BRITISH COLUMBIA
Ministry of Education

BIG IDEAS

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	Content
Students are expected to be able to do the following:	*Students are expected to know the following:*
Applied Design	• complex metalworking and design
Understanding context	• operation and safety of **welding equipment**
• Engage in a period of **user-centred research** and **empathetic observation** to understand design opportunities	• casting **methods**
Defining	• incorporation of **non-metal material** in metalwork products
• Establish a point of view for a chosen design opportunity	• **finishing** purposes and processes
• Identify potential users, intended impact, and possible unintended negative consequences	• metal selection for specific applications
• Make decisions about premises and **constraints** that define the design space, and develop criteria for success	• sequence of steps when working with powered and non-powered equipment
• Determine whether activity is collaborative or self-directed	• dimensional tolerance
Ideating	• operation, **maintenance, and adjustment** of stationary powered and non-powered equipment
• Critically analyze how competing social, ethical, and sustainability considerations impact design	• areas of **metal specialization**
• Generate ideas and add to others' ideas to create possibilities, and prioritize them for prototyping	• sheet metal layout, forming, and fabrication
• Evaluate suitability of possibilities according to success criteria and constraints	• heat treatment purposes and processes
• Work with users throughout the design process	• **design for the life cycle**
Prototyping	• ethics of **cultural appropriation** in design process
• Identify, critique, and use a variety of **sources of inspiration**	• future career options and opportunities in metalworking contexts
• Choose an appropriate form, scale, and level of detail for prototyping, and plan procedures	• **interpersonal and consultation skills** to interact with clients
• Analyze the design for the life cycle and evaluate its **impacts**	

Learning Standards (continued)

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

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

- **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
- **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

- **welding equipment:** for example, oxygen-acetylene equipment for welding, brazing, and cutting; metal inert gas (MIG), tungsten inert gas (TIG), spot, and arc welding equipment
- **methods:** for example, lost wax, sand, investment
- **non-metal material:** for example, glass, plastic, wood, motors, wheels, bearings
- **finishing:** for example, paint, powder coat, clear coat
- **maintenance, and adjustment:** for example, changing blades, bits, blade types, feeds, speeds, and positions of guards
- **metal specialization:** for example, welding, machining, art metalworking, jewellery, fabrication
- **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
- **interpersonal and consultation skills:** for example, professional communications, collaboration, follow-ups, courtesies, record keeping, ways to present visuals