UBC Geering Up
Engineering Outreach

Splint Building Design Challenge

Subject: ADST	**Grade:** 3-7	**Duration:** 3 hours
Lesson Overview	Students will learn about biomedical engineering and the importance of empathy in engineering by designing and creating splints. This project will incorporate hands-on activities that engage students in the engineering design cycle and promote cross-curricular learning.	

Curriculum Ties (in addition to satisfying multiple core competencies):

ADST Core Competencies:

Communication: **E.g. Collaborating:** Share progress while making sure to increase feedback and collaboration.

Thinking: **E.g. Critical and Reflective Thinking**: Screen ideas against criteria and constraints first, students will brainstorm and think consciously about their decisions before executing their plan.

Personal & Social: **E.g. Social Responsibility:** Evaluate the influences of land, natural resources, and culture on the development and use of tools and technologies on the construction of their tower

Content Objectives

- Having students explore the engineering design process and the ADST curriculum as well as applied skills
- Students practise using various social emotional skills including empathy etc.
- Design a splint for a specific injury that meets the needs of the“client”

Materials & Equipment Needed

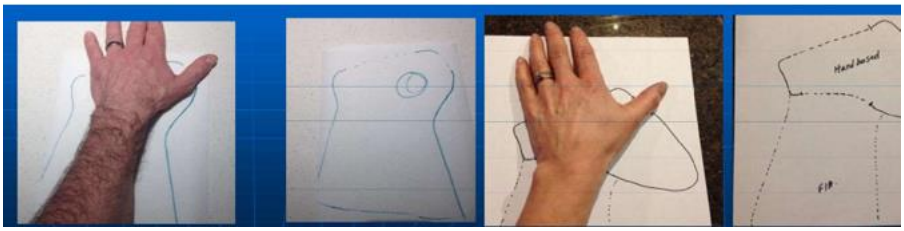
Consumables:	Non-Consumables:
• Cardboard • Newspaper • Construction paper • Foam padding • Felt • Gauze • Elastic bandages • Tape • Printed images of common injuries and splints • Engineering Design Cycle Worksheets	• Scissors • Markers • Rulers • Computers / tablets for research

Lesson & Activity

Lesson Stages	**Learning Activities**
Introduction	**Ask:** Discuss what Occupational Therapy is: A healthcare profession that helps address issues that interfere with a person's ability to do the things that are most meaningful to them. Discuss some examples of what this might look like / feel like to need an

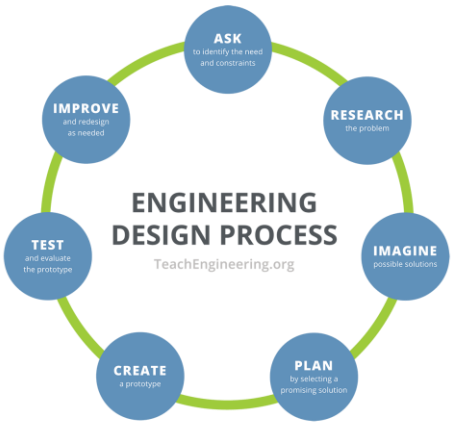
	OT. Discuss what a splint is: A medical device that stabilises part of your body to treat injuries or certain health conditions to facilitate participation in occupation. **Research:** Spend some time looking at examples of different splints. What type of materials do they use?
Activity	**Imagine:** 1) To begin, put students in groups of 3. Groups will each be given a scenario for a patient. One person in the group will act as the "patient" Scenarios are as follows: (please choose the ones that meet you classes age range and needs) a) Alex is 9-years-old who loves basketball. They fell at a concert and got a wrist fracture. b) Brook loves coffee and pastries and walking their dog everyday. They got an ankle sprain hiking up a mountain. They are really eager to get back to walking their dog everyday! c) Taylor is 71 years old and retired. They love to crochet and knit their retirement. Taylor, fractured their index finger at the middle IP joint while out on a fishing trip. Taylor is really hoping to get back to knitting crocheting and fishing soon! d) Blake, a busy 46-year-old businessperson reliant on public transport, faces a challenge with tennis elbow affecting their ability to hold onto bars while commuting with their briefcase. Balancing the demands of work and travel, Blake is looking for solutions to manage the discomfort while ensuring they can navigate their daily commute comfortably. e) Sam, a 24-year-old avid rock climber, faces frustration with a thumb sprain just as they were hoping to meet new friends at the climbing gym.

	Eager to return to the climbing wall and work on athletics and have a social life, Sam focuses on proper healing to get back to scaling those walls and perhaps finding some climbing buddies along the way. f) Quinn, a spirited 17-year-old with a knack for Wii Sports and a passion for playing piano, found themselves with a knuckle break after a particularly intense gaming session. Despite the injury, Quinn is really wanting to return to both their virtual and musical pursuits once their knuckle has healed, hopefully with less collateral damage next time! g) Parker, a dedicated 52-year-old soccer goalie and parent of teens, faces a setback with thumb and wrist sprains, hindering their ability to return to the field. Despite the injury, Parker's passion for the game remains strong as they eagerly await recovery, balancing their athletic pursuits with the therapeutic joy of crafting pottery in the meantime **Plan:** 2) Group swill now begin to brainstorm what kind of splint is needed for their patient. How will it be shaped? How can they make it comfortable for movement? Can they personalise it in any way for the patient? Ex: adding colour or patterns. a) For more advanced classes, introduce some mechanical principles of splinting • Increase area of force application to disperse pressure • Ensure 3-points of pressure in equilibrium • Eliminate friction (by effectively contouring limb) 3) Groups will begin to make a pattern for their splint.

