vocabulary through discussion and description
- develop fine motor skills
- refine eye/hand coordination

The booklet *The Republic of Childhood: Froebel's Gifts* describes Froebel's approach to slowly and thoughtfully introduce each of the multiple gifts to children. Rarely did he create a discovery corner or centre and just let the children play with all gifts at once. Froebel believed there was a rhythm/flow to the introductions and a sequence that supported individual learning. Maria Montessori and Rudolf Steiner integrated Froebel's blocks and concepts into their work with children.

Froebel's Gifts can be purchased or made (**http://www.froebelweb.org/gifts/obtain.html**). The following list is numbered by sequence of introduction to children (Bultman, p. 28).

Gifts (To be used and always returned in their original form)

1. Yarn balls
2. Wood solids
3. Wood cubes
4. Wood rectangles
5. Subdivided 3" cube (cubes & prisms)
6. Subdivided 3" cube (columns, rectangles & caps)
7. Parquetry tiles
8. Sticks & rings
9. Beads
10. Peas & sticks

Occupations (Materials are modified and remain in their new form)

11. Perforating (pricking)
12. Embroidery (sewing)
13. Drawing
14. Cutting paper
15. Weaving paper (braiding)
16. Painting
17. Intertwining paper
18. Origami
19. Box construction
20. Modeling clay

Problem Scenario

Working with pre-school and primary teachers in your community and school, determine ways to integrate Froebel's Gifts into your learning environments. Remember, Froebel is considered to be the inventor of kindergarten. He believed "Children come into the world with their own inner structure, just as an acorn holds the structure of an oak tree. 'It is the destiny and life-work of all things to unfold their essence.' ...Parents and educators act as 'gardeners.' Creating a fertile environment that encourages each child to blossom into his/her full potential," (Bultman, p. 3). Froebel believed as the gardeners, it is our responsibility to introduce each gift and occupation and tend carefully to each child's learning.

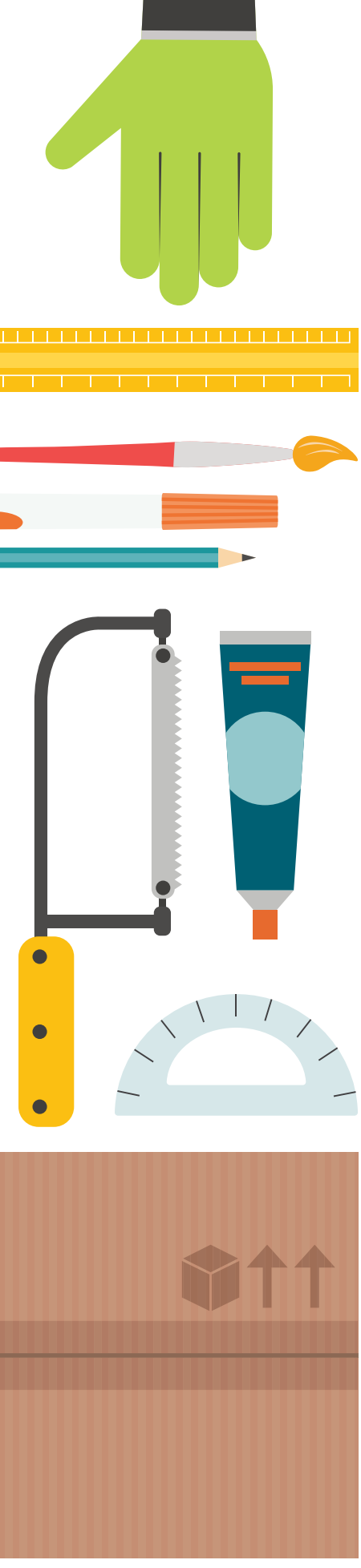
Success Determinants

Success will be determined by:

- ❒ Ways in which you can position Froebel's Gifts within your curricular intent
- ❒ Ways in which you can position Froebel's Gifts within the BC ADST curriculum
- ❒ Consider ways to involve the local makerspace or local makers in the creation of the gifts (**http://www.froebelweb.org/gifts/obtain.html**)

Paramenters

- ❒ Think beyond creating a centre where the gifts are merely available for the children to play with.



Resources

Ballweg, J. (2012). *Inquiry in the Block Area* available from *Math at Play* **http://blog.mathatplay.org/page/3/**.

Bultman, S. (2000). *The Froebel Gifts: The building gifts* 2–6. Grand Rapids, MI: Uncle Goose Toys.

Early Childhood Today Editorial Staff (2016). *Pioneers In Our Field: Friedrich Froebel—Founder of the First Kindergarten*. The first installment in Early Childhood Today's series on the Roots of Early Childhood Education, available from **http://www.scholastic.com/teachers/article/pioneers-our-field-friedrich-froebel-founder-first-kindergarten**.

Patet, Pradnya (2016). *Empowering mathematical minds through play*, available from **http://www.communityplaythings.co.uk/learning-library/articles/empowering-mathematical-minds**.

Wiggin, K. & Smith, N. (1985). *The Republic of Childhood: Froebel's Gifts* from **http://www.gutenberg.org/files/%2031097/31097-h/31097-h.htm**.

6 Animal Care

Overview

In 2013, many residents in southern Alberta experienced, or were threatened by flooding. River levels along the Bow River watershed were at their highest in 60 years (Environment and Climate Change Canada, 2014, Retrieved from **https://www.ec.gc.ca/meteo-weather/default.asp?lang=En&n=5BA5EAFC-1&offset=2&toc=hide**). Water forced over 100,000 Albertans to leave their homes. Natural disaster is just one reason a family may have to unexpectedly vacate or abandon their home on short notice. An unexpected short term absence raises the question of animal care for companion animals and livestock.

Design Rationale

People in our community rely on pets for love, companionship, security, entertainment and more, and they give them the same in return, each enhancing the other's existence. At times though, life does not allow us to provide the daily care they require. In these instances, we take on the responsibility of ensuring their needs are met even when we are not there to provide for them.

Problem Scenario

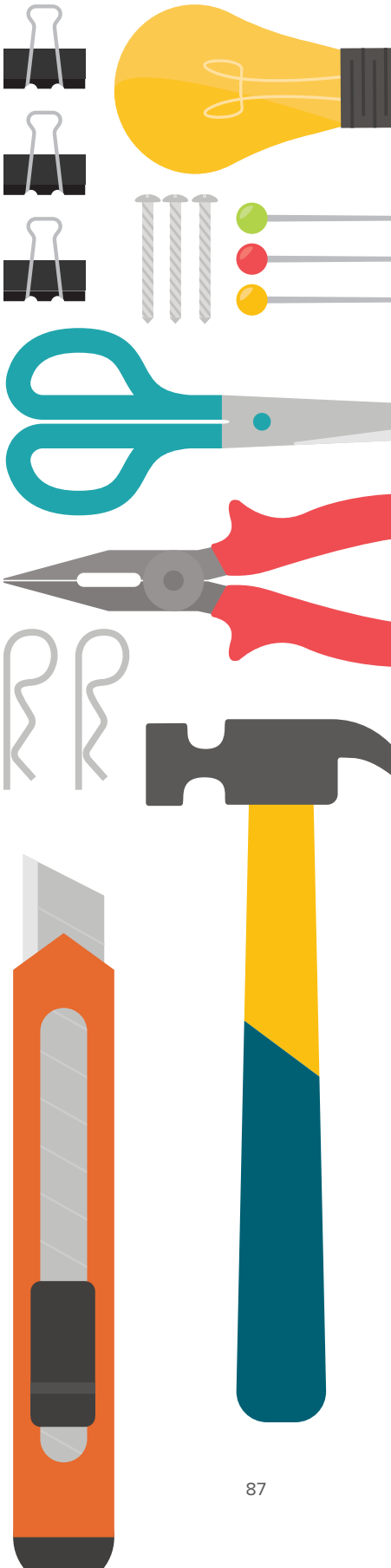
Your team has been selected to develop the prototype of a system or a tool, that will allow animal caregivers/owners the ability to leave for a period of time with peace of mind. Your prototype will address one or more of the following needs:

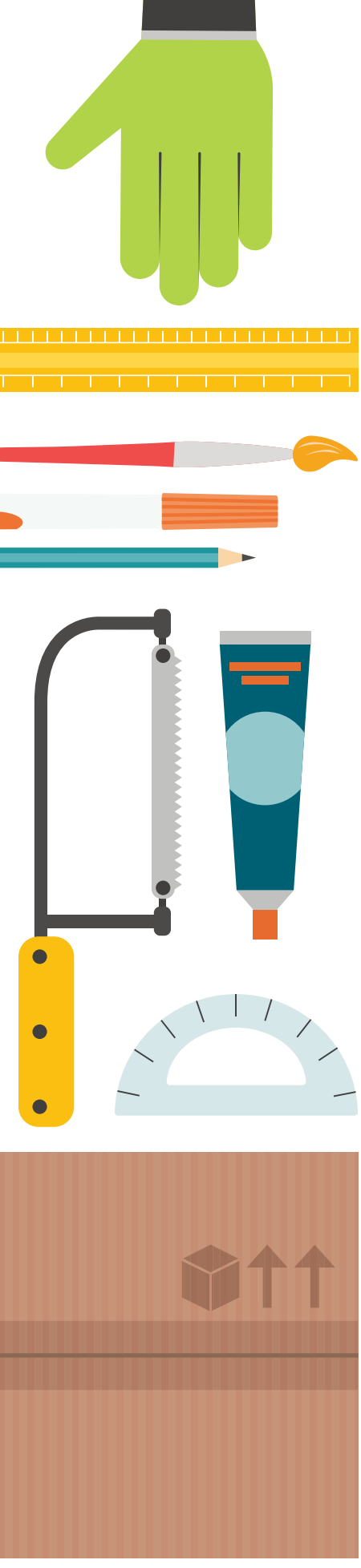
- Access to food
- Access to water
- A waste solution
- Comfort (temperature/light)
- Exercise
- Companionship

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Uniqueness and usability of the tool
- ❒ At least one piece of functionality using technology
- ❒ Alignment of the prototype with the design
- ❒ Ability of your tool to be adaptable to animals of different species and size, indoor/outdoor use
- ❒ Uses the consumable items in the participant group kit provided
- ❒ Alignment to the design motto: "Make it smaller, stronger, do more, be easier to use, be cheaper, be cleaner, be greener."





Parameters

- ❒ Must incorporate at least one functional element enabled by the technology (Little Bits) found in your participant group kit.
- ❒ Plan how to use something of every consumable item in the participant group kit provided.
- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's prototype.
- ❒ Use the tools that have been provided at the shared tool station.

Note

This Design Challenge comes from Joanne Britton and her colleagues at Chilliwack School District, British Columbia. It was first designed for use at a Maker Day for educators held at the University of the Fraser Valley. It is a modification of Design Challenge #7.

7 Frugal Innovation for a Sustainable, Happy Future

Overview

We live in an interconnected world; our actions and activities impact living conditions for others both locally and globally. In 2000 the United Nations drafted initial Millennium Goals (**http://www.un.org/millenniumgoals/**) to improve quality of life. Recently, these goals were revised, focusing on issues of environmental sustainability, happiness, and well being.

Frugal innovation refers to removing nonessential features from a solution in order to make it as widely applicable as possible. Of primary concern is achieving the highest quality at the lowest cost. Experts suggest frugal innovation may provide the best approach to reducing the complexity and cost of finding solutions to global challenges impacting our global community. It is suggested that frugal innovation may be one of the best ways to achieve the new Millennium Goals (**http://frugalinnovationhub.com/en/**).

Design Rationale

As Canadians, we enjoy an enviable quality of life—clean water, expectation of safety, strong government, etc. We expect that these qualities will be sustained, maintained, and even improved. However, concerns related to environmental sustainability increasingly impact our life. It is important that we find solutions to our problems that respect environmental sustainability at local and global levels and continue to provide the quality of life that is important to us. A challenge in the future will be how we can sustain our values and lifestyle, maintain a sense of happiness and well being, and address the concerns that face us, in ways that are respectful of larger contexts.

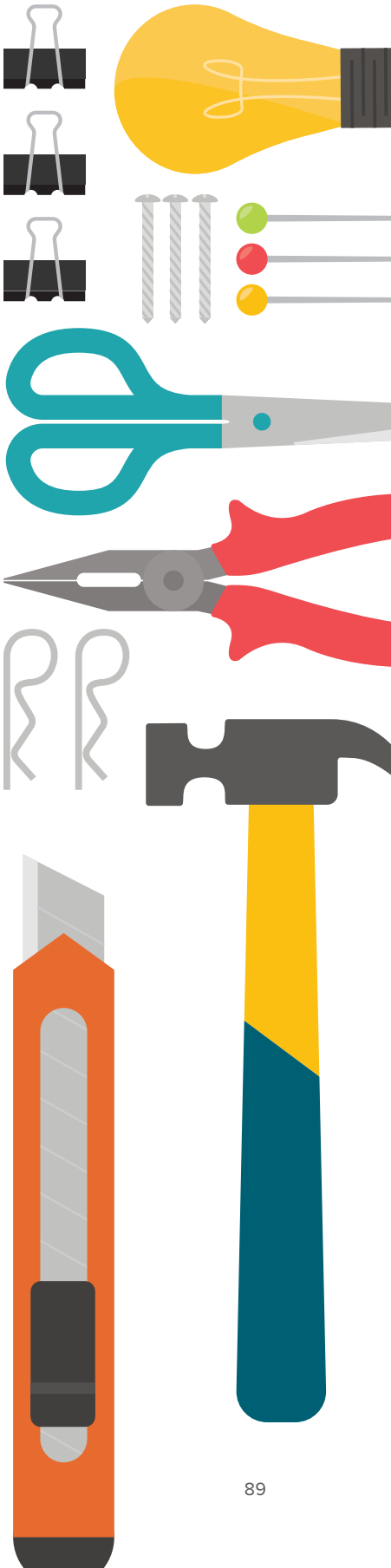
Problem Scenario

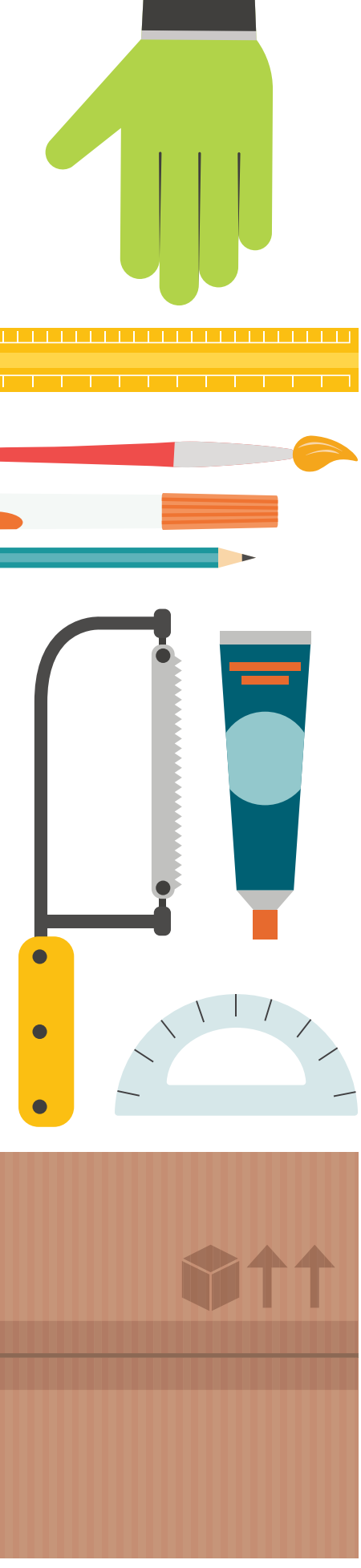
Your team has been selected to look at sustainability issues in your region. Your team must choose an issue that resonates with you and develop a prototype to address the concerns raised by that issue. The issue that you choose should have an impact on the day-to-day quality of life for an identified group in your region. The solution should also increase their happiness, be frugal in design, and have little impact on the environment.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Addresses the issues suggested in the design challenge
- ❒ Uses some of all the consumable items found in the participant group kit provided
- ❒ Introduces the functional elements from the appropriate technologies bar and enhances your prototype
- ❒ Demonstrates accurate measures and cuts with careful fabrication
- ❒ Aligns with your design sketch





Parameters

- ❒ Plan how to use something of every consumable item in the participant group kit provided.
- ❒ Use materials found in the Appropriate Technologies Bar section described in **https://issuu.com/ubcedo/docs/diy_guidebook** and the shared pantry to aid your group in the development your solution.
- ❒ Use the tools that have been provided at the shared tool station.
- ❒ Incorporate at least three (3) functional elements enabled by components from the appropriate technologies bar, and your team must be prepared to explain how these components support your prototype.

8 *Chindogu*: Designing for the Pleasure of Design

Overview

We often think of design as the creation of plan or object for a specific function. We use a design process to move our thinking from initial ideas to conceptual sketches. From the sketches, we can then create working prototypes that we can test and evaluate. When we use design thinking, we engage in human centred design, focusing our design on how the end user might use our prototype to address a real problem.

Chindogu is a fun twist on the typical design process. Chindogu is a Japanese word that means unusual tool. The inventor of the term, Kenji Kawakami actually thinks "weird tool" is a better translation! There are three basic rules for chindogu objects. They must be "make-able," although they actually do not serve any real or needed purpose; be open access and cannot be patented; and be humorous, but that is not their entire purpose or function. In other words, they are an actual tool and not a joke or a trick.

