# BIG IDEAS

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| Design for the life cycle includes consideration of social and **environmental impacts**. | Personal design interests require the evaluation and refinement of skills. | Tools and technologies can be adapted for specific purposes. |

## Learning Standards

### Curricular Competencies

*Students are expected to be able to do the following:*

**Applied Design**

***Understanding context***

- Engage in a period of **user-centred research** and **empathetic observation** to understand design opportunities

***Defining***

- Establish a point of view for a chosen design opportunity
- Identify potential users, intended impact, and possible unintended negative consequences
- Make inferences about premises and **constraints** that define the design space, and identify criteria for success
- Determine whether activity is collaborative or self-directed

***Ideating***

- Generate ideas and add to others' ideas to create possibilities, and prioritize them for prototyping
- Critically analyze how competing social, ethical, and sustainability considerations impact design
- Choose an idea to pursue based on success criteria and maintain an open mind about potentially viable ideas

***Prototyping***

- Identify and apply **sources of inspiration**
- Choose a form for prototyping and develop a **plan** that includes key stages and resources
- Analyze the design for life cycle and evaluate its **impacts**
- Visualize and construct prototypes, making changes to tools, materials, and procedures as needed
- Record **iterations** of prototyping

### Content

*Students are expected to know the following:*

- simple metalworking and design
- orthographic and pictorial drawings
- **measuring instruments**
- **tables and charts** for tolerancing and machining
- operation and safety of **stationary power equipment** and **stationary non-power equipment** in the processing of material
- **size and lay out** of metal
- types of **metals and alloys** and their characteristics
- selection of metal type, size, structural shape, and finish for specific applications
- ferrous and non-ferrous metals and their applications
- **heat treatments**
- **welding and cutting**
- common **mechanical fastening methods**
- forging and foundry applications
- **design for the life cycle**
- ethics of **cultural appropriation** in design process

## Learning Standards (continued)

| Curricular Competencies | Content |
|---|---|
| ***Testing***<br>• Identify and communicate with **sources of feedback**<br>• Develop an appropriate test of the prototype, conduct the test, and collect and compile data<br>• Apply information from critiques, testing results, and success criteria to make changes<br>***Making***<br>• Identify appropriate tools, **technologies**, materials, processes, cost implications, and time needed<br>• Create design, incorporating feedback from self, others, and testing prototypes<br>• Use materials in ways that minimize waste<br>***Sharing***<br>• Decide how and with whom to **share** product and processes for feedback<br>• Share the product to evaluate its success<br>• Critically reflect on their design thinking and processes, and identify new design goals<br>• Identify and analyze new design possibilities, including how they or others might build on their concept<br>**Applied Skills**<br>• Apply safety procedures for themselves, co-workers, and users in both physical and digital environments<br>• Identify and assess the skills needed for design interests, individually or collaboratively, and develop specific plans to learn or refine them over time<br>• Develop competency and proficiency in skills at various levels involving manual dexterity and metalwork techniques<br>**Applied Technologies**<br>• Explore existing, new, and emerging tools, technologies, and systems to evaluate suitability for design interests<br>• Evaluate impacts, including unintended negative consequences, of choices made about technology use<br>• Examine the role that advancing technologies play in metalworking contexts | |

  

## Big Ideas – Elaborations

- **environmental impacts:** including manufacturing, packaging, disposal, and recycling considerations

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Metalwork
Grade 11

## Curricular Competencies – Elaborations

- **user-centred research:** research done directly with potential users to understand how they do things and why, their physical and emotional needs, how they think about the world, and what is meaningful to them
- **empathetic observation:** aimed at understanding the values and beliefs of other cultures and the diverse motivations and needs of different people; may be informed by experiences of people involved; traditional cultural knowledge and approaches; First Peoples worldviews, perspectives, knowledge, and practices; places, including the land and its natural resources and analogous settings; experts and thought leaders
- **constraints:** limiting factors, such as task or user requirements, materials, expense, environmental impact
- **sources of inspiration:** may include personal experiences, First Peoples perspectives and knowledge, the natural environment, places, cultural influences, social media, and professionals
- **plan:** for example, pictorial drawings, sketches, flow charts
- **impacts:** including social and environmental impacts of extraction and transportation of raw materials; manufacturing, packaging, transportation to markets; servicing or providing replacement parts, expected usable lifetime; and reuse or recycling of component materials
- **iterations:** repetitions of a process with the aim of approaching a desired result
- **sources of feedback:** may include peers; users; First Nations, Métis, or Inuit community experts; other experts and professionals both online and offline
- **technologies:** tools that extend human capabilities
- **share:** may include showing to others, use by others, giving away, or marketing and selling

## Content – Elaborations

- **measuring instruments:** for example, measuring tape, steel rules, calipers, micrometers, scales, dial indicators, protractors
- **tables and charts:** for example, tap and die, drill guides, feeds and speeds, milling charts
- **stationary power equipment:** for example, lathe, mill, drill press, grinders, sanders, welders, cutting tools, forge, casting
- **stationary non-power equipment:** for example, box and pan, brake, English wheel, Roper Whitney punch, Beverly Shear tools, press, slip rollers, hand seamer
- **size and layout:** for example, gauge, weight, scribes, dividers
- **metals and alloys:** for example, iron, steel, aluminum, copper, brass
- **heat treatment:** for example, hardening, tempering, annealing
- **welding and cutting:** for example, oxygen-acetylene, metal inert gas (MIG), tungsten inert gas (TIG), plasma, oxy cutting
- **mechanical fastening methods:** for example, rivets, bolts, screws, threaded rod
- **design for the life cycle:** taking into account economic costs, and social and environmental impacts of the product, from the extraction of raw materials to eventual reuse or recycling of component materials
- **cultural appropriation:** using or sharing a cultural motif, theme, “voice,” image, knowledge, story, or practices without permission or without appropriate context or in a way that may misrepresent the real experience of the people from whose culture it is drawn