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: **Applied Design** ***Understanding context*** • Engage in a period of **user-centred research** and **empathetic observation** ***Defining*** • Establish a point of view for a chosen design opportunity • Identify potential users, intended impacts, and possible unintended negative consequences • Make decisions about premises and **constraints** that define the design space, and identify criteria for success • Determine whether activity is collaborative or self-directed ***Ideating*** • Take creative risks • Generate ideas and enhance others' ideas to create a range of possibilities, and prioritize the possibilities for prototyping • Critically analyze how competing social, ethical, and sustainability considerations impact creation and development of solutions • Choose an idea to pursue based on success criteria and maintain an open mind about potentially viable ideas ***Prototyping*** • Choose a form for prototyping and develop a **plan** that includes key stages and resources • Analyze the design for the life cycle and evaluate its **impacts**	*Students are expected to know the following:* • simple robotics design and production • interaction of robotic **subsystems** • relation of **structure** and **power** to **motion** • relation of **sensors** and **control** to **logic** • friction and traction • power and torque • developments in robotic technology • robotic technologies in the community and industry • similarities and differences between remotely controlled and autonomous robots • programming related to microcontrollers • design for the life cycle

Learning Standards (continued)

Curricular Competencies	Content
• Visualize and construct prototypes, making changes to tools, materials, and procedures as needed • Record **iterations** of prototyping ***Testing*** • Identify and communicate with **sources of feedback** • Develop an **appropriate test** of the prototype, conduct the test, and collect and compile data • Apply information from 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 results from testing of the prototype • Use materials in ways that minimize waste ***Sharing*** • Determine how and with whom to **share** creativity, or share and promote design and processes • Share the product with users to evaluate its success • Critically reflect on plans, products, and processes, and identify new design goals • Identify and analyze new possibilities for plans, products and processes, including how they or others might build on them **Applied Skills** • Apply safety procedures for themselves, co-workers, and users in both physical and digital environments • Individually or collaboratively identify and assess skills needed for design interests • Demonstrate competency and proficiency in skills at various levels involving manual dexterity and robotics • Develop specific plans to learn or refine identified skills over time	

Learning Standards (continued)

Curricular Competencies	Content
Applied Technologies • Explore existing, new, and emerging tools, technologies, and systems to evaluate suitability for design interests • Evaluate impacts, including unintended negative consequences, of choices made about technology use • Examine the role that advancing technologies play in robotics-related contexts	

Big Ideas – Elaborations

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Robotics
Grade 11

- **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
- **environmental impacts:** including manufacturing, packaging, disposal, and recycling considerations
- **technologies:** tools that extend human capabilities

Curricular Competencies – Elaborations

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Robotics
Grade 11

- **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 include 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
- **plan:** for example, pictorial drawings, sketches, flow charts
- **impacts:** including social and environmental impacts of extraction and transportation of raw materials; manufacturing, packaging, and 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
- **appropriate test:** includes evaluating the degree of authenticity required for the setting of the test, deciding on an appropriate type and number of trials, and collecting and compiling data
- **share:** may include showing to others or use by others, giving away, or marketing and selling

Content – Elaborations

- **subsystems:** for example, structure, motion, power, sensor, control, logic
- **structure:** for example, stress analysis, tension, torsion, bending, shear
- **power:** for example, hydraulic, pneumatic, electric
- **motion:** for example, rotary, linear, reciprocating, oscillating
- **sensors:** for example, bump, line follower, optic, sonic, limit, potentiometer, ultrasonic
- **control:** for example, tethered, radio, autonomous
- **logic:** if, then, else