Design Rationale

People are encouraged to make chindogu for the sheer pleasure of designing a tangible item. Kenji Kawakami suggests that making chindogu helps us to

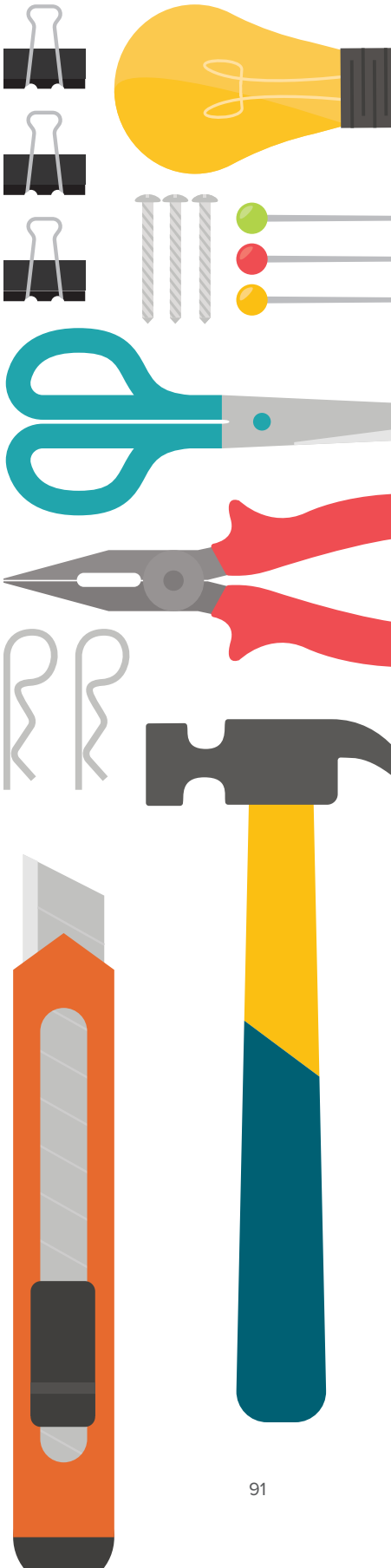
- improve our divergent thinking and creativity
- improve our craft abilities and artist skills
- revel in creativity without the pressure of making something functional or commercial

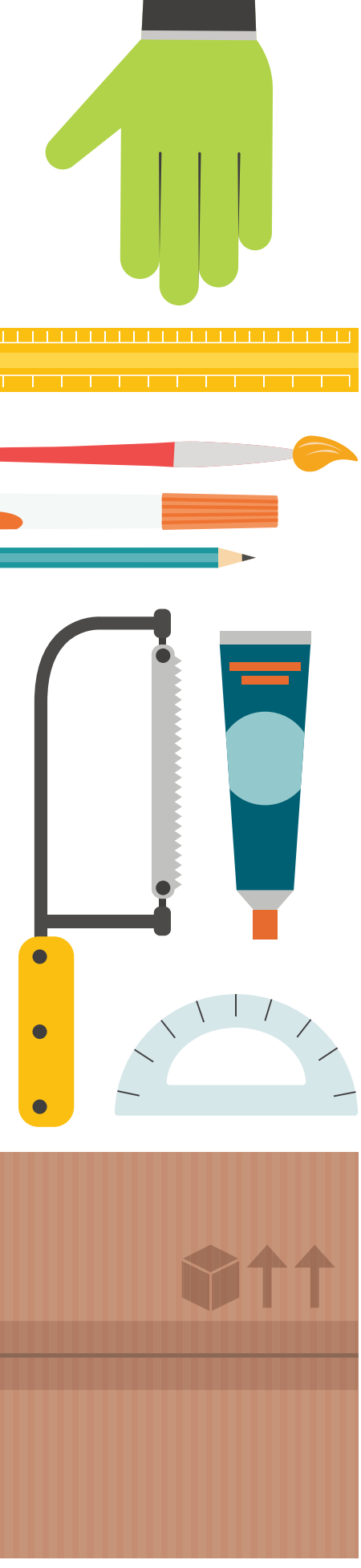
Examples of chindogu include

- duster slippers for cats, so they can help out with the housework
- the baby mop, an outfit worn by babies, so that as they crawl around, the floor is cleaned
- the all-day tissue dispenser, which is basically a toilet roll fixed on top of a hat, for hay fever sufferers

You can find more examples on the official chindogu site **http://www.chindogu.com/?page_id=181** or search cindogu and images on the Internet for pictures of existing designs.

One of the best ways to think about chindogu is to consider two items that have seemingly absolutely no connection. For example, think about shoes and an umbrella. Anything pop into your mind?





Problem Scenario

Your team has been selected to design a prototype of a chindogu that is functional (in a chindogu kind of way), well crafted, and will provoke a smile on the face of someone seeing it! Please remember, a prototype is a model that illustrates the functionality of an idea or design. It may be life sized or scaled to a model that fits in your hand. However, a prototype needs to be as real looking as possible, using the materials available.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Addresses the issues suggested in the design challenge
- ❒ Uses some of all the consumable items found in the participant group kit provided
- ❒ Aligns with your design sketch
- ❒ Meets the definition of a chindogu

Parameters

- ❒ Plan how to use something of every consumable item in the participant group kit provided.
- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's prototype.
- ❒ Use the tools that have been provided at the shared tool station.

9 Hand Shadows: Seeing Is Believing

Overview

Some people believe that the art of hand shadowing has existed since about 850 AD. Hand shadows have provided entertainment and education since there was a controllable light source and blank wall onto which to project the shadow.

The first known book about this topic was published in 1859 by Henry Bursill, *Hand Shadows to be Thrown Upon the Wall*. It is available from Project Gutenberg as a free download (**http://www.gutenberg.org/ebooks/12962?msg=welcome_stranger**). Bursill hand drew all the illustrations in his book. Of course, there are now apps for hand shadows. A great resource for hand shadows *The Classic Art of Hand Shadows* is available from Lee Valley (**http://www.leevalley.com/US/gifts/page.aspx?p=58216&cat=4,53201&ap=1**).

Design Rationale

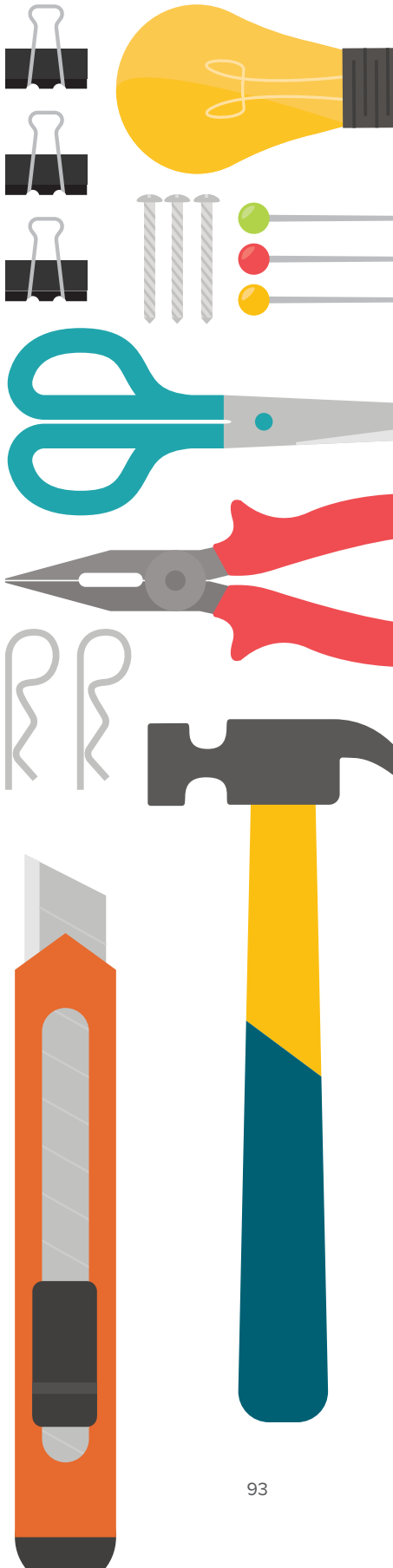
To see what is being depicted in a hand shadow, we have to look beyond the actual hands and see only the shadow image. For the best viewing of a hand shadow, people often create a frame or a stage so only the shadow image can be seen. By figuring out a set of movements, you can animate your hand shadows. It is also possible to add small props (i.e. paper cuts outs, etc.) to make your shadows more realistic.

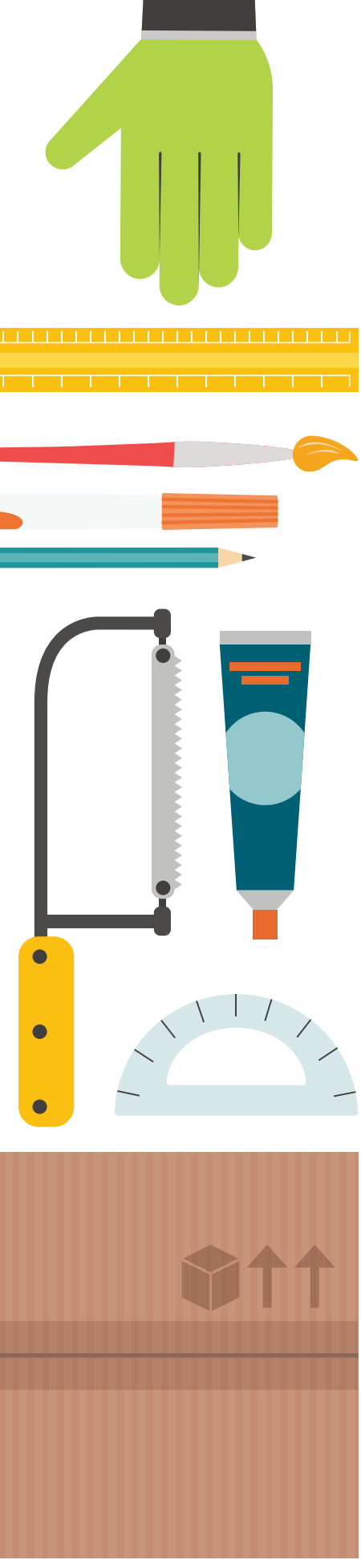
The educational value of hand shadowing is in learning to:

- decode or make sense of shapes and images
- produce a short show using hand shadows as characters
- think in multiple dimensions or formats
- think about light and shadow
- image shapes and movement

Problem Scenario

Your team has been selected to produce a 1-minute hand shadow production that encourages positive citizenship or general good behavior. Your production should have multiple characters and each member of your group must play a role in the production. We will use a design thinking process to help your group identify an issue related to citizenship or behavior that is of concern in our school.





Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Addresses the issues suggested in the design challenge
- ❒ Aligns with your design sketch
- ❒ Meets the production and uses of hand shadows well
- ❒ Develops an entire production—shadows, story, props and light source

Parameters

- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's frame or stage.
- ❒ Use the tools that have been provided at the shared tool station.

10 Geometrigraph and Polygraph Templates: Designing with Geometry

Overview

The geometrigraph and polygraph were manufactured in the late 1800s. Using just these two devices, you can create curved, parallel or perpendicular lines as well as circles, angles and a range of polygons from 3-sided to 20-sided.

Design Rationale

These shapes have been used by wood workers, quilters, sign makers, graphic artists, and many others to create geometric shapes in tangible forms or in three dimensions.

The geometrigraph and polygraph can be found in the Victoria and Albert Museum in London. The geometrigraph and polygraph also inspired the creation of the Spirograph in 1965 where it was introduced at the prestigious Nuremberg International Toy Fair.

Interest in the geometrigraph and polygraph template has increased with the introduction of Zentangles as a relaxing, meditative art form (**https://www.zentangle.com/**).

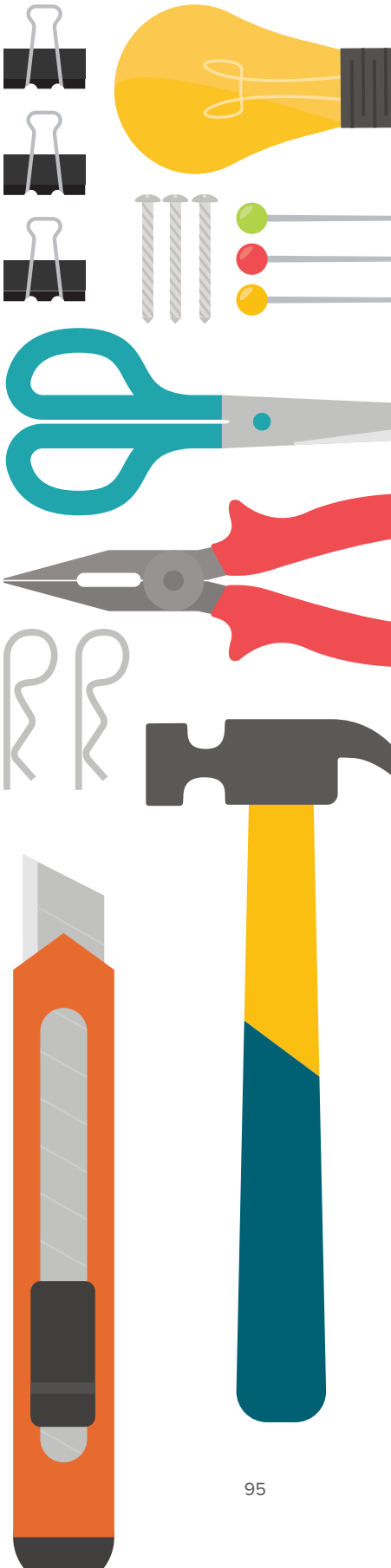
Problem Scenario

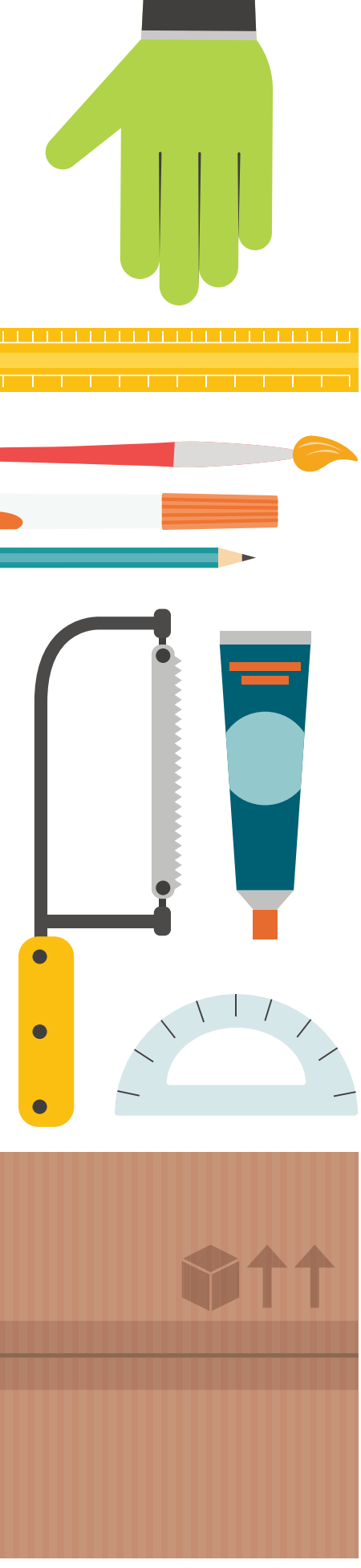
Your team has been selected to produce an interesting, complex, aesthetic geometric image that requires the use of both the geometrigraph and polygraph. You should be able identify the shapes in your image. You also need to design a structure that allows you to secure your paper and the templates and allow for complex drawing by multiple users.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Addresses the issues suggested in the design challenge
- ❒ Uses the templates well
- ❒ Includes multiple geometric shapes
- ❒ Is aesthetic and complex
- ❒ Provides easy identification of the geomotric shapes to your audience





Parameters

- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's prototype.
- ❒ Use the tools that have been provided at the shared tool station.

11 Automata

Overview

Automata are whimsical and wonderful machines that combine art, play, humour, science and engineering. They have a long history that appears to transcend geography and culture.

Cuckoo clocks with movable figures and mechanical bell ringers, often found in medieval European churches, are examples of automata, as are complex toys with multiple movable parts from Japan and China. Some of the earliest mention of automata can be found in Greek mythology where Prometheus was tortured by an artificial eagle for giving fire to humans. If you are unfamiliar with automata, please watch **https://www.youtube.com/watch?v=9OqEze9JTu0**.

Design Rationale

In Design Challenge 2, *Using Machines to Make Overly Complex Compound Machines*, we introduced the concept of mechanical advantage. Automata are complete units that typically tell a short story—someone chopping wood, a horse running, etc. They utilize a combination of levers, cranks, linkages, cams, shafts, ratchets, gearing, and drives.

For specific tips on how to make an automata out of simple materials, please refer to **http://tinkering.exploratorium.edu/sites/default/files/Instructions/cardboard_automata.pdf**.

Problem Scenario

Your team has been selected to produce an interesting, complex, narrative automata that uses as many mechanical combinations as possible (i.e. levers, cranks, linkages, cams, shafts, ratchets, gearing, and drives).

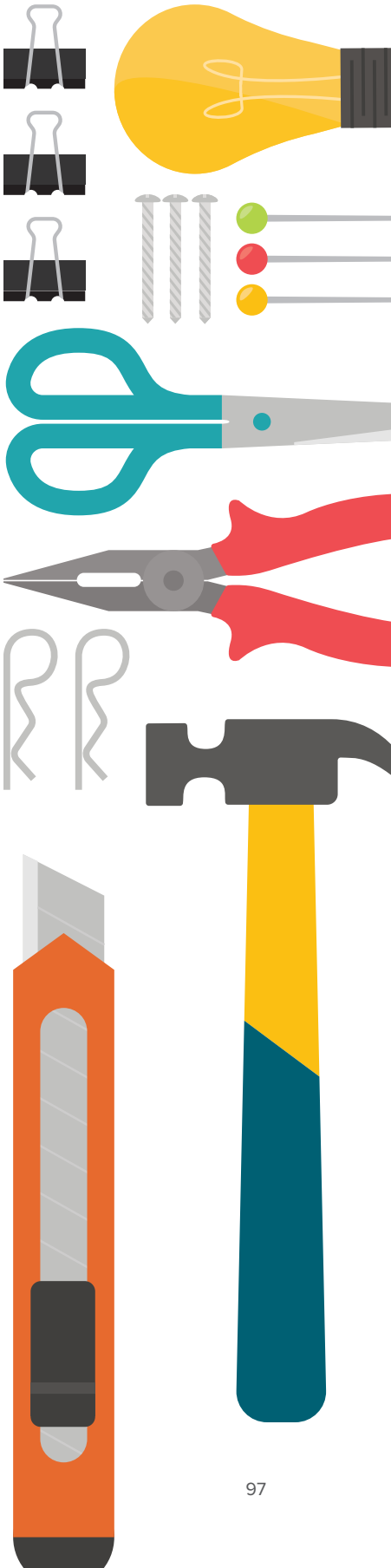
Success Determinants

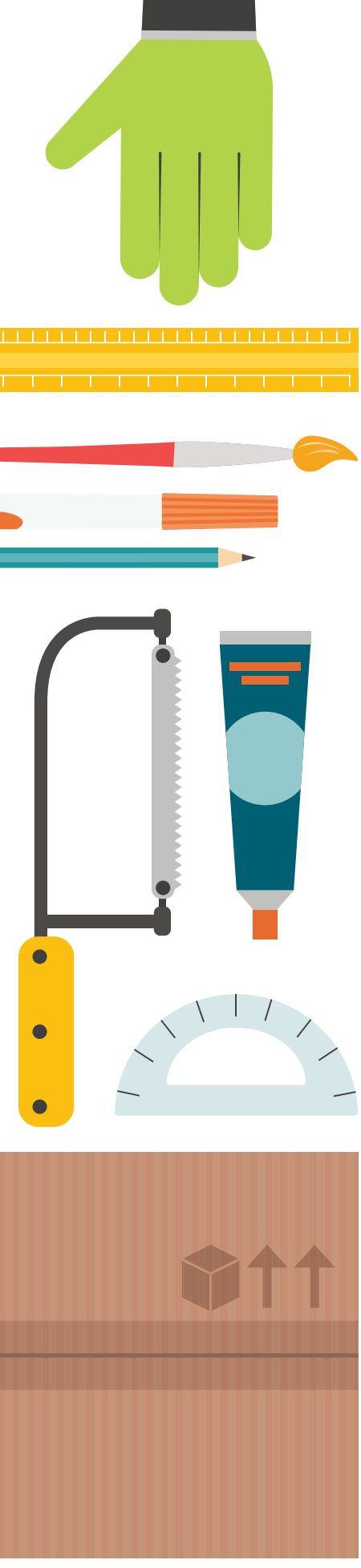
Success will be determined by the degree to which your design solution:

- ❒ Addresses the issues suggested in the design challenge
- ❒ Is aesthetic and complex
- ❒ Identifies the various mechanical functions of an automata

Parameters

- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's prototype.
- ❒ Use the tools that have been provided at the shared tool station.
- ❒ Use at least two mechanical combinations (i.e. levers, cranks, linkages, cams, shafts, ratchets, gearing, and drives).





Note

If you this position this challenge in Social Studies or English, the students' automata might be a specific character doing contextually relevant task. For example, if students were reading the novel *The Old Man and the Sea*, the automata might be an older man fishing from a boat. If students were studying the exploration of the Northwest Passage, the automata might be people paddling a canoe. Also, please note automata differ from Rube Goldberg machines as automata are narrative while Rube Goldberg machine are excessive in their complexity!