	 **Create:** 4) Students will use newspaper, scrap paper ,coloured paper, cardboard and felt(optional)to make their prototype splint. We have also listed some other optional materials, if you are wanting to elevate this activity. As they are making it, they should keep in mind the needs of their "client". 5) Students test their design on the patient and ask them how it feels? Is it working? Etc.and make adjustments to make it comfortable for the patient.
Closure	**Test:** Students test their design on the patient and ask them how it feels? Is it working? **Improve:** Make adjustments to make it comfortable for the patient as directed by them. **Discussion:** Allow time to discuss some social emotional learning here. How did students feel when they had to work as a team after? How did it go?

	What role did they take on in the group? What would they do differently next time?

Background Knowledge



The Engineering Design Cycle:

- Ask
  - What is the problem we're trying to solve?
  - What are the limits that our solution needs to follow?

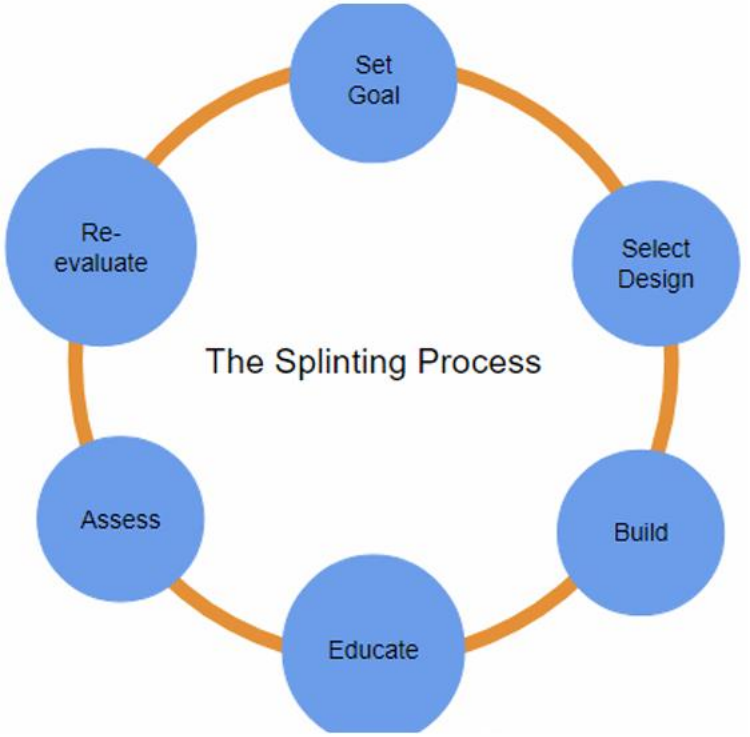
- Research
  - Has someone already created something like this?
  - Who are the experts in this field?

- Imagine
  - Brainstorm a large quantity and variety of ideas before narrowing the options.
- Plan
  - What criteria should we use to narrow down our ideas?
  - Which ideas need to be screened based on the original constraints we identified?

- Create
    - What kind of prototypes can we create? A sketch, scale model, CAD model, computer simulation, etc
- Test
    - What does our final design need to accomplish? Can we test this with the prototype we made?
    - Run an experiment
    - Create a computer simulation
    - What information are we looking to gain from these tests?

- Improve
    - Based on the results from the testing, what can we improve on our design?
    - Are there certain aspects we found too difficult to create?

Additional Resources



Splints: An Overview

A **splint** is a medical device that stabilises part of your body to treat injuries or certain health conditions. It is commonly used for:

- Broken bones
- Burns
- Post-surgical recovery
- Joint pain (such as arthritis)
- Muscle weakness

Purpose of Splints

Splints help facilitate participation in daily occupations and provide:

- Protection
- Rest and support
- Correction and prevention
- Substitution of injured muscles

Key Design & Material Considerations

1. Splinting Materials

When selecting materials, keep the following properties in mind:

- Memory
- Conformability and stretch
- Colour
- Thickness
- Breathability

2. Anatomical Considerations

When designing a splint, pay close attention to:

- Hand creases
- Bony prominences

- Hand arches
- Keeping the limb in a functional position

3. Mechanical Principles

- **Increase the area of force application** to disperse pressure (ensure your design covers enough surface area to feel comfortable).
- **Ensure 3 points of pressure in equilibrium** (consider the torque on your system and design a splint with long enough sections to resist force).
- **Eliminate friction** by contouring your splint to the limb as snugly as possible.

Clinical Appointments

First Appointment

During the initial visit with a client, you will want to:

1. Assess their condition and goals.
2. Select an appropriate design.
3. Fabricate the splint.
4. Provide wear and care education.

Follow-up Appointment

During a follow-up visit:

- The splint and the skin touching it are assessed.
- The client is asked about their experience using the splint.
- Any necessary adjustments or modifications are made based on the collected feedback.