

BIG IDEAS

Social, ethical, and sustainability considerations impact design.

Complex tasks require the sequencing of skills.

Complex tasks require different technologies and tools at different stages.

Learning Standards

Curricular Competencies	Content
<p><i>Students are expected to be able to do the following:</i></p> <p>Applied Design</p> <p><i>Understanding context</i></p> <ul style="list-style-type: none"> Engage in a period of research and empathetic observation in order to understand design opportunities <p>Defining</p> <ul style="list-style-type: none"> Choose a design opportunity Identify potential users and relevant contextual factors Identify criteria for success, intended impact, and any constraints <p>Ideating</p> <ul style="list-style-type: none"> Take creative risks in generating ideas and add to others' ideas in ways that enhance them Screen ideas against criteria and constraints Critically analyze and prioritize competing factors, including social, ethical, and sustainability considerations, to meet community needs for preferred futures Choose an idea to pursue, keeping other potentially viable ideas open <p>Prototyping</p> <ul style="list-style-type: none"> Identify and use sources of inspiration and information Choose a form for prototyping and develop a plan that includes key stages and resources Evaluate a variety of materials for effective use and potential for reuse, recycling, and biodegradability Prototype, making changes to tools, materials, and procedures as needed Record iterations of prototyping 	<p><i>Students are expected to know the following:</i></p> <ul style="list-style-type: none"> internal and external combustion components of a combustion engine non-fuel power systems disassembly and assembly sequences engine terminology lubrication and antifriction hydraulic and pneumatic systems transfer and conversion of energy hand tools and power tools specific to mechanical repair and maintenance torques and tolerances for specific operations fasteners and fittings energy transmission and conversion systems technologies that reduce energy use and waste historical and potential future impact of energy, power, and transportation systems on society and the environment alternate energy sources

Learning Standards (continued)

Curricular Competencies	Content
<p><i>Testing</i></p> <ul style="list-style-type: none"> • Identify sources of feedback • Develop an appropriate test of the prototype • Conduct the test, collect and compile data, evaluate data, and decide on changes • Iterate the prototype or abandon the design idea <p><i>Making</i></p> <ul style="list-style-type: none"> • Identify and use appropriate tools, technologies, materials, and processes for production • Make a step-by-step plan for production and carry it out, making changes as needed • Use materials in ways that minimize waste <p><i>Sharing</i></p> <ul style="list-style-type: none"> • Decide on how and with whom to share their product and processes • Demonstrate their product to potential users, providing a rationale for the selected solution, modifications, and procedures, using appropriate terminology • Critically evaluate the success of their product, and explain how their design ideas contribute to the individual, family, community, and/or environment • Critically reflect on their design thinking and processes, and evaluate their ability to work effectively both as individuals and collaboratively in a group, including their ability to share and maintain an efficient co-operative work space • Identify new design issues <p>Applied Skills</p> <ul style="list-style-type: none"> • Demonstrate an awareness of precautionary and emergency safety procedures in both physical and digital environments • Identify the skills and skill levels needed, individually or as a group, in relation to specific projects, and develop and refine them as needed <p>Applied Technologies</p> <ul style="list-style-type: none"> • Choose, adapt, and if necessary learn about appropriate tools and technologies to use for tasks • Evaluate the personal, social, and environmental impacts, including unintended negative consequences, of the choices they make about technology use • Evaluate how the land, natural resources, and culture influence the development and use of tools and technologies 	

Curricular Competencies – Elaborations

- **research:** seeking knowledge from other people as experts (e.g., First Peoples Elders), secondary sources, and collective pools of knowledge in communities and collaborative atmospheres
- **empathetic observation:** aimed at understanding the values and beliefs of other cultures and the diverse motivations and needs of different people
- **Defining:** setting parameters
- **constraints:** limiting factors such as task or user requirements, materials, expense, environmental impact, issues of appropriation, and knowledge that is considered sacred
- **Ideating:** forming ideas or concepts
- **sources of inspiration:** may include experiences; traditional cultural knowledge and approaches, including those of First Peoples; places, including the land and its natural resources and analogous settings; and people, including users, experts, and thought leaders
- **plan:** for example, pictorial drawings, sketches, flow charts
- **iterations:** repetitions of a process with the aim of approaching a desired result
- **sources of feedback:** may include peers; users; keepers of traditional cultural knowledge and approaches, including those of First Peoples; and other experts
- **appropriate test:** consider conditions, number of trials
- **technologies:** things that extend human capabilities
- **share:** may include showing to others, use by others, giving away, or marketing and selling
- **product:** for example, a physical product, a process, a system, a service, or a designed environment

Content – Elaborations

- **non-fuel:** battery
- **engine terminology:** relating to fundamentals of operation; classification and types
- **lubrication:** for example, oil, grease
- **antifriction:** for example, bearings, bushings
- **conversion systems:** for example, gear, sprocket, pulley, chain, cable
- **alternate energy sources:** for example, wind, solar, geothermal