12 It's Never Black or White or Paper or Plastic

Overview

We have all heard the phase, "Reduce, Reuse and Recycle." The majority of Canadians have recycling options right on their doorsteps, provided by their municipalities. The recycling symbol is a common marking on the items we use. On a personal level, what to use and how to reduce our consumption can be challenging.

Design Rationale

The evolution of packaging and the use of containers to carry purchases from shopping is interesting. In many parts of the world, customers are expected to bring their own shopping bags, and these often take the form of baskets, reusable cloth or heavy-duty plastic bags, boxes, etc. Not so long ago, a very familiar question at our store's check out counter was whether you wanted a paper or plastic bag to transport your purchase. Currently, many stores will either charge you for a disposable bag or will credit you a few cents if you use your own bag.

Many of us feel that we are doing our part to reduce waste by bringing our own fabric bags or recyclable containers. However, the issue of what is the best solution for waste reduction may not be so black and white/paper or plastic. Please read this article from *WIRED Magazine* **http://www.wired.com/2016/06/banning-plastic-bags-great-world-right-not-fast/**. This article reminds us that using anything is complicated and has unintended consequences and impacts. While plastic bags litter the landscape and take years to decompose, paper bags consume trees, and many cloth bags are made using cotton, a very environmentally costly plant to grow.

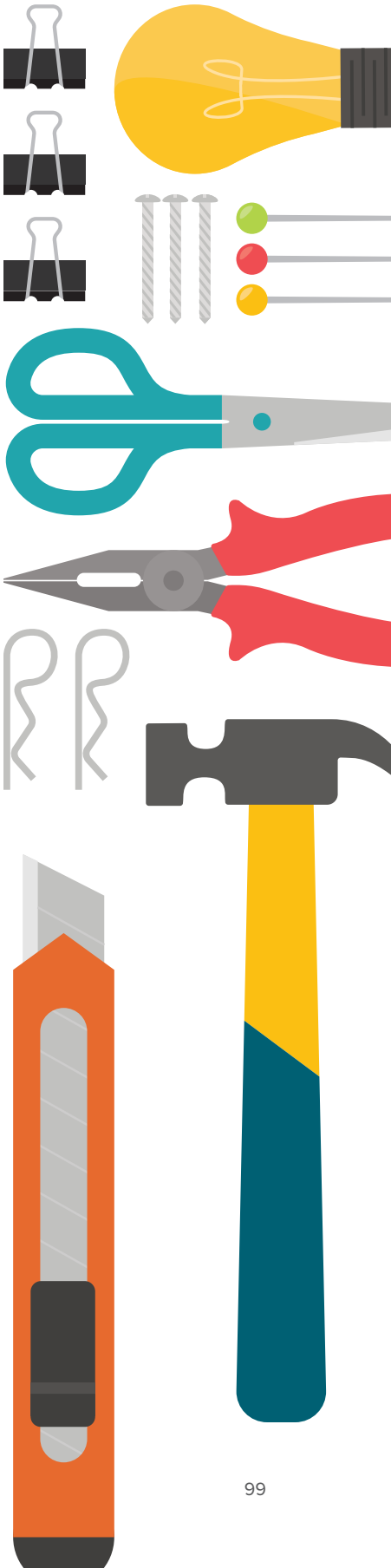
Problem Scenario

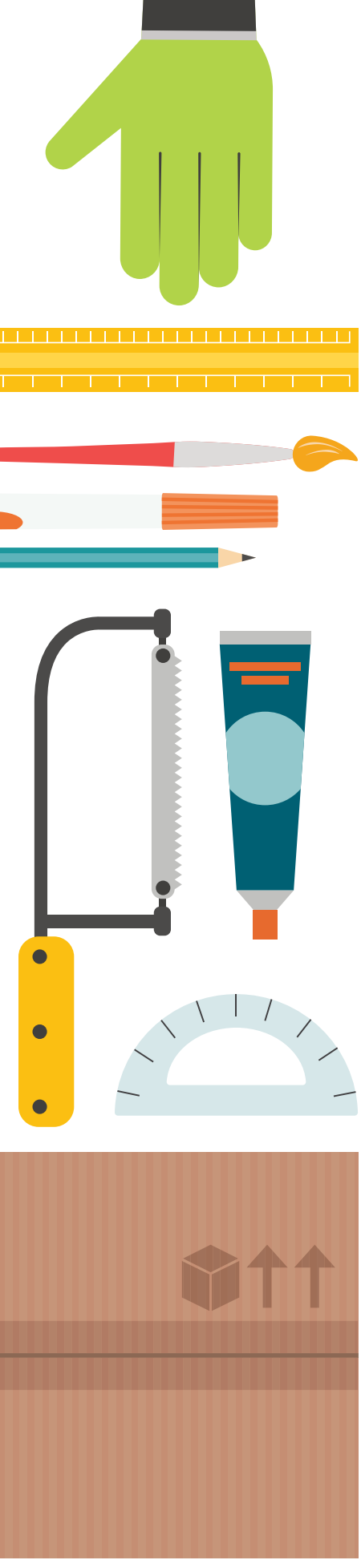
Your team has been selected to produce an option for consumers to transport their purchases. Your option needs to tend to the challenges and issues surfaced in the article, *Banning Plastic Bags Is Great for the World, Right? Not So Fast* (**http://www.wired.com/2016/06/banning-plastic-bags-great-world-right-not-fast/**). Your option also needs to be flexible, portable, reasonable, and useable by a large sector of the population.

Success Determinants

Success will be determined by the degree to which your design solution:

- ❒ Addresses the issues suggested in the design challenge
- ❒ Uses some of all the consumable items found in the participant group kit provided
- ❒ Aligns with your design sketch
- ❒ Is useful, aesthetic and environmentally responsible
- ❒ Is easy to show how the merits of your option in relationship to the points shared in the article, *Banning Plastic Bags Is Great for the World, Right? Not So Fast* (**http://www.wired.com/2016/06/banning-plastic-bags-great-world-right-not-fast/**)





Parameters

- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's prototype.
- ❒ Use the tools that have been provided at the shared tool station.

13 Between a Number and a Person: Considerations of Identity and Respect

Overview

Between 1944 and 1969, the Canadian government implemented the Eskimo Identification Tag system. These tags were given to "...every Inuk living in the Western and Eastern Arctic. Each disc was about 2.5 centimetres in diameter, made of hard cardboard or leather and sienna-like in colour. The expectation was that each Inuk would keep the disc, which had a hole punched in its top, on his or her person at all times.

One side of the disc was embossed in its centre with a black image of the seal of the Crown, with the words "Eskimo Identification Canada" circling the perimeter. The other side had a line of code beginning with either the letter "E" (for Eastern Arctic) or "W" (for Western Arctic), followed by a number representing the community or region where the individual was living. (A "6," for example, indicated the Pangnirtung/ Broughton Island region.) Completing the code was a set of identification numbers specific to the Inuk carrying the disc. (If you didn't have the disc on you, it was considered wise to have memorized the line of code.)," (Adams, 2016, Para 3-4, Retrieved from **http://www.theglobeandmail.com/arts/art-and-architecture/barry-pottles-photography-explores-inuit-objectification-by-id-tags/article30060124/**).

Design Rationale

The rationale for the Eskimo Identification Tag system was, "Federal agents deemed Inuit names to be too long, difficult to spell and frustrating to pronounce. In addition, Inuit naming traditions were complex. There was no gender specificity, no surnames. Women didn't take the family name of their husbands upon marriage. Children would carry several names for a time, then discard or change them as their personalities became more fixed," (para. 5-6).

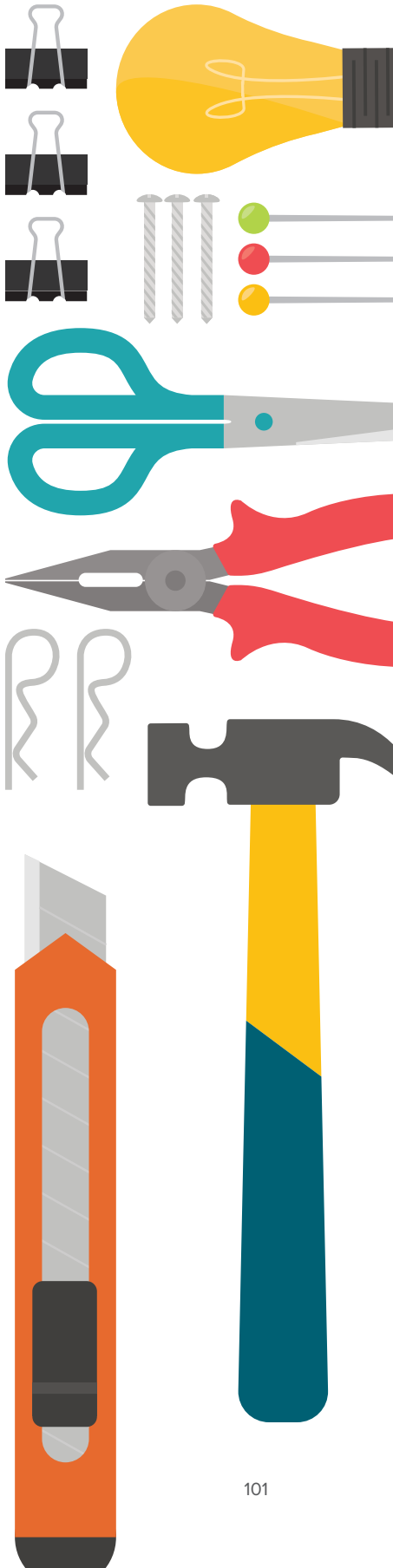
Identity and identification are important in a civil society. Globally, obtaining legal identity is a struggle in some places. Organizations such as United Nations work with independent groups and companies to design ethical and respectful ways of providing identity to refugees and others disposed by global challenges. Biometrics is one way (see *Client Study: UNHCR: Identity management system uses biometrics to better serve refugees*, Retrieved **https://www.accenture.com/us-en/success-unhcr-innovative-identity-management-system**).

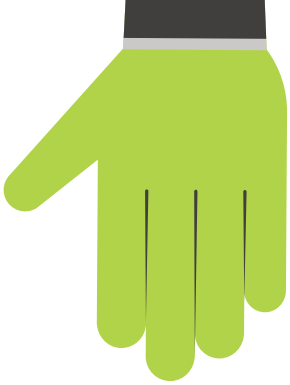
In Canada, identity and proper identification are essential for access to social services such as medical assistance, financial aid, and even job certification.

Problem Scenario

Your team has been selected to design a respectful yet secure way of providing identification for new immigrants, refugees and/or elderly or very young Canadians who might not have ready access to existing forms of complex identification records.

Your option also needs to be secure, flexible, portable, reasonable, and respectful to a large sector of the population.

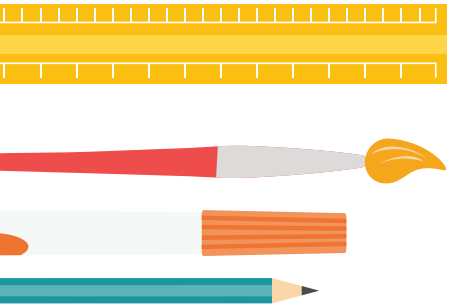




Success Determinants

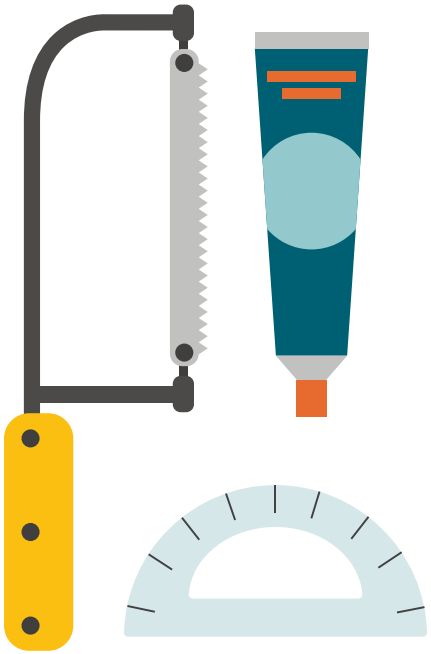
Success will be determined by the degree to which your design solution:

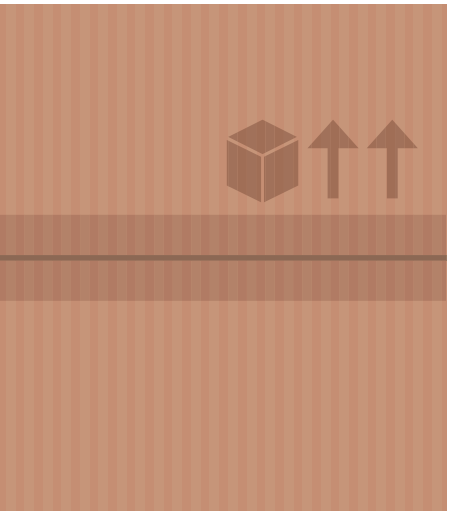
- ❒ Addresses the issues suggested in the design challenge
- ❒ Is useful and respectful



Parameters

- ❒ Choose consumable items and materials found in the shared pantry to aid in the enhanced development of your group's prototype.
- ❒ Use social media options or other digital technology as a portion of your solution.
- ❒ Use the tools that have been provided at the shared tool station.





14 Agricultural Automation

Overview

Agriculture is the cultivation of animals, plants, fungi, and other life forms for food, fiber, biofuel, medicinal and other products used to sustain and enhance human life. In Canada, agriculture is often a business that operates on a large or small scale. Increasingly, agricultural operations have some aspect of their work that is automated in some way, regardless of the size of the operation.

Design Rationale

Each time there is a downturn in oil prices, Canadians are reminded how important it is to have a diversified economy.[6] For example, Alberta is known worldwide for its excellent grain production and sound animal husbandry practices as well as its oil sands and natural gas. British Columbia exports lumber and farmed fish as well as promotes tourism. Canada competes in a global marketplace, so it is important that we remain as competitive as possible. Around the world, automation and mechanization have dramatically increased productivity in many areas of agriculture. The spin-off industries that refine raw products require technological innovation to strengthen the economy and increase jobs and services.

Problem Scenario

Your team has been selected to develop a prototype[7] of a tool or piece of equipment that will improve an aspect of an agricultural operation and improve its functionality. Your prototype must improve on existing economic viability, safety, effectiveness, or provide something absolutely new. Because this is a prototype, it may be full size or a scale model.[8] However, your prototype needs to represent / illustrate the components of its functionality, and it needs to look real as possible.

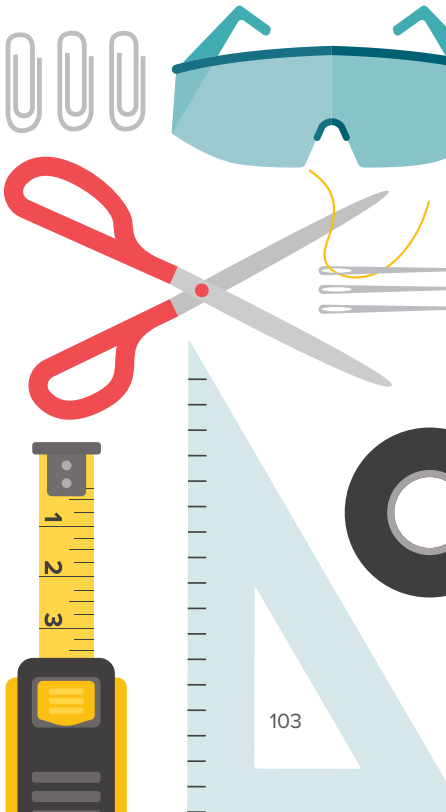
SkillsCanada Alberta

Suggested Grade Level

- Upper elementary through to secondary school

Suggested Subject Area

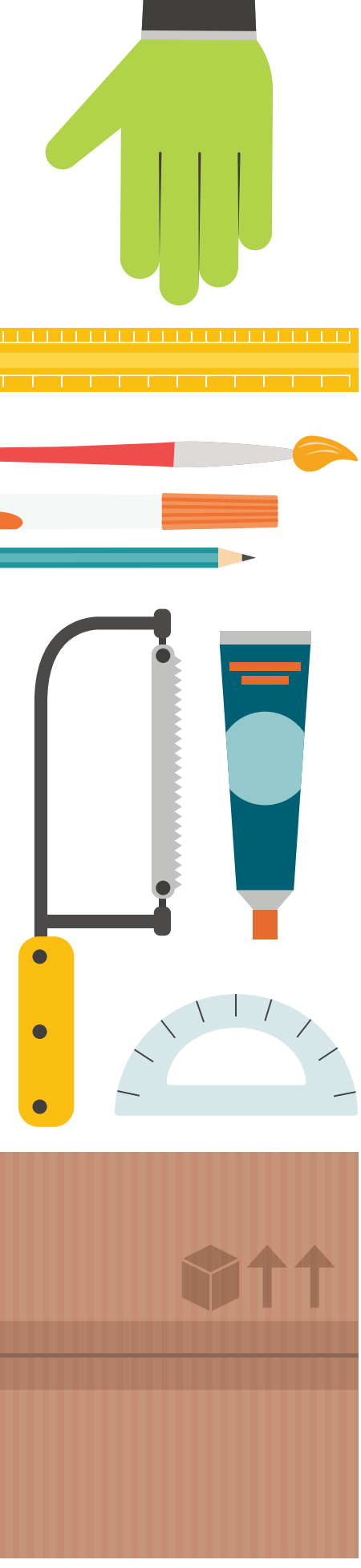
- Agriculture
- CTF
- CTS
- Economics
- Science
- Social Studies



6 A diversified economy means that a region is not solely reliant on single source of revenue.

7 A prototype is a model that illustrates the functionality of an idea or design. It may be life sized or scaled to a model that fits in your hand. However, a prototype needs to be as real looking as possible, using the materials available.

8 A scale model means that your model may be much smaller or larger than the actual, final product.



Success Determinants

Success will be determined by:

- ❒ Ability of your prototype of a tool or piece of equipment to save an agriculturist time, money, or some other needed functionality
- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Degree to which your prototype looks like your design sketch
- ❒ Functionality of your automation or mechanization
- ❒ Uniqueness and usability of your prototype and the degree to which it solves an actual problem
- ❒ Your ability to fully explain the physical and software aspects of your project to someone unfamiliar with agricultural operations and the problem for which your prototype is a possible solution

Parameters

- ❒ Your prototype must have a technological component to it that is controlled by code that your team has written. That code must have at least one for loop (or while loop) or an if-else statement.
- ❒ Your project must include some use of code that you haven’t learned in class.
- ❒ Your project must include at least one sensor (physical input) and two actuators (physical output).

Sensors (physical inputs)

- button
- photo resistor
- piezo (as a microphone)
- potentiometer
- soil moisture sensor
- temperature sensor
- ultrasonic sensor

Actuators (physical outputs)

- dc motor
- lcd display
- led
- piezo (as a speaker)
- rgb led
- servo motor

- ❒ The only resources or materials you can use that are not provided in your participant group kit include:
  - Cardboard / corrugated cardboard
  - Duct tape
  - Hot glue
  - Pipe cleaners

15 Classroom Furniture

Overview

The classroom furniture may help or hinder collaborative learning. The ability to move furniture easily, quickly, and safety is important in classrooms wanting to create and support collaborative learning. When students are using digital technologies such as tablets or laptops, they need to be able to move around, connect to electricity, work in ever-changing groups, and use a variety of materials and resources. Also, recent studies suggest that sitting is the new smoking. From Smith Systems website: "movement can contribute to ... concentration and is considered beneficial to physical health," (Retrieved January 2016, **https://smithsystem.com/school-setting/classrooms/**).

Design Rationale

In some Canadian schools, classrooms look and feel very traditional. Students sit in individual desks and those desks are often arranged in rows. Increasingly, some schools are changing the arrangement of furniture in their classrooms. Typical individual desks and chairs are being replaced with more welcoming, colourful, and different looking furnishing. Educators are increasingly suggesting that we need to think about how the furniture students use can become a physical point of contact between the student, the teacher, the learning, and the school.

Problem Scenario

Your team has been selected to develop a prototype for a structure component of classroom furniture that supports learning innovations and collaboration. It needs to be welcoming, comfortable, functional, colourful, and mobile. Your furniture must be a scale prototype of a classroom furniture model that could be found in a class setting. For this design challenge, your prototype must satisfy two of the following identified concerns:

1. Be adaptable for use by children with disabilities
2. Be affordable
3. Be easy to move
4. Be enjoyable for users of all ages
5. Be innovative and not an exact copy of something that currently exist
6. Be useful and beneficial for students of varying heights and sizes
7. Foster a positive, collaborative and enjoyable learning environment by addressing a specific concern or function

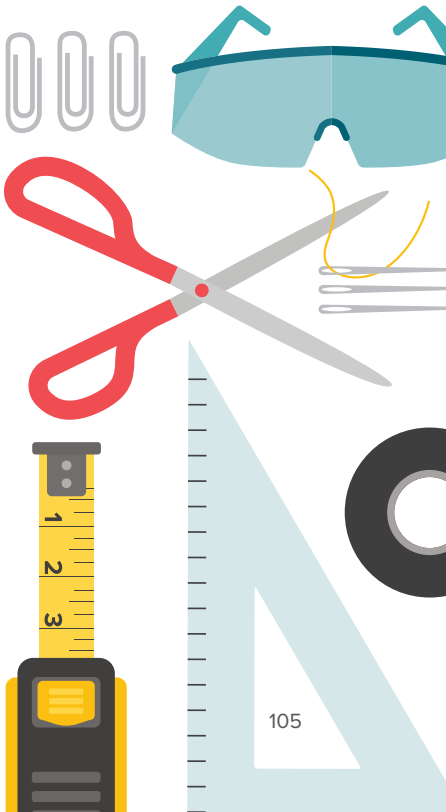
SkillsCanada Alberta

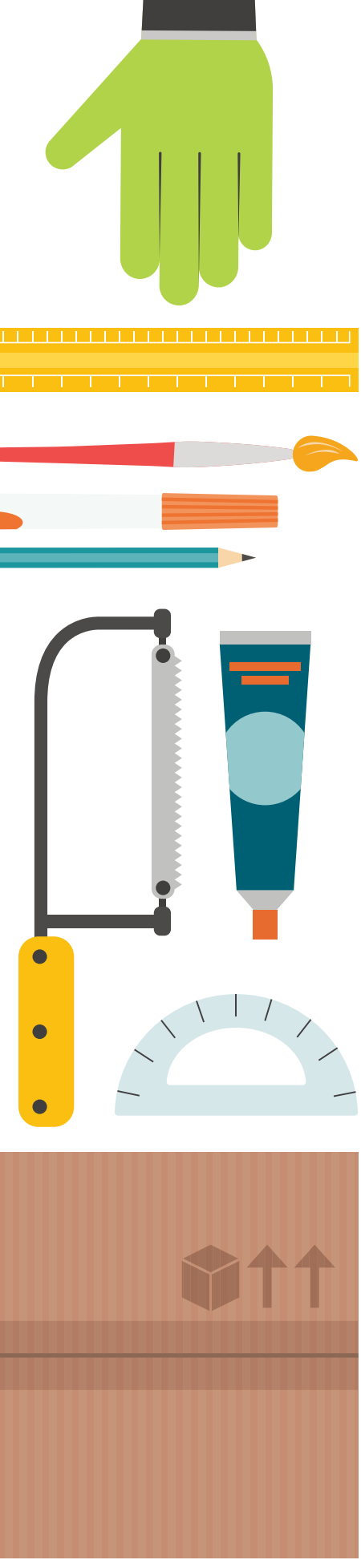
Suggested Grade Level

- Elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—wherever school culture or community is addressed
- CTF
- CTS
- Health Sciences
- Mathematics
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Ability of your prototype for a structure component of classroom furniture to help the user enjoy learning
- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Degree to which your prototype is adaptable to all users
- ❒ Degree to which your prototype looks like your design sketch
- ❒ Ease of long term maintenance and durability
- ❒ Ergonomic design
- ❒ Functionality
- ❒ Promotes active learning
- ❒ Uniqueness and usability of your prototype and the degree to which it solves an actual problem

Parameters

- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing and ergonomic.
- ❒ You must use some of all the consumable items in the participant group kit in some way.

16 Integrative Learning / Integrative Living

A Resource for Teachers

Overview

When educators create rich learning experiences for their students, they engage in the complex act of curricular interpretation and planning. The act of moving from curriculum as written to curriculum as embodied through learning requires thoughtful consideration and continuous design, iteration and revision. Research informed by the learning sciences (Bell, Lewenstein, Shouse, & Feder, 2009), growth mindset (Dweck, 2012), and PISA results (Programme for International Student Assessment, 2012) has shown that what we know about learning and how students learn has changed. As well, the needs of Canadian society, especially in terms of what constitutes a skilled workforce, have changed over the last few decades. These changes require educators to reconsider how students might engage differently with mandated curricular intentions, suggesting a multi-disciplinary and multi-faceted approach to instructional delivery focused on active learning and problem finding and problem solving situated in real world contexts is appropriate.

Design Rationale

Over the past two decades, large Canadian cities such as Calgary have rapidly expanded and diversified their economic bases. Calgary is a city with an ever-growing boundary and a footprint that exceeds New York City—a city with eight times the population of Calgary (Retrieved January 2016, **http://forum.skyscraperpage.com/showthread.php?t=136479**). Calgary's growth has slowly encroached on the natural habitats in the area. As a result, animal habitats in the region are in danger. There is a desperate need to consider the impact of urbanization on the natural environment.

In 2005, the City of Calgary produced a document, *Green Infrastructure In Calgary's Mobility Corridors* (Retrieved January 2016, **http://www.dcs.sala.ubc.ca/docs/calgary_green_infrastructure_mobility_corridors_sec.pdf**). This document is one of many that frame the problem of urban impact on the natural environment. Documents like this help educators to situate general curricular outcomes into relevant local or regional contexts. To make this link, educators need to hone their knowledge, understanding, and consideration of various disciplines and create rich learning opportunities for their students.

Skills Canada Alberta

Suggested Grade Level

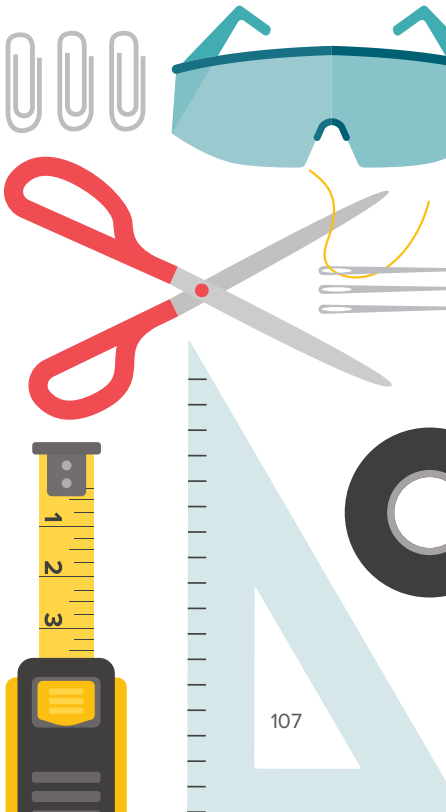
Adults working in elementary through to secondary school

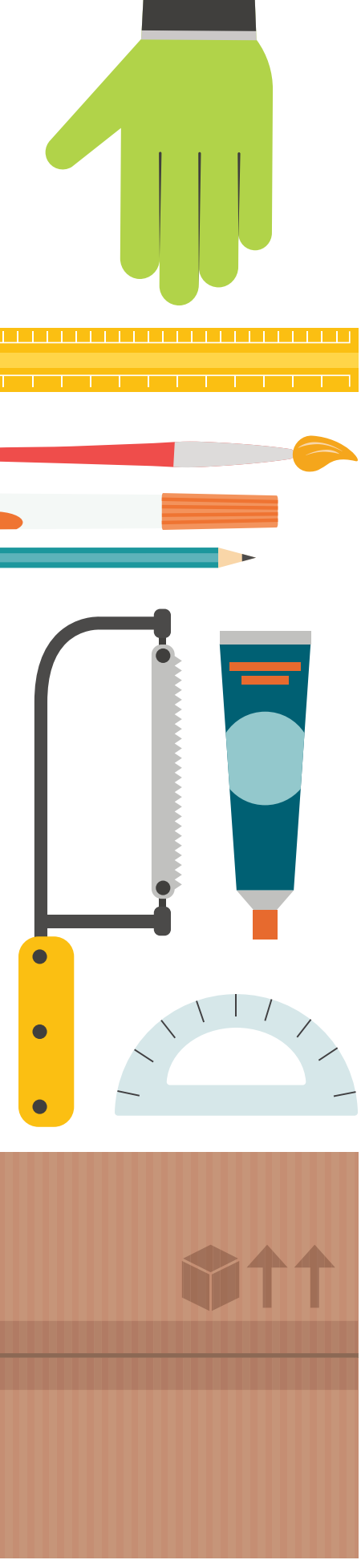
Suggested Audiences

- Directors of Instruction
- Principals
- School-based learning leaders

Suggested Subject Area

- Citizenship—wherever school culture or community is addressed
- Science
- Social Studies





Problem Scenario

The City of Calgary and surrounding areas are in need of your help. Local government offices are seeking innovative solutions to protect the ecosystem that sustains its local animal population. These potential solutions require the integration and synergy of multiple discipline areas, including ecology, biology, animal and human behaviours, natural resources, impact of urbanization and industrialization on rural areas, and economic implications. Proposals should include graphic representation of data analysis and predictions of population changes and patterns.

Your team has two tasks:

1. Create a metaphor[9] of student learning.
2. Develop a learning experience based on the problem scenario.

Task One: Your team will create a metaphor that illustrates your concept of how students learn. This will be a facilitated process using a human-centred design thinking process, collaborative prototyping, a design charrette[10] and reflection.

Task Two: Your team will design a learning experience for your students that requires them to:

- conduct a needs analysis of the current state of local habitats,
- research and develop strategies for remediation of an affected ecosystem, and
- create an opportunity to present their recommended action plans—possibly to members of the city planners or their local aldermen.

In creating your learning experiences, you need to consider a number of factors that students will need to understand:

- Action plan considers research on all areas that have contributed to the ecological impacts of urban sprawl
- Careful consideration of human factors that have led to the decline of the animal population
- Close consideration of the financial implication of your proposed action plan
- Description of the current state of affairs and potential future scenarios for animal growth based on analysis of data collected
- Identification of a specific animal populations for the students to target in their proposals
- What constitutes a sustainable and viable plan
- What constitutes a viable remediation strategy

9 A metaphor is a representation of ideas or concepts in a tangible and often creative or imaginative way. For example, we might use hearts as a metaphor for love, and then tear the heart or pierce it in some way to show angst or heartbreak.

10 A design charrette invites all participants to stop creating and become critical friends to other groups by asking good, open-ended questions while participating in a gallery tour of all the groups' metaphors.

Success Determinants

Success will be determined by:

- ❒ Clear linkages between curriculum outcomes and local issues
- ❒ Creation of assessment approaches that honour summative and formative learning (Retrieved January 2016 **http://www.learnalberta.ca/content/mewa/html/assessment/types.html**)
- ❒ Creation of engaging hands-on learning that fosters a growth mindset (Dweck, 2012) in students and supports learning innovations suggested by the learning sciences—possibly a 2 or 3 page lesson plan with supporting references and student resources

Parameters

- ❒ You must create a tangible metaphor, using some of all the consumable items in your participant group kit.
- ❒ You must incorporate multiple discipline areas into your lesson plan and resources.
- ❒ You must present formative and summative assessment strategies.

References

Bell, P., Lewenstein, B., Shouse, A., & Feder, M. (2009). *Learning science in informal environments: People, places, and pursuits*. Retrieved January 2016, **http://www.nap.edu/catalog/12190/learning-science-in-informal-environments-people-places-and-pursuits**.

Dweck, C. (April 20, 2012). *Exploring a growth mindset*. Retrieved January 2016, **https://www.youtube.com/watch?v=9hC1DwZS8tI**.

Girling, C., Galdon, M., Davis, L. & R. Kellett. (2005). *Green infrastructure in Calgary's mobility corridors*. Retrieved January 2016, **http://www.dcs.sala.ubc.ca/docs/calgary_green_infrastructure_mobility_corridors_sec.pdf**.

Programme for International Student Assessment (PISA). (2012). *PISA 2012 results*. Retrieved January 2016, **https://www.oecd.org/pisa/keyfindings/pisa-2012-results.htm**.

17 Waste Management

Overview

Consider the impact landfills have on society and what alternatives might be. Globally, the world's cities are struggling with what to do with their daily trash. In 2014, it was reported that 3 billion of the world's 7 billion population live in cities, producing more than 1.3 billion metric tons of sold waste per year (Retrieved January 2016, **https://weather.com/science/environment/news/worst-cities-trash-garbage-problems-20130926#/1**). As you look through the pictures on the website Trash Cities: The World's Worst Garbage Problems, try to identify the types of trash and how it might have found its way into those settings. The trash illustrated in the pictures does not just make the environment look unattractive, it is potentially dangerous to us all!

Design Rationale

We love to think about Canada as being clean—drinkable water, clear air, and environmentally responsible. At the same time, Canadians produce more garbage per person than any other country on earth (Retrieved January 2016, **http://www.cbc.ca/news/business/canadians-piling-up-more-garbage-than-ever-before-as-disposables-rule-1.3248949**). In 2015, Canada sent one of the largest delegations to the Global Environmental Summit (Retrieved January 2016, **http://www.carbonbrief.org/analysis-which-countries-have-sent-the-most-delegates-to-cop21**). On a global scale Canada should take steps towards leading the field on environmental awareness and has a responsibility to model good practice and assist others address their trash issues. Trash is a problem both of use (over packaging, disposable rather than reusable items, etc.), reuse, recycling, and disposal.

Problem Scenario

Your team has been selected to develop a more effective way to deal with trash. Sites like **http://www.conserve-energy-future.com/15-easy-ways-to-reduce-landfill-waste.php** suggest ways to reduce landfill waste. However, your task is to develop a prototype of a product that:

- Fosters recycling or re-using of previously wasted materials,
- Provides a needed purpose or service,
- Reduces trash going into landfills, and
- Satisfies the following factors:
  - Does not currently exist
  - Does not negatively impact the environment
  - Has a legitimate purpose
  - Has long term benefits
  - Is small scale and inexpensive

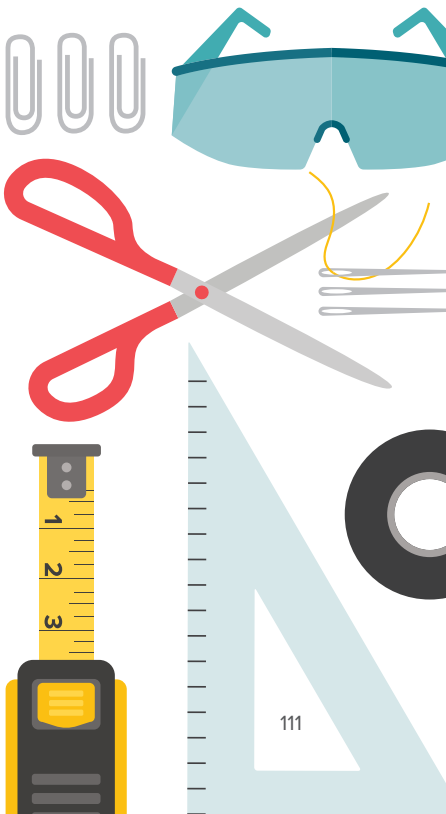
Skills Canada Alberta

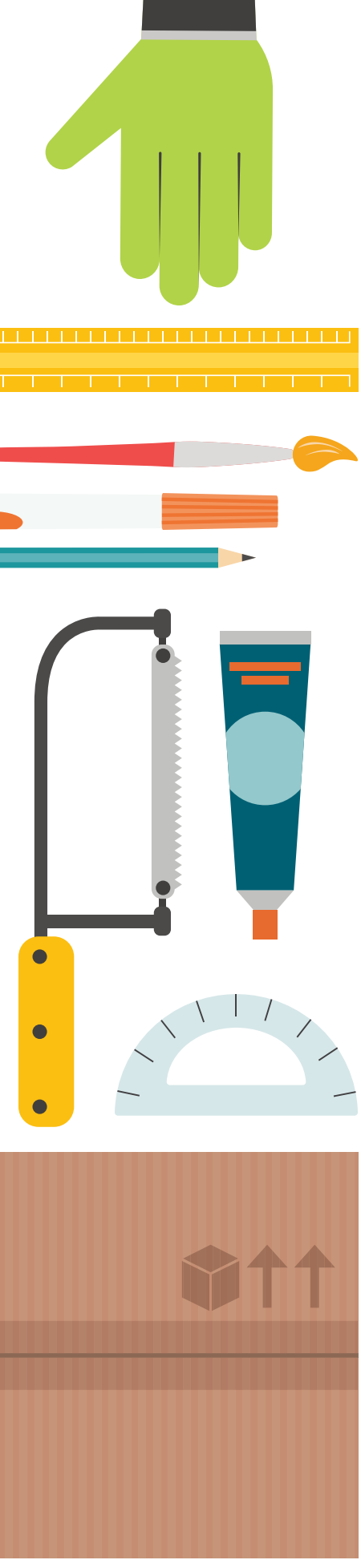
Suggested Grade Level

Elementary through to secondary school

Suggested Subject Area

- Citizenship—wherever school culture and community is discussed
- CTF
- CTS
- Mathematics
- Science
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Degree to which your prototype addresses the problem posed in the design challenge
- ❒ Degree to which your prototype aligns with your group’s design sketch
- ❒ Ease of long term maintenance suggested with your prototype
- ❒ Functionality illustrated within your prototype
- ❒ Uniqueness

Parameters

- ❒ You may use the tools provided to you in the classroom/pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing and ergonomic.
- ❒ You must use some of all the consumable items in the participant group kit.

18 Defining the Components of Society Using Artist Trading Cards

Overview

Society is typically defined as a group of people living together in the same geographical and social territory. Historically, the word society comes from the Latin word *societas*, which means friend or ally. This connection suggests many societies were formed for protection and strength (Retrieved January 2016, **https://en.wikipedia.org/wiki/Society**). In Canada, we pride ourselves in creating a multicultural society built through immigration (Retrieved January 2016, **https://en.wikipedia.org/wiki/Category:Canadian_society**).

In our globalized world, society is becoming an increasingly complex system. We often refer to complexity within a society as being a social fabric that is woven together by different social structures (i.e. clubs, groups, etc.) and social components including points of view, age, gender, race, culture, religion, activities, dress, etc. Given the complexity within our society, many times symbols (**https://en.wikipedia.org/wiki/Symbol**) become representations of our society. These symbols can appear on many items including artist trading cards (**https://en.wikipedia.org/wiki/Artist_trading_cards**).

Design Rationale

Often students may feel like our Canadian society is run primarily by adults. One example: *2020 vision: What will downtown Edmonton look like at the end of the decade?* (Retrieved February 2016, **http://www.edmontonjournal.com/business/commercial-real-estate/2020+vision+What+will+downtown+Edmonton+look+like+decade/10198815/story.html**).

"Students may struggle to find their place. Within our schools, there are clubs, groups, and other social structures that may be organized by educators or students. As students gain understanding of which social structures and social components constitute a society within their schools, they may more easily find their places, and begin to work towards becoming productive members of society. Alternatively, older students might mentor younger students and build relationships across multiple schools," (one example of mentorship programs—Retrieved January 2016, **http://albertamentors.ca/for-educators/benefits-mentoring-schools/**).

Problem Scenario

As part of the older student population in our school, your group has been selected to develop a set of 12 artist trading cards (3 artist trading cards per group member). Your artist trading cards will be used as models for the rest of the school as everyone participates in *Artist Trading Cards Trading Week*. During the week, all the students in our school will be invited to make their own set of cards to trade. Your group's set of 12 cards needs to illustrate a social structure or social component within the school that represents Canadian Society in 2020. If you have friends who are reluctant to draw their own card, you might introduce them to Zentangles—an inclusive start to making personal marks on small paper.

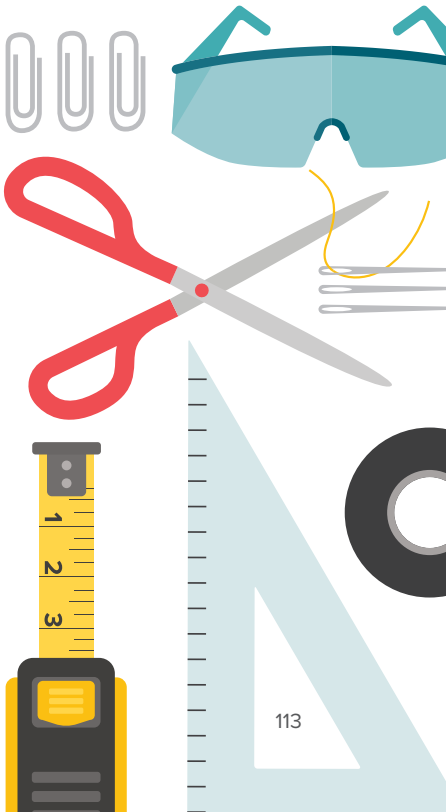
Skills Canada Alberta

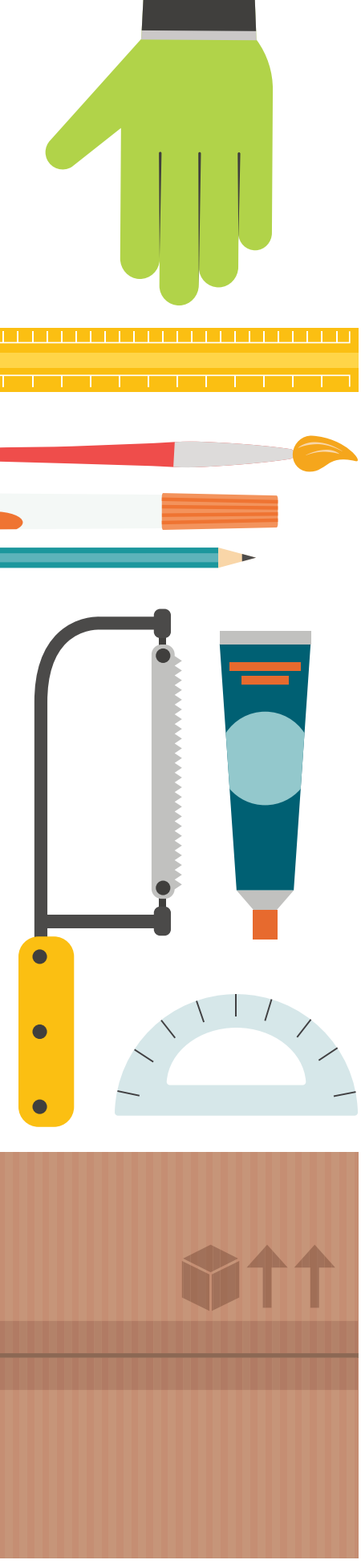
Suggested Grade Level

- Elementary through to secondary school
- Used as school community building activity

Suggested Subject Area

- Citizenship—wherever school culture and social community are discussed





The set of cards must satisfy the following:

- Illustrate one social structure or social component within the school
- Be reflective of one social structure or social component presented in Canadian Society in 2020
- One side of the card is your representation; the other side of the card clearly labels what you are representing

Success Determinants

Success will be determined by:

- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Artist trading cards can be created in any medium available from the shared pantry of resources
- ❒ Artist trading cards should be colourful and carefully created
- ❒ At least one of the group’s artist trading cards reflects a unique aspect of Canadian society in 2020 and that aspect is clearly labeled
- ❒ Each artist card is 2 ½" x 3 ½" card and can be in either portrait or landscape orientation
- ❒ Each member of the group makes 3 unique cards

Parameters

- ❒ You must complete a display panel including your design thinking sketches, sample artist trading cards, your design notes, and your reflections on the activity which will illustrate the artist trading cards you are illustrating.
- ❒ You must use some of all the consumable items in participant group kit in some way in the production of your cards.

Resources

Artist Trading Cards **https://en.wikipedia.org/wiki/Artist_trading_cards**

Zentangle **https://www.zentangle.com/**

ReadWriteThink **http://www.readwritethink.org/classroom-resources/student-interactives/trading-card-creator-30056.html**

19 Apathy to Empathy

Overview

Thanks to social media and an almost continuous news cycle (e.g. television, radio, newspapers, etc.), we are provided many glimpses into global events, both happy and tragic, on a daily basis.

Some suggest social media has made our society apathetic to the world around us. Others propose that we are merely sympathetic to tragedies in a superficial, short-term way because another tragedy is always being reported. Initiatives like *Fight Apathy* (Retrieved January 2016, **http://states.jsa.org/fightapathy/**) and *Me to We* (Retrieved January 2016, **http://www.metowe.com/**) attempt to mobilize youth to make a difference and move from apathy to sympathy to empathy.

Apathy typically refers to lacking passion or emotion or care for things that others might find engaging or important. When we talk about social or world issues, apathy is demonstrated by a lack of awareness of the issues or in statements like, "That problem is too big or taking place too far away," and "Why should I care?" or "What could I do?"

Sympathy typically refers to the ability to feel an emotion about an issue, whether it be sadness, joy, compassion, etc. When we talk about social or world issues, sympathy may be demonstrated in statements like, "Those poor people, I wonder what I can attend to help?" Sympathetic activities include crowd funding efforts, charity events, and awareness raising.

Empathy typically refers to the ability to deeply understand and almost enter into another's feelings. When we empathize, we move beyond sympathy and begin to engage with both the feelings and the cause of those feelings. When we talk about social or world issues, empathy can be demonstrated in statements like, "I wonder what is causing this situation or lack of emotion... how might we alleviate this person's concerns and engage others through our actions?"

Examples of apathy, sympathy and empathy, positioned within the situation of homelessness might include:

- Apathy: Homelessness is terrible but it isn't my problem. I don't know anyone who is homeless.
- Sympathy: Homelessness must be terrible. Let's organize a bottle drive and give the proceeds to our local homeless shelter.
- Empathy: Homelessness must be terrible. I'm going to volunteer to serve meals at our local homeless shelter and begin to learn more about the causes and issues of homelessness in our community.

It takes effort to create empathic newspaper headlines and social media tweets of human stories. That effort helps others to start caring for people and to comprehend empathetically. Classroom activities like Stanford's d.School Empathy Mapping may help to understand this process (Retrieved May 2016, **http://dschool.stanford.edu/wp-content/themes/dschool/method-cards/empathy-map.pdf**).

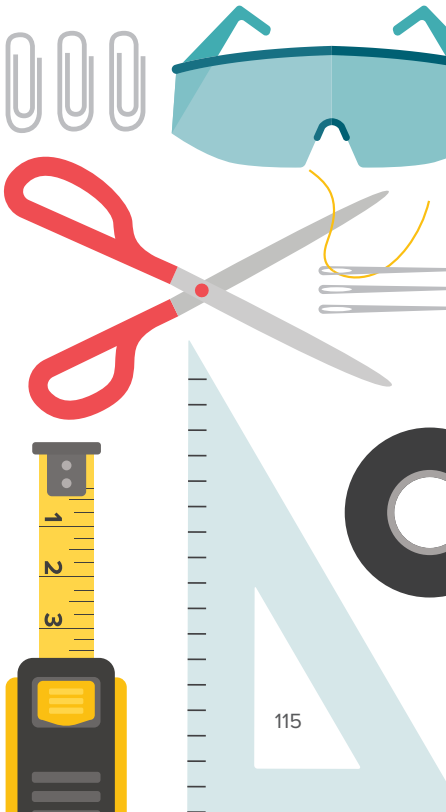
SkillsCanada Alberta

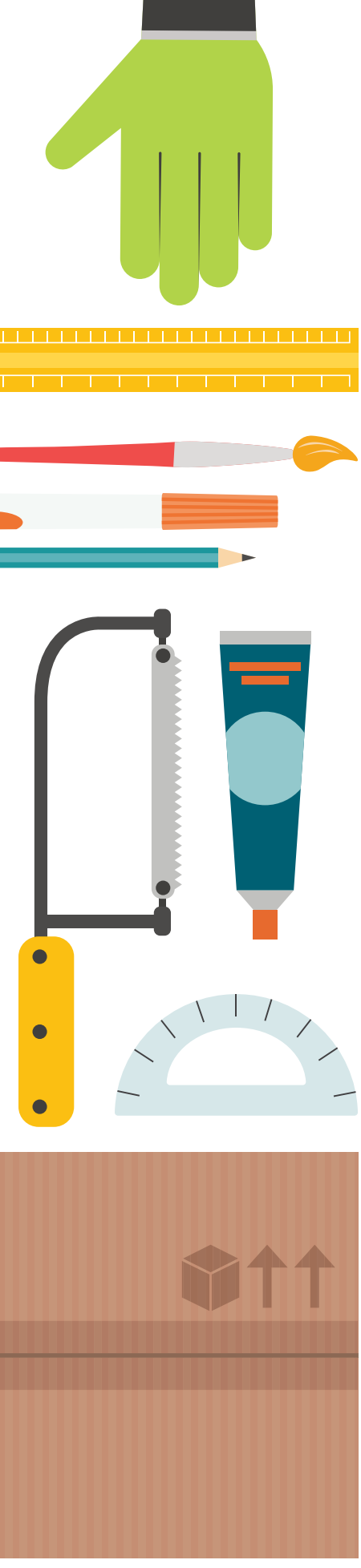
Suggested Grade Level

Middle school to secondary school

Suggested Subject Area

- CTF
- CTS
- Economics
- Science
- Social Studies





Design Rationale

We live in a global community connected through various forms of media. The youth of today have many opportunities to become empathetic and to be aware of global issues. They bring their passion and energy to personally engage in global change. A key for developing responsible global awareness begins with moving from apathy or sympathy to empathy and action. Agencies and organizations may help us find ways to start being responsible for the well-being of others. A few examples include the United Nations (Retrieved May 2016, **http://www.un.org/millenniumgoals/**), Red Cross and Red Crescent (Retrieved January 2016, **https://www.icrc.org/en/who-we-are/movement**), Medecins sans Frontieres (Retrieved January 2016, **http://www.msf.org/**), Citizen Journalism (Retrieved January 2016, **https://en.wikipedia.org/wiki/Citizen_journalism**).

Problem Scenario

Your team has been selected to identify a global problem and create either a metaphor that helps others understand the origin/cause of the problem and represents a potential solution that is innovative and creative OR a prototype of an object that would help alleviate the problem. There is no shortage of global problems that your group of extremely energetic, committed, and aware young people could identify, discuss, and engage. The key is to find a global problem that ignites your team's passion. In order to affect change, everyone on your team needs to be personally invested and engaged in the outcome. In other words, you must begin to replace your apathy or sympathy with empathy.

Success Determinants

Success will be determined by:

- ❒ Alignment to design motto: "Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener."
- ❒ Degree to which your metaphor or object looks like your design sketch
- ❒ Development of a metaphor or object that will affect change
- ❒ Uniqueness of your metaphor or object and the degree to which it describes or solves an actual global problem
- ❒ Your team's ability to articulate the connections between your chosen global problem and your metaphor/object.
- ❒ Your team's ability to develop a meaningful connection between a global problem and your personal passion

Parameters

- ❒ Global issue must come from the ideas generated during class discussions.
- ❒ You may use items and tools in your classroom's pantry.
- ❒ You must prepare an appropriate social media or news presentation, which demonstrates your global issue, your passion, and how your solution/object will affect change.
- ❒ You must use something of everything in your participant group kit.

20 Displaced Students

Overview

The population boom, immigration, and rural families continuing to move into urban centres have taxed the capacity of schools to accommodate students in their immediate area. Not so many years ago, children walked or rode their bikes to their neighbourhood schools. However, increasingly urban centres are building large community schools to accommodate students being bussed or driven from multiple neighbourhoods. As a result, more and more students feel alienated and isolated, like strangers in their schools. A challenge becomes how to create initial and ongoing experiences for new students so they can increasingly feel welcomed; build relationships with their fellow students, teachers, and staff; find their place; and gradually become active members of their school communities.

Design Rationale

Schools are dynamic and potentially vibrant places. We know that if people feel connected and can find their place, they feel valued and accepted. It only takes seconds to make a first impression. As members of our school community, we need to find ways to welcome newcomers. The first experiences of new students with our school need to be positive, welcoming and inclusive. New students enter each year. Many students enter mid-year and back to school activities are completed. The question becomes—how might members of school communities welcome new students, from a variety of cultures, economic backgrounds, and communities in a manner that creates that much needed positive first impression?

Problem Scenario

A new school is opening in your community. The purpose of this school is to accommodate the overflow student population from 10 different suburb communities across the city. Your team has been selected to develop a prototype or a metaphor of a welcoming experience that will create a sense of warmth and acceptance and will help the new students begin to form a sense of connection and acceptance towards the school and its community.

Your team needs to consider how your welcoming experience(s) will address the issues of sustainability, cost, time, and cultural sensitivity, while creating a long-lasting, positive impact on the new students, regardless of when they first visit the school.

Your welcoming experience must satisfy at least two of the following criteria:

- Be a tangible item that the new students can take home at the end of the day and that will serve a purpose
- Be enjoyable and engaging for new students (Grades 7–12)
- Be reflective of the school culture, mission, and vision
- Develop a sense of belonging and/or connection to the school community
- Foster a connection with classmates

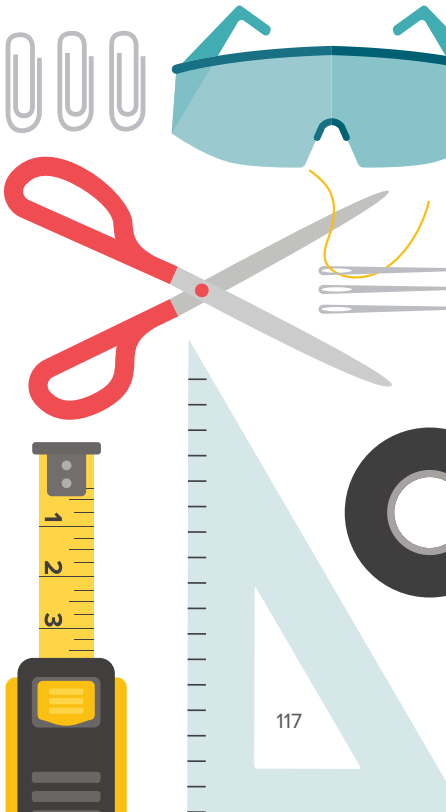
SkillsCanada Alberta

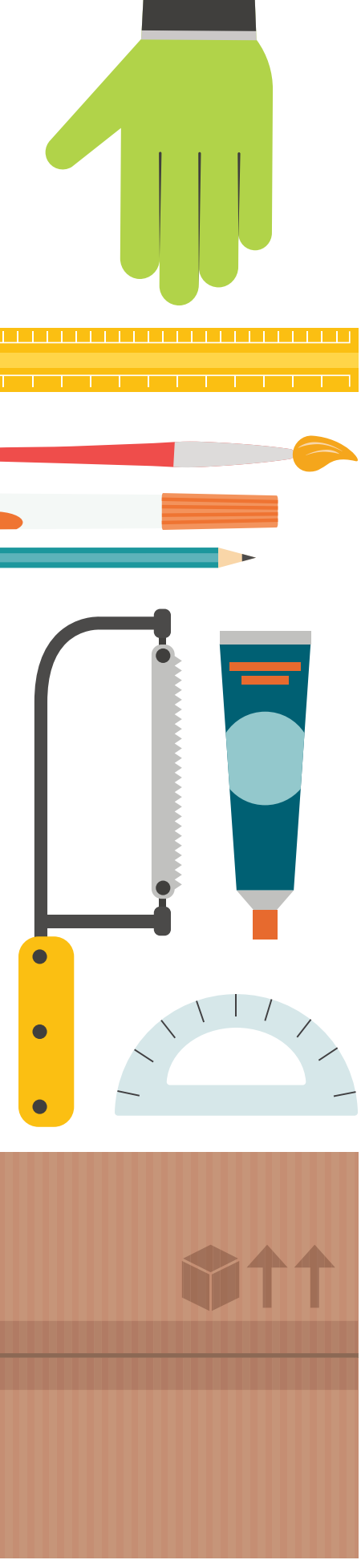
Suggested Grade Level

Grades 7–12

Suggested Subject Area

- Citizenship—including school culture / community
- CTF
- CTS
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Ability of your item to help the user establish a connection
- ❒ Alignment of the prototype or metaphor with the design sketch
- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Degree to which it is adaptable to all users
- ❒ Degree to which it is culturally inclusive
- ❒ Functionality
- ❒ Uniqueness
- ❒ Usability

Parameters

- ❒ You may use the tools provided to you in the classroom/pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing and usable.
- ❒ You must use some of all the items in the participant group kit in some way.

21 Growth Mindset: Electricity

A Resource for Teachers

Overview

Because of children's natural curiosity, they begin to explore electricity by watching thunderstorms, flipping light switches on and off, and other exploratory and potentially dangerous ways. Electricity is everywhere and absolutely useful, but it also can be very dangerous and electrical accidents may occur.

"In the United States, 50,900 fires each year are attributed to electrical failure or malfunction, resulting in 490 deaths and 1,440 injuries. Arcing faults are a major cause of these fires. About 3,300 residential fires originate in extension cords each year, killing 50 people and injuring about 270 others," (Retrieved January 2016, **http://www.esfi.org/resource/holiday-data-and-statistics-359**).

We know that the prevention of fires and accidents requires knowledge and awareness. Children can be introduced to the power and purpose of electricity in age appropriate ways, and they will take that knowledge and understanding home to their families.

There are many websites and other resources to help educators develop engaging learning experiences and connect those experiences to specific curriculum outcomes. However, educators need the time to imagine exciting and open-ended ways to introduce key concepts to their students so experimentation and exploration can take place. We know a key to developing a growth mindset toward scientific thinking is to help children to think like a scientist and develop a positive, growth-oriented attitude toward learning scientific concepts. Carol Dweck (2016), a researcher from Stanford University explains,

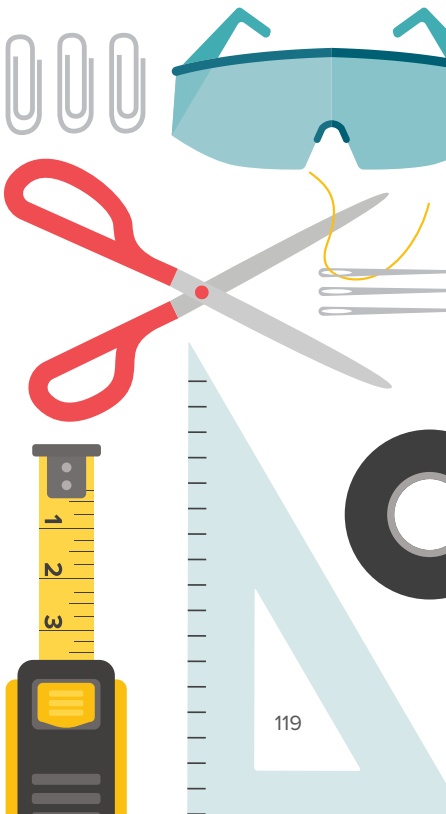
"In a growth mindset, people believe that their most basic abilities can be developed through dedication and hard work—brains and talent are just the starting point. This view creates a love of learning and a resilience that is essential for great accomplishment. Virtually all great people have had these qualities," (Retrieved January 2016, **http://mindsetonline.com/whatisit/about/index.html**).

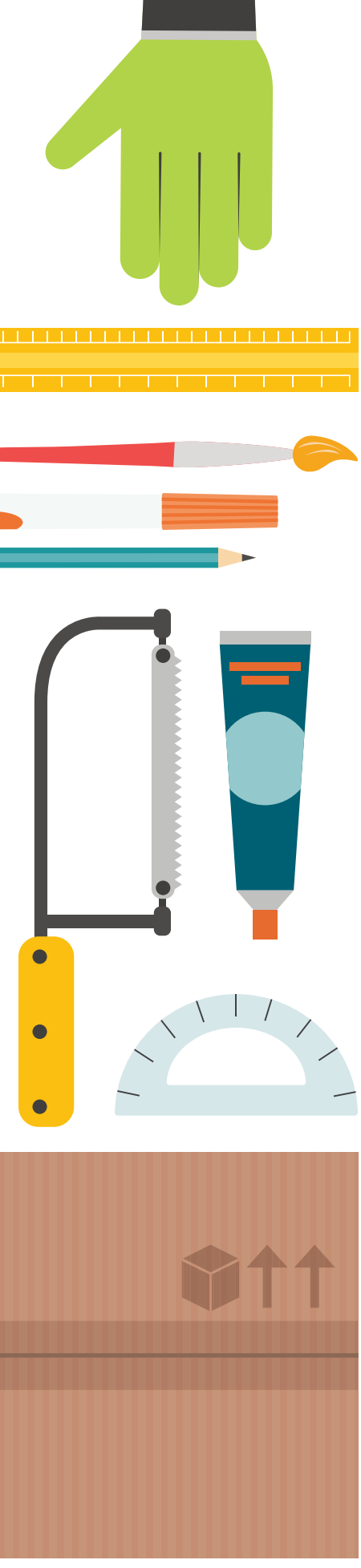
Scientific thinking refers to the process of observation, exploration and discovery by being curious, open-minded and creative (Retrieved January 2016, **http://undsci.berkeley.edu/article/think_science**).

Skills Canada Alberta

Suggested Audience

- Curriculum leaders
- District directors of instruction/learning leaders
- Elementary classroom teachers





Design Rationale

A 2003 study (Retrieved January 2016, **https://cset.stanford.edu/sites/default/files/files/documents/publications/Osborne-Attitudes%20Toward%20Science.pdf**) suggests that students' attitudes toward science are impacted by the following factors:

- anxiety toward science
- attitudes of parents towards science
- attitudes of peers and friends towards science
- enjoyment of science
- fear of failure on course
- motivation towards science
- perception of the science teacher
- personal achievement in science
- personal value they place on science
- self-esteem at science
- the nature of the classroom environment

Helping students create positive attitudes toward science often falls solely on classroom educators, who themselves may not have a growth mindset about their own abilities toward tackling science concepts. Therefore, educators need opportunities to explore science in supportive, hands-on, experiential ways.

Problem Scenario

Your group has been selected to develop a sample learning activity that introduces students to a core concept about electricity in a hands-on, experiential way. Your group must design the learning activity, write it up in a way that other educators could use it in their classes, connect it to your curriculum, and complete the activity yourselves, providing a working model of the learning.

Your design challenge is situated in the topic of electricity because it is important that children understand its potential and power in safe yet challenging and engaging ways. You need to design an activity that satisfies their curiosity about electricity and fosters their love of play. An interesting starting place to explore learning activities might be the following links (Retrieved January 2016): **http://www.pbs.org/parents/adventures-in-learning/2014/02/electric-play-dough/** or **http://www.esfi.org/be-smart-about-fire-and-electrical-safety**.

Success Determinants

Success will be determined by:

- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Complexity and opened-ness of the learning activity—the ability of students to explore and experiment and show what they know and need to learn rather than follow a script or a recipe to complete the task
- ❒ Degree to which it is adaptable to all students at a specific learning level/stage or age
- ❒ Degree to which your activity adheres to your design sketch
- ❒ Practicality of the learning activity for the average classroom
- ❒ Uniqueness and usability of your learning activity and the degree to which it solves a curricular outcome

Parameters

- ❒ You must be prepared to explain and share your learning activity and completed project.
- ❒ You must consider how to make your learning activity safe, intriguing, informative and fun.
- ❒ You must create a lesson write up that other educators could follow and adapt.
- ❒ You must use some of all the items in your participant kit in some way.
- ❒ Your learning activity must be helpful in teaching children about electricity.

22 Developing Historical Empathy

Overview

The study of a country's history and evolution requires more than the memorization of dates, names and facts. Historians need to develop a deep understanding of the confounding circumstances of events, including people, places, cultures, politics, and many other factors. Coming to know why things happened the way they did is as important as knowing what happened and when. As Jill Lepore said, "The study of our history requires investigation, imagination, empathy and respect," (The Whites of Their Eyes: The Tea Party's Revolution and the Battle over American History, 2010).

When we take the opportunity to learn about Canada's history, we can begin to understand and appreciate the struggles of the people who helped to shape Canada's identity today. As Frederick Douglas said, "Without a struggle, there can be no progress" (1857).

Design Rationale

Canada has a reputation of being a compassionate and caring country. We have a history of being global peace keepers, and our 14th prime minister, Lester B. Pearson, won the Nobel Peace Prize in 1957 for his efforts.

In the recent humanitarian crisis in Syria, Canadians have stepped up to welcome refugees and incorporate them into our communities. Canadians pride themselves in the inclusion of others. We respect diversity as a society and through our legal systems. However, we do not have an unblemished history, especially in our treatment and inclusion of Aboriginal Peoples (Retrieved July 2016, **http://www.naho.ca/publications/topics/terminology/**).

Problem Scenario

Your team has been selected by the Canadian Arts and Heritage organization to design an interactive, 3-dimensional depiction of a historical event that involved an injustice to Aboriginal Peoples. This depiction should help viewers to understand the what, where, when, and why of the event. Further, it should help them to gain empathy for those impacted by the event.

Your depiction must:

- be a scale model that captures the feelings and thoughts of one of the people or groups of people involved in an historical event
- communicate clearly this perspective to an audience
- have some degree of interaction
- demonstrate your knowledge of the historical event and the context in which it occurred

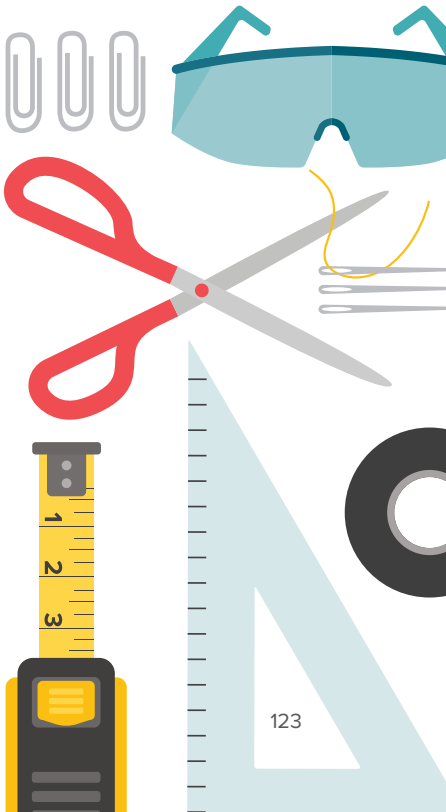
SkillsCanada Alberta

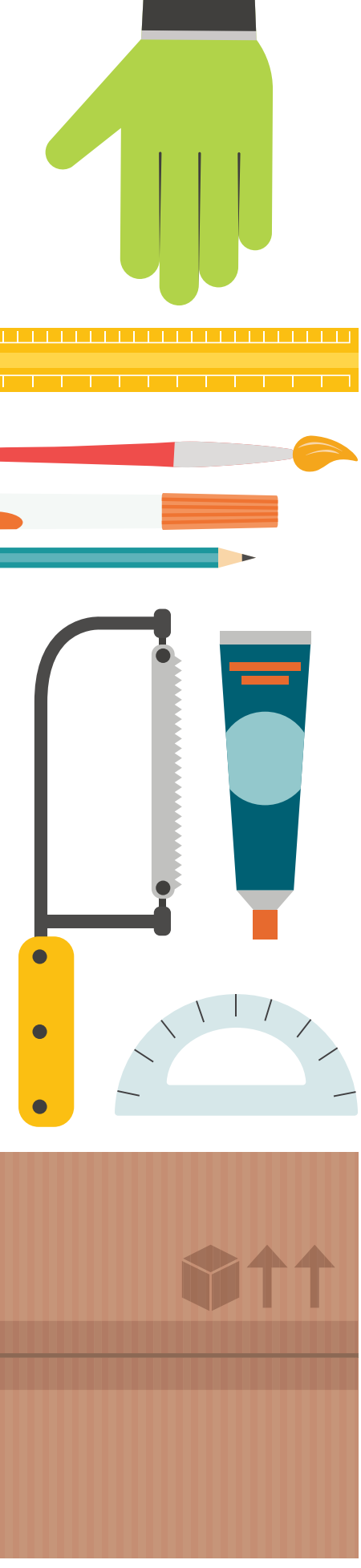
Suggested Grade Level

- Elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Ability of your depiction to capture the perspective (thoughts & feelings) of the group impacted by the historical event
- ❒ Alignment of your depiction with the design sketch
- ❒ Degree to which the event is represented in detail
- ❒ Degree to which your depiction is visually appealing (craftsmanship, attention to detail) to warrant the placement in a museum
- ❒ Purposeful use of colour/general aesthetics to capture mood and feeling
- ❒ Uniqueness and accuracy of your depiction and the degree to which it portrays a historical event

Parameters

- ❒ You may use the tools provided to you in the classroom pantry.
- ❒ You must prepare a group display which includes:
    - A monument plaque that explains the connections between the represented perspective and the historical event
    - Your team names
    - Reflection on the design process that you and your team has just completed
    - Your design thinking sketches
- ❒ You must use some of all of the items in the participant group kit in some way.

23 Eco-smart Recreation Facility

Overview

Developers are becoming increasingly interested in designing structures that are properly suited for their environments. Structures that are not designed this way are prone to damage from catastrophic environmental events such as flooding. According to the *Alberta Provincial Flood Damage Assessment Study* (**http://www.alberta.ca/albertacode/images/pfdas-alberta-main.pdf**), damage from flooding in Alberta has cost billions of dollars over the last decade. Without proper mitigation, cities must repeatedly repair and rebuild structures in flood areas at great expense.

In addition to flood mitigation, structures are being increasingly designed to reduce their impact on the surrounding environment. People are recognizing the importance of maintaining ecosystems in urbanized areas by considering factors such erosion, airflow, solar exposure, and pollution (i.e. chemical, light, and sound). One way of regulating building design is through certification programs such as LEED (**http://www.usgbc.org/leed**).

LEED certified buildings save money and resources overtime and are designed to have a positive impact on the health of occupants, while promoting renewable, clean energy. LEED standards influence the building design and construction, interior design, building operation and maintenance, and neighbourhood development. To obtain LEED certification, credits are given to building designs that provide:

- Access to a variety of transportation options
- Are energy efficient
- Are water efficient and reduce potable water consumption
- Create innovative solutions to problems
- Have high quality indoor air and access to daylight/views
- Minimize the impact on ecosystem and water resources
- Use sustainable building materials and reduce waste

Design Rationale

Land is in short supply and decisions made for land use must be a rigorous process involving market analysis, demographic research, education, multiple stakeholder points of view, scientific input and considerations of sustainability. Before a solution is chosen, all viewpoints, demographic and economic points of view should be considered and should be allowed to offer questions and multiple solutions/ options. Solutions should adhere to a three-prong approach using the pillars of sustainability—economic, environmental, and societal needs (Retrieved January 2016, **http://www.thwink.org/sustain/glossary/ThreePillarsOfSustainability.htm**). These pillars help guide problem finding and help planners work toward solutions that will be successful and sustainable into the future.

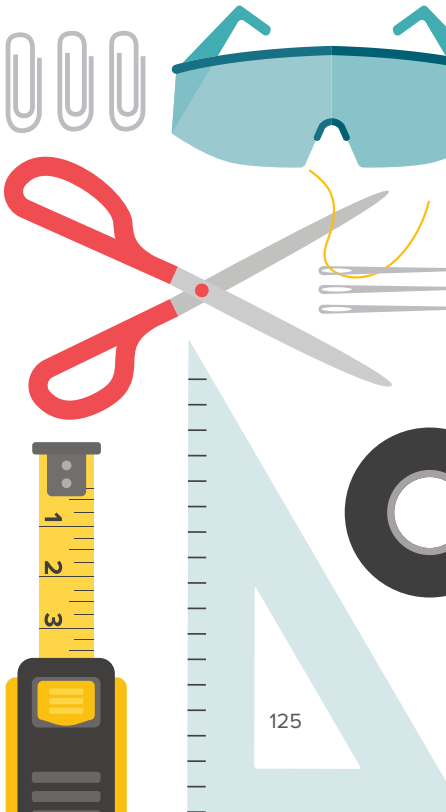
SkillsCanada Alberta

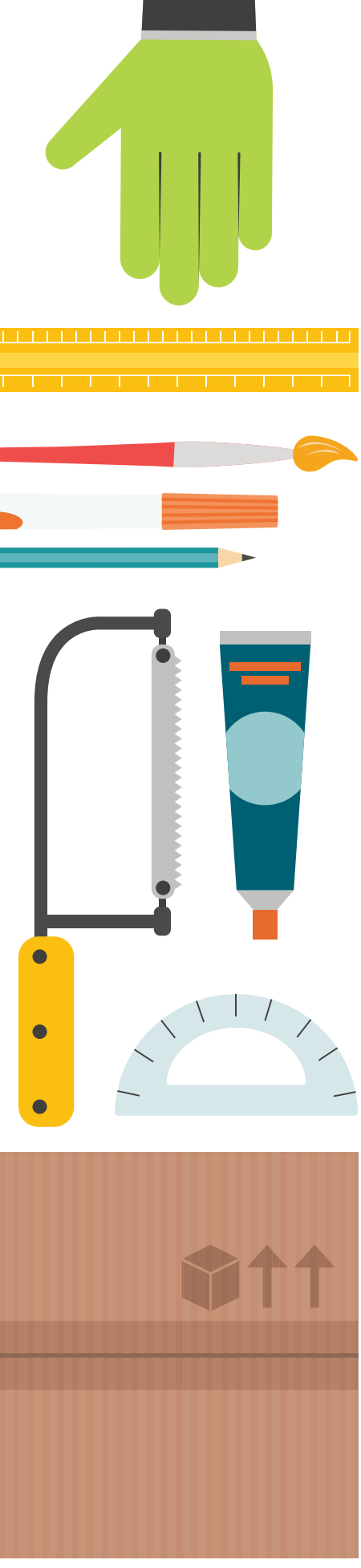
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Physical Education
- Science
- Social Studies





Problem Scenario

Your team has been selected to design and develop a proposal for a recreational facility on a plot of land. Your design must preserve the ecosystem, while minimizing environmental impact and providing opportunities for all interested stakeholders. You have an undeveloped plot of land with a creek running through it. The total area is 30 acres, and you do not have to develop it all. This is an imaginary plot of land in your community, so other than the creek and the size, you can use your imaginations to describe the property you are developing.

Your proposal must meet the following criteria:

- Development addresses the protection of the area from flood damage
- Environmental preservation is considered in the development
- Offer multiple recreation opportunities
- Provide evidence of research into the site characteristics, including size, topography, soil composition, vegetation, surrounding features, existing infrastructure
- Provide models of any structures to be built, and they must be constructed to be environmentally friendly (see LEED certification requirements as a reference)
- Year round access is provided to recreational opportunities

You will create a design document as well as a prototype or scale model that demonstrates your design. A design document is a series of sketches and written descriptions that answer the criteria presented in the problem scenario. A prototype or a model illustrates the functionality of an idea or design.

Success Determinants

Success will be determined by:

- ❒ Addresses Pillars of Sustainability
- ❒ Alignment of the design to meet the needs outlined in the problem scenario
- ❒ Alignment of the prototype and the design sketch
- ❒ Alignment to the motto: “Make it smaller, stronger, do more, be easier to use (build), be cheaper, be clean, be greener.”
- ❒ Design incorporates concepts from the course content
- ❒ Uniqueness of design and prototype

Parameters

- ❒ You may make a pitch to use the materials found in the pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must use some of all the items in participant group kit in some way.
- ❒ You should use the tools provided by the teacher.

24 Water Conservation

Overview

There are millions of litres of water wasted each day in schools across North America. Think about how much water is wasted when you take a drink from a water fountain, flush a toilet, or wash your hands. A recent statistic suggests that almost 95% of the water that enters a home is wasted (Retrieved January 2016, **http://www.huffingtonpost.com/2008/07/30/10-facts-about-wasted-wat_n_115642.html**). We know, "783 million people worldwide do not have access to clean water. 6 to 8 million people die annually from the consequences of disasters and water-related diseases," (Retrieved May 2016, United Nations, 2016, **http://www.unwater.org/**). Clean water is related to health and wellness, and water usage directly impacts water quality and quantity.

Design Rationale

Canada has 1/5 of the world's fresh water. We need to become leaders in the conservation and stewardship of this vital resource the world shares. We have a responsibility to examine every opportunity to conserve and reuse water. Many of us have no idea how much water we consume and waste in our everyday activities. Online tools like the Water Footprint Calculator can help (Retrieved January 2016, **http://www.gracelinks.org/1408/water-footprint-calculator**).

Problem Scenario

Your team has been selected to develop a working prototype of a water conservation solution for your school. Your prototype might include ways to capture and filter existing water in your school. The purpose of the prototype should be to minimize the amount of water that is wasted in and around your school. It must satisfy the following concerns:

- Must address the need for sanitation, if necessary (potable vs non-potable water)
- Must be safe (someone cannot fall into it)
- Should be protected from extreme temperatures and the environment
- Should include a distribution component
- Should include water collection/reuse from a variety of sources (rain, water fountains, etc.)
- Should limit or reduce evaporation

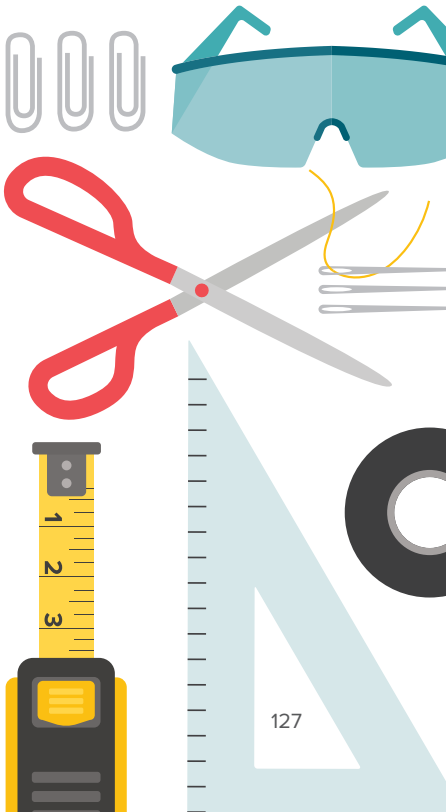
SkillsCanada Alberta

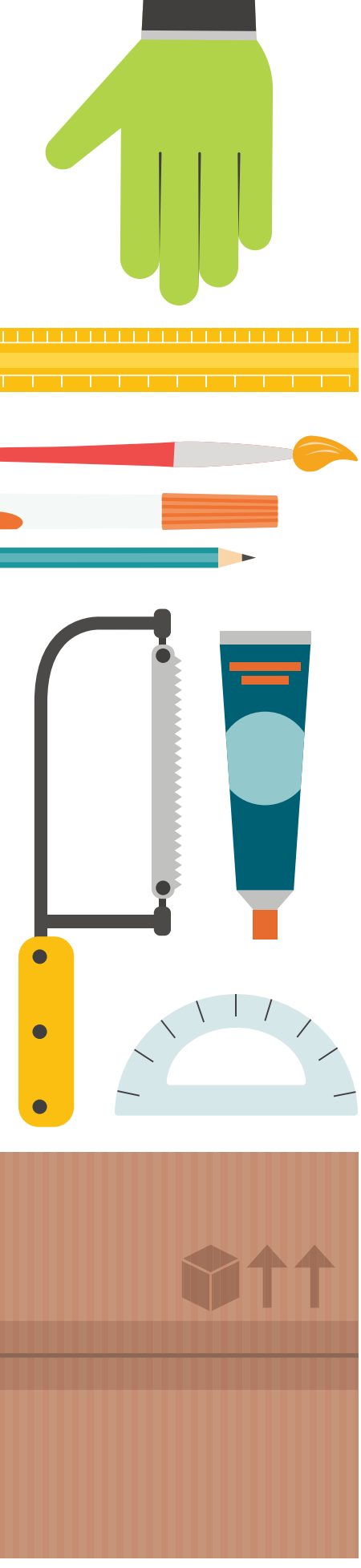
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Science
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Functionality
- ❒ Low maintenance—easily sustainable and maintainable
- ❒ Must fit in to existing structures without being an eye sore
- ❒ Prototype is aligned with design
- ❒ Should address problems and concerns from the problem scenario
- ❒ Simplicity of design

Parameters

- ❒ You may use the tools located in the shared tool area.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing and ergonomic.
- ❒ You must use some of all the items in the participant group kit in some way.

25 Alternative Dwellings

Overview

Most of our building supplies come from natural resources—trees, stones, brick, adobe, etc. Unfortunately not all of the resources available are suitable for building materials (Retrieved January 2016, **https://en.wikipedia.org/wiki/Natural_building**). As these natural resources are being consumed, builders are beginning to question how might they use alternative materials or unusual materials to build homes within our communities.

Design Rationale

People around the world live in a variety of structures—some structures are highly portable and mobiles while others are more permanent. Climate, culture, political and economic stability, and geography impact how and where people live.

Problem Scenario

Your team has been selected to develop a prototype or scale model of a dwelling that might be unique in your community. It needs to be movable and/or portable and able to withstand the climate and geography of your area. Your team needs to consider the availability of materials, local and traditional designs, and the needs of the ideal family who might live in the structure.

Your prototype or scale model must satisfy at least two of the following identified concerns:

- Be able to house families of different sizes
- Be able to withstand climate and natural events of the area
- Be accessible for a variety of family members
- Be portable
- Replace natural resource available in your community/region

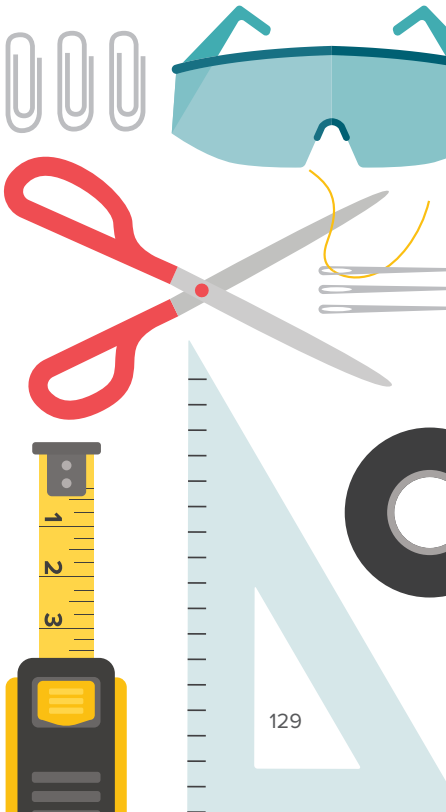
SkillsCanada Alberta

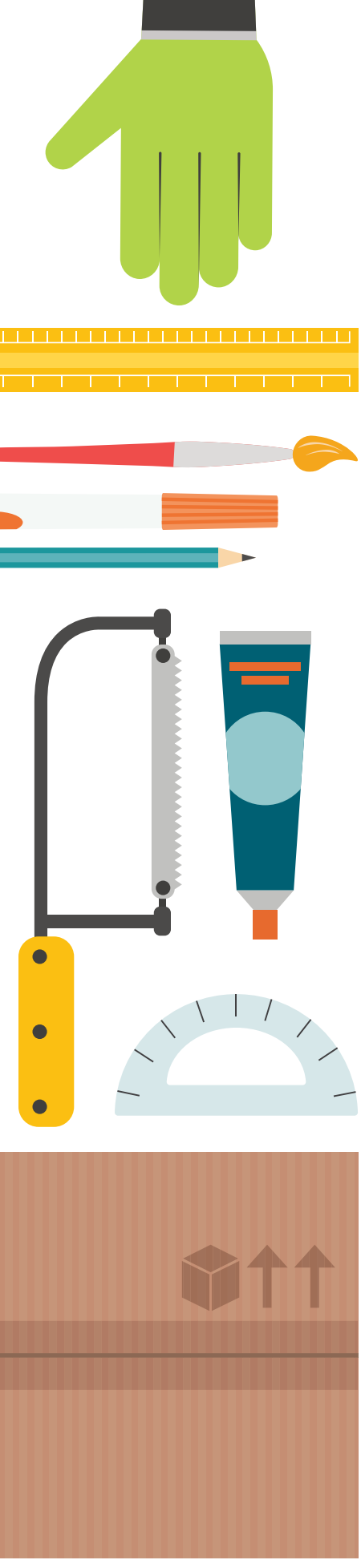
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Geography
- Science
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Alignment of the prototype with the design sketch
- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener”
- ❒ Degree to which your prototype looks like your design sketch
- ❒ Ease of long term maintenance and durability
- ❒ Functionality
- ❒ Is able to fit with other buildings in the area (colours, design, structure)
- ❒ Shows understanding of the geography of the land for which the structure is being built
- ❒ Uniqueness and usability of your prototype and the degree to which it solves an actual problem

Parameters

- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing and ergonomic.
- ❒ You must present your design thinking sketch, your prototype and design notes.
- ❒ You must use some of all the items in the participant group kit in some way.
- ❒ You should use the tools located in the shared tool area.

26 Mars Shelter and Transportation

Overview

NASA is preparing to send humans to an asteroid by 2025 and to land on Mars in the 2030's (Retrieved January 2016, **http://mars.nasa.gov/programmissions/science/goal4/**). NASA has been sending robotic explorers to Mars for years with the intention of eventually sending humans there (Retrieved January 2016, **http://mars.nasa.gov/odyssey/**). Globally, teams of engineers, designers, inventors, scientists, and others are developing technologies and tools to help us achieve the goal of humans living and working on Mars.

Design Rationale

Historically, humans have been curious about other places. We have the desire to explore and discover (Retrieved January 2016, **http://www.newworldencyclopedia.org/entry/Human_migration**). Our fascination with space and space exploration extends our natural curiosity to migrate from where we evolved. Naturally, we may expect human presence on a planet other than Earth to be a logical step for human advancement and discovery. However, many issues need to be considered: the environmental concerns on other planets (i.e. air pressure, gravity, heat, etc.), basic human needs (i.e. food, water supply, etc.), transportation issues (i.e. how to get there and back), and what might constitute quality of life on a new planet (Retrieved January 2016, **http://www.simplypsychology.org/maslow.html**).

Problem Scenario

Your team has been selected to design a lightweight, portable shelter or personal transportation vehicle for use on Mars. Your team has been tasked with developing a prototype that can be assembled quickly and withstand the rigours and challenges of the Martian environment.

Your prototype needs be made of individual components for easy storage and transportation to Mars. Your team needs to consider the added value of your components being lightweight, compact, and highly functional. Your Martian prototype must be able to satisfy one or more of the following concerns:

- Appropriateness for the Martian atmosphere
- Cost efficiency
- Quality of life

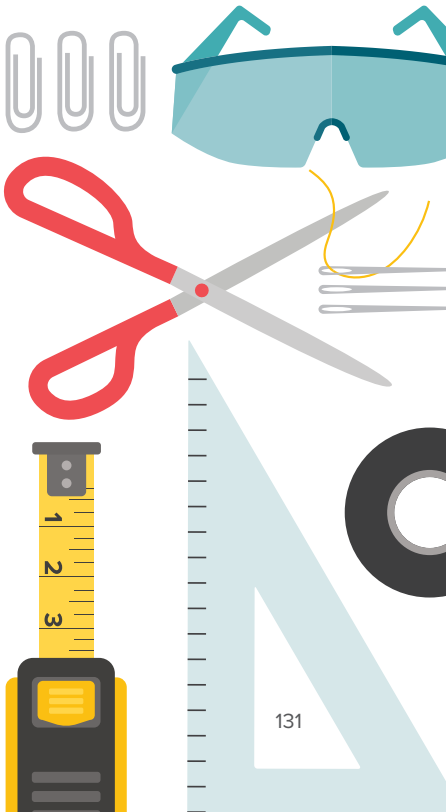
SkillsCanada Alberta

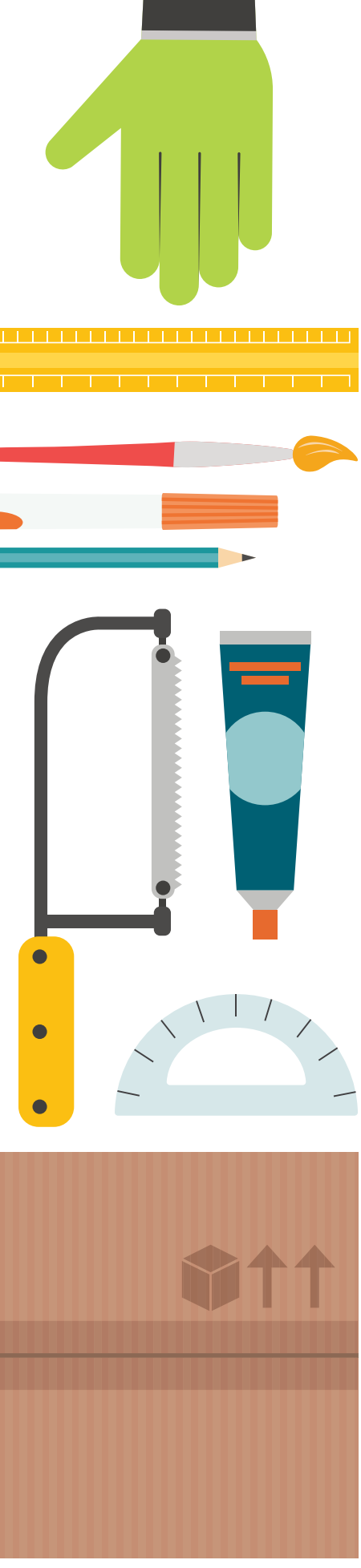
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Physics
- Language Arts
- Social Studies
- Science 7–9





Success Determinants

Success will be determined by:

- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Completion of a detailed blueprint/plan before beginning construction
- ❒ Degree to which your prototype is adaptable to Martian conditions and multiple users
- ❒ Degree to which your prototype looks like your design sketch
- ❒ Ease of long term maintenance and durability
- ❒ Functionality of your prototype
- ❒ Uniqueness and usability of your prototype and the degree to which it solves an actual problem

Parameters

- ❒ You may use the tools provided to you in the classroom pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing, and usable.
- ❒ You must use some of all the items in the participant group kit in some way.

27 Stimulating Our Senses

Overview

Many schools have students with diverse learning needs. Sometimes, it is the simplest of tools or toys that can make a difference and support a student's learning in wonderful and powerful ways. For example, students who have sensory processing challenges struggle to learn through their senses as the majority of us do.

"Sensory processing is how we transform sensory information from within our own bodies and the external environment into messages we can act on. It's tempting to think of senses (touch, sight, sound, movement, body awareness, taste, and smell) as separate channels of information, but they work together to give us a reliable picture of the world and our place in it," (Retrieved January 2016, h**ttp://www.sensorysmarts.com/signs_of_spd.html**).

Design Rationale

Lindsey Biel and Nancy Pesk have written a checklist to determine our "sensory smarts" (Retrieved January 2016, **https://www.sensorysmarts.com/sensory-checklist.pdf**). Temple Grandin, in her compelling TED Talk (Retrieved January 2016, **https://www.ted.com/talks/temple_grandin_the_world_needs_all_kinds_of_minds?language=en**), talks about what is to live and learn with autism.

"We all learn through our senses. ... Right now your senses are working together. You hear background sounds and feel your clothing, chair, and the floor beneath your feet. You resist gravity to stay seated. You see letters on the screen. You filter out unimportant sensory input so you can make sense of what you are reading. If you occasionally lose focus because your shirt label is itchy, you may have a mild sensory issue. If you keep sliding off your chair, look away when you hear any noise, feel like your shirt is hurting you, or the words you are reading pulsate, you may have sensory processing disorder, also known as sensory integration dysfunction. Sensory issues affect all kinds of people—from those with developmental delays, attention and learning problems, autistic spectrum disorders and other diagnoses to those without any other issues," (Retrieved January 2016, **https://www.sensorysmarts.com/signs_of_spd.html**).

Problem Scenario

Your team has been asked to develop a toy or tool that would help a student with a sensory processing challenge improve their ability to learn in school. You will probably need to research sensory processing issues and then focus on one sense or sensory challenge. You team is required to create a prototype of the toy or tool.

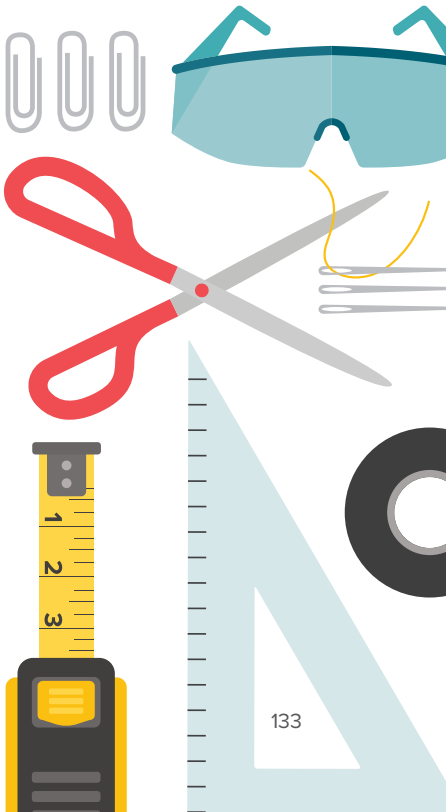
SkillsCanada Alberta

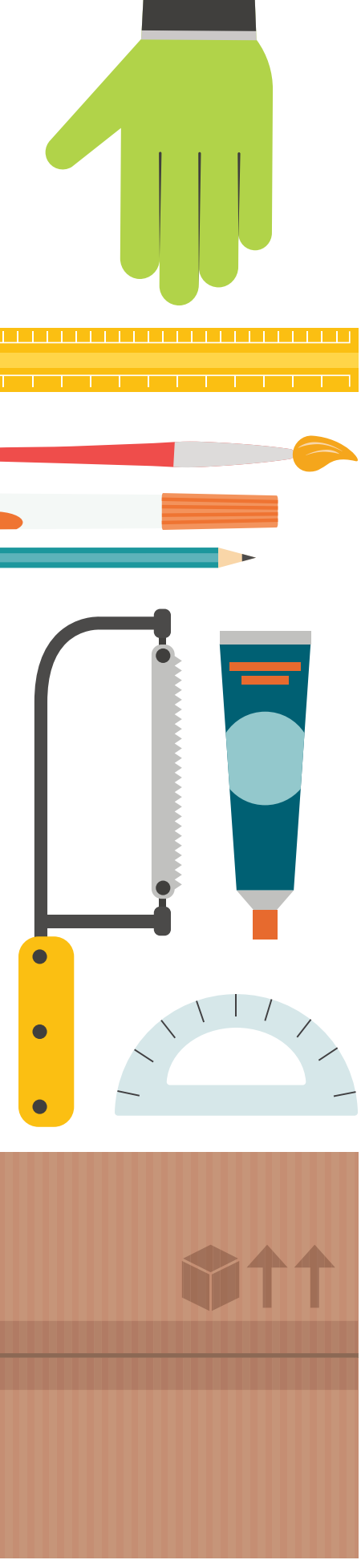
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Physics
- Science
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Ability of your prototype to help a child learn
- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Degree to which it is adaptable to the user
- ❒ Degree to which your prototype looks like your design sketch
- ❒ Ease of long term maintenance and durability
- ❒ Functionality
- ❒ Uniqueness and usability of your prototype and the degree to which it solves an actual challenge

Parameters

- ❒ You may use the tools provided to you in the classroom pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing, and ergonomic.
- ❒ You must use some of all the items in your participant group kit in some way.

28 Inclusive Playgrounds

Overview

"Children with disabilities are often excluded from or restrained in play activities because of the physical barriers of play structures and the surrounding environment," (Ripat & Becker, 2012). Organizations and foundations, like the Rick Hansen Foundation, (Retrieved July 2016, **https://www.rickhansen.com/Our-Work/School-Program/Accessible-Play-Spaces/Lets-Play-Inclusive-Playgrounds**) recognize children with disabilities require active play opportunities.

Design Rationale

Canadians pride ourselves in our respect and inclusion of others. However, 1 in 7 people with disabilities are excluded from enjoying playgrounds and parks. We need to consider what inclusion and accessibility might mean to people of all ages and abilities across our communities.

Problem Scenario

Your team has been selected to develop an amazing playground structure or a component of a playground that is inclusive, safe, fun, and engaging. Your team's design needs to include your ideas of fitness, flexibility, and a joy of play. You must consider issues of mobility, access, sensory challenges, etc.

Success Determinants

Success will be determined by:

- ❒ Ability of your prototype to help the users enjoy playgrounds
- ❒ Addressing the design challenge by creating something that is helpful, functional, and unique
- ❒ Following the design motto: "Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener."

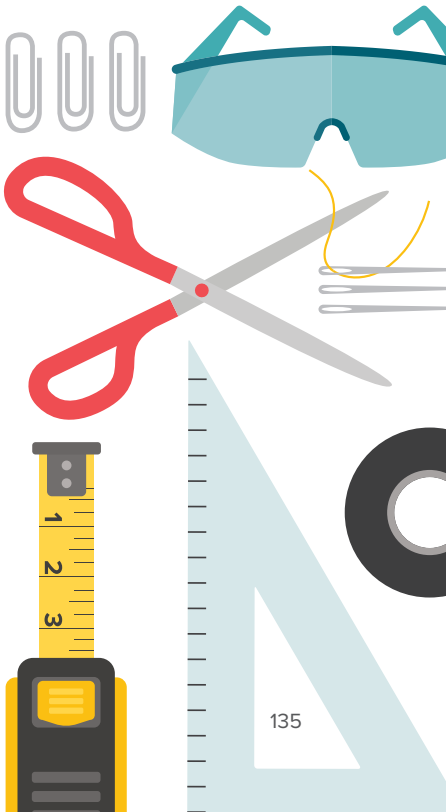
SkillsCanada Alberta

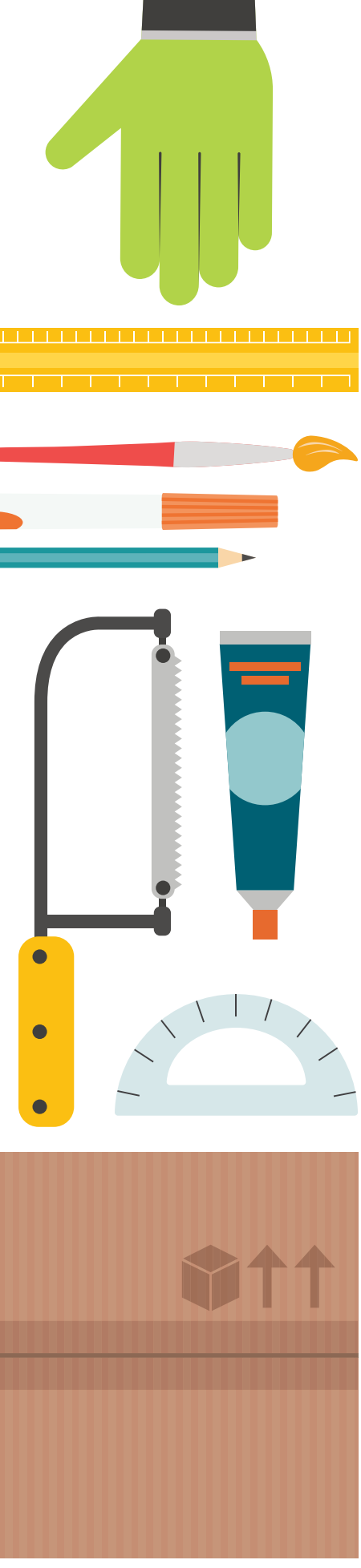
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Physical Education
- Science
- Social Studies





Parameters

- ❒ You may exchange items from the pantry.
- ❒ You must use some of all the items in the participant group kit in some way.
- ❒ Your small-scaled playground structure or component of a playground must include at least two of the following concerns:
    - Be accessible for someone with mobility issues
    - Be accessible for users of variable heights/sizes
    - Be accessible for someone with sensory issues
    - Be accessible for someone with cognitive challenges
    - Be enjoyable for users of all ages

29 Outdoor Classroom

Overview

What is an outdoor classroom? It is a gathering place for teachers and students to integrate nature into learning within the school grounds. It brings learning to life by situating formal learning within a school's natural environment and giving students the opportunity to get outside and experience nature.

Design Rationale

Studies have shown that outdoor classrooms can make learning more effective because they allow students to explore and learn in a more comfortable and relaxed outside setting—especially on nice days. Imagine being able to have your math class outside while you get fresh air while you learn. Imagine how your powers of observation would increase as the seasons change and birds and bugs fly by. Imagine planting your own gardens and landscaping your learning space in harmony with native plantings.

Problem Scenario

Your teacher has invited your group to design an outdoor classroom for your school. This space must be accessible to all students, be functional for teachers to conduct a lesson, and be must sustainable and easily maintained by you, the students, with minimal assistance from your teacher, staff, and community volunteers. You must create a prototype of your design and share it with the class.

Success Determinants

Success will be determined by:

- ❒ Alignment of your ultimate prototype to your design
- ❒ Alignment to design motto: "Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener."
- ❒ Appropriateness of the plantings to your local environment and weather conditions
- ❒ Functionality of the classroom
- ❒ Originality and creativity of the design
- ❒ Sustainability and ease of maintenance

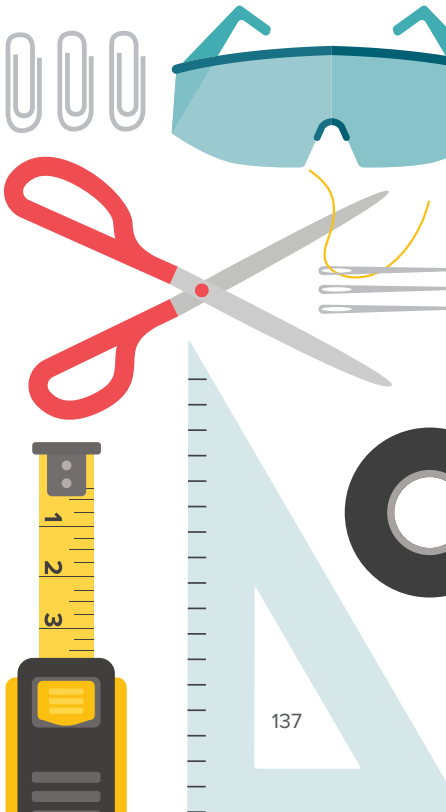
SkillsCanada Alberta

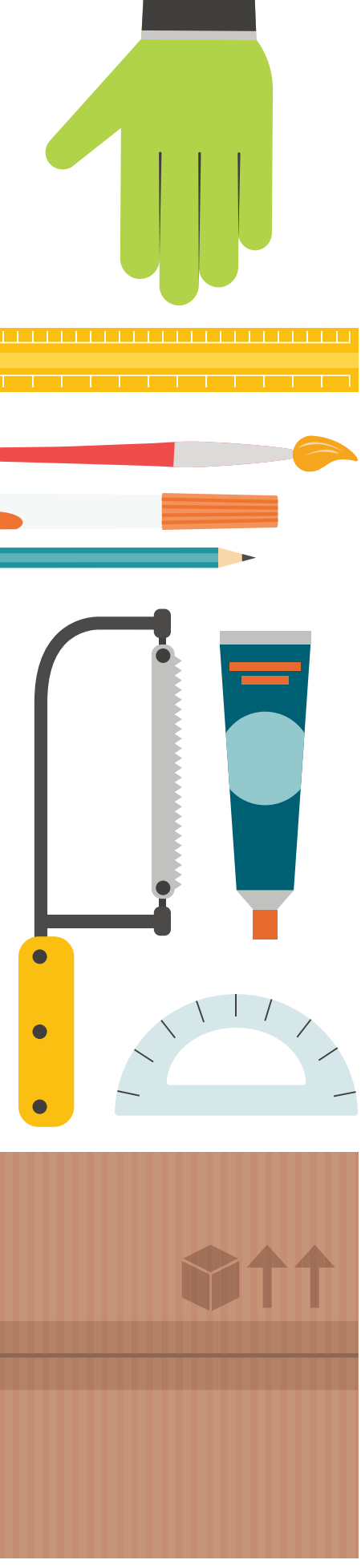
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Citizenship—including school culture/community
- CTF
- CTS
- Science
- Social Studies





Parameters

- ❒ You may use the tools provided to you in the classroom pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing, and sustainable.
- ❒ You must use some of all the items in the participant group kit in some way.

30 Outdoor Learning Spaces

Overview

Students have limited opportunities to learn outdoors. For example, one school representative reported four picnic tables for 1,250 students. So when these students might have times during the day to enjoy the benefits obtained from learning outside, there were few places to sit or study or enjoy a conversation. While picnic tables have typically been used as outdoor furniture, they are not the most flexible or comfortable form of seating. Also, they are not necessary ergonomically sound or easily moved! Over time, schools would like to increase outdoor learning opportunities by creating learning spaces that support learning, healthy lifestyles, and fitness.

Design Rationale

According to research, outdoor learning spaces can improve student learning. A recent article entitled *Peaceful Learning in Outdoor Spaces* is a good introduction to the topic (Retrieved January 2016, **http://www.naesp.org/communicator-august-2014/peaceful-learning-outdoor-spaces**). Sound research cites the many benefits of outdoor learning including better health, better grades, decreased stress, increased motivation, better behaviour, improved memory, and increased appreciation for the environment (Retrieved January 2016, **http://www.englishoutdoorcouncil.org/research.in.outdoor.learning.html**). However, seating is an issue due to cost, flexibility, long-term maintenance, and ergonomic issues.

Problem Scenario

Your team has been selected to develop a prototype for an outdoor learning space that is functional and will allow students to benefit from the outside environment. Your team needs to consider issues of wellness, usability, functionality, durability, long-term maintenance, and aesthetic appeal.

Your outdoor learning space prototype must be a small-scaled prototype of a space or element of the space that can accommodate learning.

It must satisfy at least two of the following identified concerns:

- Adhere to safety codes/permits
- Be accessible to all students, of all abilities
- Encompass more than just a structure (greenery, plantings, art, etc.)
- Encourage movement and flexible learning
- Enhance/support learning already taking place in the school/classroom
- Support fitness and attend to ergonomic issues

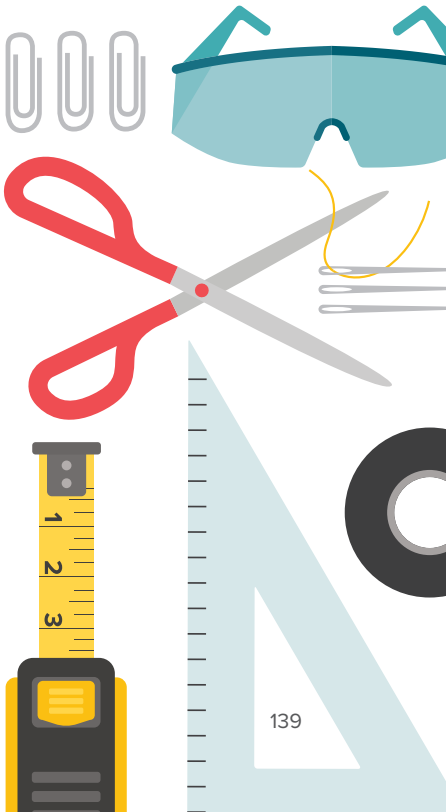
SkillsCanada Alberta

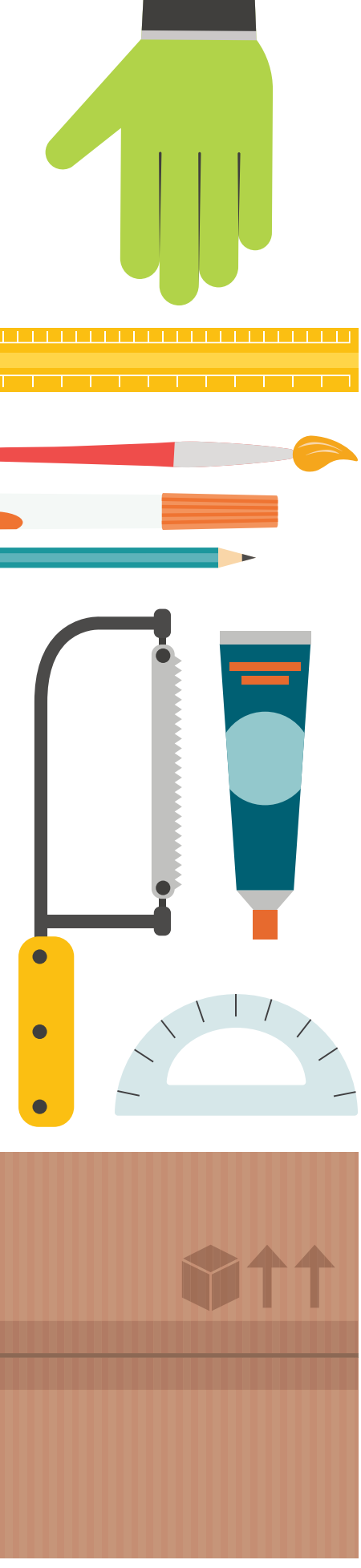
Suggested Grade Level

- Upper elementary through to secondary school
- Possibly primary grades with adult assistance

Suggested Subject Area

- Agriculture
- Citizenship—including school culture/community
- CTF
- CTS
- Physical Education
- Science
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Ability of your prototype to help the users enjoy outdoors
- ❒ Alignment of the prototype with the design sketch
- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener”
- ❒ Colorfulness / design to match environment and attract users
- ❒ Degree to which it’s intuitive to all users
- ❒ Ease of long term maintenance
- ❒ Ergonomic / learning-friendly design
- ❒ Functionality
- ❒ Intriguing enough to hold users’ attention
- ❒ Uniqueness

Parameters

- ❒ You must consider how to make your prototype colourful, intriguing and ergonomic.
- ❒ You must prepare a group display which includes your design notes, your design thinking sketches and your prototype.
- ❒ You must use some of all the items in the participant group kit in some way.

31 Up-cycling Fashion

Overview

One of the growing trends in fashion is called up-cycling. Up-cycling gives old or discarded clothing a better purpose through a process which converts it into something useful and often beautiful. From Triple Pundit website:

"There are more textiles produced in the world today than realistically can be used—many of the large clothing chains can produce as many as a half a billion garments a year. A question you have to ask is 'What happens to those clothes after they have fulfilled their "useful" lives?' About 14.3 million tons of textiles were sent to the landfill in 2012, or around 5.7 percent of total municipal solid waste generation in the U.S., according to the Environmental Protection Agency (Retrieved January 2016, **http://www.epa.gov/osw/conserve/materials/textiles.htm**). If not discarded as trash, unwanted apparel is often donated to thrift stores. Though a good step toward avoiding the landfill, this is not as beneficial as people think as only about 20 to 30 percent of donated clothing is actually re-sold (Retrieved January 2016, **https://greenthreadblog.wordpress.com/2014/02/20/the-afterlife-of-our-closets/**). Part of the reason such a low percentage of re-sale exists is due to the drastic increase in second-hand clothing stores in the past 15 years which leaves thrift store with cheap fashion and junky basics instead of vintage gems,"(Retrieved January 2016, **http://www.triplepundit.com/special/sustainable-fashion-2014/upcycling-new-wave-sustainable-fashion/**).

Design Rationale

How might we up-cycle textile waste in our world? We all have garments that have worn out or gone out of style. Typically, these items will end up in a landfill, even if they make a brief stop in a thrift store first. One of the first things we learn as we try to be greener is to try to reuse items before recycling them. Fascinating sites like *40 Mind blowing Ways to Repurpose Old Clothing* (Retrieved January 2016, **http://www.trendsandideas.com/40-mindblowing-ways-to-repurpose-old-clothing/**) provide some interesting ideas for consideration.

Problem Scenario

Every year the school ends up with lots of unclaimed clothing in its lost and found collection. Your team has been given the task of designing something useful that could be made from that collection. It could be an item for a vulnerable member of our community (i.e. a homeless person, a person in a shelter, a person in a care facility, a person receiving medical treatment, etc.). You need to design a prototype of your item.

Your design sketch and prototype must meet the following criteria:

- It should be appropriate, functional and attractive
- It might be designed for a specific season or purpose

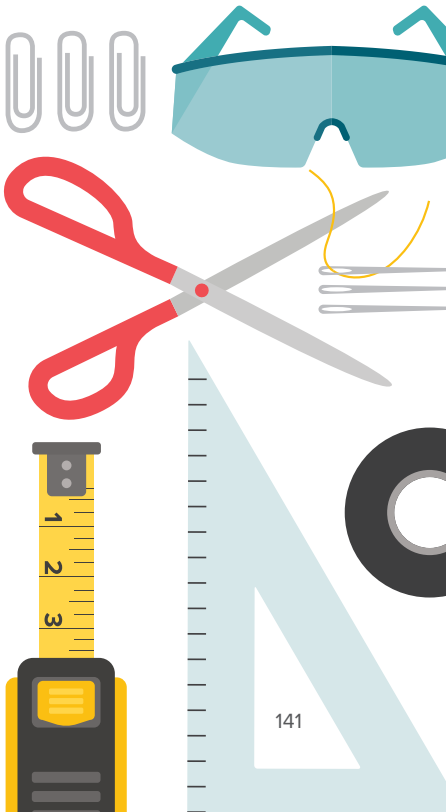
SkillsCanada Alberta

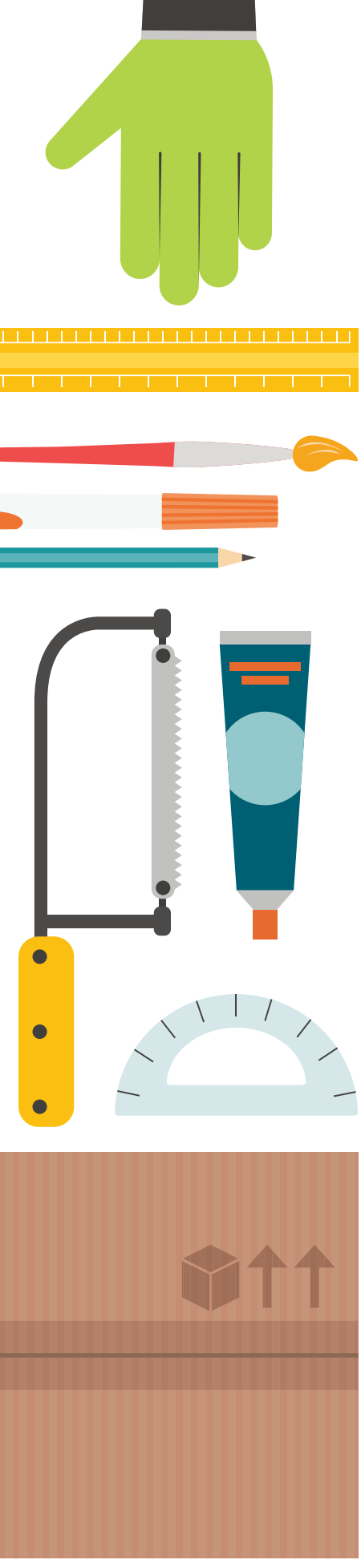
Suggested Grade Level

Upper elementary through to secondary school

Suggested Subject Area

- CTF
- CTS
- Fabric and Textiles
- Home Economics
- Social Studies





Success Determinants

Success will be determined by:

- ❒ Alignment to design motto: “Make it smaller, stronger, do more, be easier to use, be cheaper, be clean, be greener.”
- ❒ Degree to which your prototype looks like your design sketch
- ❒ Ease of long term maintenance and durability
- ❒ Functionality of the design and prototype
- ❒ Uniqueness and originality of the design
- ❒ Usability of your prototype and the degree to which it solves an actual problem

Parameters

- ❒ You may use the tools provided to you in the classroom pantry.
- ❒ You must complete a display panel, which includes your design thinking sketch, your prototype, your design notes, and your reflections on the activity.
- ❒ You must consider how to make your prototype colourful, intriguing, and ergonomic.
- ❒ You must use some of all the items in the participant group kit in some way.