Applied Design, Skills, and Technologies

Core Competencies

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.

BIG IDEAS

Products can be **designed for life cycle**.	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* • Conduct **user-centred research** to understand design opportunities and barriers ***Defining*** • Choose a design opportunity and point of view • Identify potential users, intended impact, and possible unintended negative consequences • Make inferences about premises and **boundaries** that define the design space ***Ideating*** • Take creative risks to identify gaps to explore as design space • Generate ideas to create a range of possibilities and add to others' ideas in ways that create additional possibilities • Critically analyze how competing social, ethical, and sustainability considerations impact designed solutions to meet global needs for preferred futures • Prioritize ideas for prototyping and **designing with users** *Prototyping* • Identify and use a variety of **sources of inspiration** and **information** • Choose an appropriate form, scale, and level of detail for prototyping, and plan procedures for prototyping multiple ideas • Analyze the **design for life cycle** • Construct prototypes, making changes to tools, materials, and procedures as needed • Record **iterations** of prototyping	*Students are expected to know the following:* • social, legal, and ethical responsibilities associated with vehicle operation • use of technical information and manuals for the purpose of **diagnostics** and repair • **automotive tools** and **equipment** • **lifting equipment** and **procedures** • chassis and body • engine **diagnostic** support systems • emerging and alternative energy sources used to power automotive vehicles • fundamentals of engine operation • **vehicle systems** • **vehicle safety systems**

Learning Standards (continued)

Curricular Competencies	Content
Testing • Identify feedback most needed and possible **sources of that feedback** • Develop an **appropriate test** of the prototype • Gather feedback from users over time to critically evaluate their design and make changes to product design or processes • Iterate the prototype or abandon the design idea *Making* • Identify appropriate tools, technologies, materials, processes, **potential funding sources**, and time needed for production, and where/how these could be available • Use project management processes when working individually or collaboratively to coordinate production *Sharing* • **Share** their progress while making to increase feedback, collaboration, and, if applicable, marketing • Decide on how and with whom to share or promote their **product**, creativity, and, if applicable, intellectual property • Critically evaluate their design thinking and processes, and their ability to work effectively both as individuals and collaboratively in a group, including the ability to implement project management processes • Identify new design issues, including how they or others might build on their concept **Applied Skills** • Demonstrate an awareness of safety issues for themselves, co-workers, and users in both physical and digital environments • Identify and evaluate their skills and skill levels, in relation to their project or design interests, and develop specific plans to learn or refine their skills over time **Applied Technologies** • Explore existing, new, and emerging tools, **technologies**, and systems and evaluate their suitability for their design interests • Analyze the role and impact of technologies in societal change, and the personal, social, and environmental impacts, including unintended negative consequences, of their choices of technology use • Analyze how cultural beliefs, values, and ethical positions affect the development and use of technologies	

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- **designed for life cycle:** taking into account in the design process, economic costs, and social and environmental impacts of the product, from the extraction of raw materials to eventual reuse or recycling of component materials

- **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
- **Defining:** setting parameters
- **boundaries:** limiting factors, such as available technology, expense, environmental impact, issues of appropriation, and knowledge that is considered sacred
- **Ideating:** forming ideas or concepts
- **designing with users:** working with users at all stages of the design process
- **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
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- **iterations:** repetitions of a process with the aim of approaching a desired result
- **sources of that feedback:** may include peers; users; keepers of traditional cultural knowledge and approaches, including those of First Peoples; and other experts
- **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
- **potential funding sources:** It is not the intent, and not appropriate, for students to have to raise funds in order to complete their school project. Students may, however, wish to investigate sources of funding for the commercial development of their products.
- **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
- **technologies:** things that extend human capabilities

Content – Elaborations

- **automotive tools:** hand, power, pneumatic
- **equipment:** for example, wheel balancer, tire changer
- **lifting equipment:** jack, hoist, stand
- **procedures:** planning, integrity, stability
- **diagnostics:** onboard diagnostic systems, external diagnostic systems
- **vehicle systems:** driveline, suspension, steering, electric
- **vehicle safety systems:** for example, air bags, crumple zones

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Learning Standards (continued)

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Big Ideas – Elaborations

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Drafting
Grade 11

- **designed for life cycle:** taking into account in the design process, economic costs, and social and environmental impacts of the product, from the extraction of raw materials to eventual reuse or recycling of component materials

Curricular Competencies – Elaborations

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Drafting
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
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- **technologies:** things that extend human capabilities

Content – Elaborations

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Drafting
Grade 11

- **drawings and images:** basic sketches, orthographic projections, pictorials, and working drawings
- **drawing management:** for example, managing layers, symbols, object groups, text styles, dimension styles

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Learning Standards (continued)

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Big Ideas – Elaborations

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APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Electronics
Grade 11

Curricular Competencies – Elaborations

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- **product:** for example, a physical product, a process, a system, a service, or a designed environment
- **technologies:** things that extend human capabilities

Content – Elaborations

- **Watt's law:** the relationships between power and current, voltage, and resistance
- **manufacturing processes:** layout, printing, etching, drilling
- **testing instruments:** meters, signal generators, frequency generator, oscilloscope
- **components:** resistors, capacitors, diodes, silicon controlled rectifiers (SCRs), transistors, integrated circuits, transformers
- **circuits:** digital, analogue, amplifiers, oscillators, timer circuits

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Learning Standards (continued)

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Big Ideas – Elaborations

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APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Metalwork
Grade 11

Curricular Competencies – Elaborations

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- **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
- **technologies:** things that extend human capabilities

Content – Elaborations

- **measuring instruments:** measuring tape, steel rules, calipers, micrometers, scales, dial indicators, protractors
- **tables and charts:** tap and die, drill guides, feeds and speeds, milling charts
- **stationary power equipment:** lathe, mill, drill press, grinders, sanders, welders, cutting tools, forge, casting
- **stationary non-power equipment:** box and pan, brake, English wheel, Whitney punch, Beverly shear, press, slip rollers, hand seamer
- **size and lay out:** gauge, weight, scribes, dividers
- **metals and alloys:** iron, steel, aluminum, copper, brass
- **heat treatment:** hardening, tempering, annealing
- **gas welding and gas cutting:** oxygen-acetylene, metal inert gas (MIG), tungsten inert gas (TIG), plasma, oxy cutting
- **mechanical fastening methods:** rivets, bolts, screws, threaded rod

BIG IDEAS

Products can be **designed for life cycle**.	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* • Conduct **user-centred research** to understand design opportunities and barriers ***Defining*** • Choose a design opportunity and point of view • Identify potential users, intended impact, and possible unintended negative consequences • Make inferences about premises and **boundaries** that define the design space ***Ideating*** • Take creative risks to identify gaps to explore as design space • Generate ideas to create a range of possibilities and add to others' ideas in ways that create additional possibilities • Critically analyze how competing social, ethical, and sustainability considerations impact designed solutions to meet global needs for preferred futures • Prioritize ideas for prototyping and **designing with users** *Prototyping* • Identify and use a variety of **sources of inspiration** and **information** • Choose an appropriate form, scale, and level of detail for prototyping, and plan procedures for prototyping multiple ideas • Analyze the **design for life cycle** • Construct prototypes, making changes to tools, materials, and procedures as needed • Record **iterations** of prototyping	*Students are expected to know the following:* • interaction of robotic **subsystems** • how **structure** and **power** relate to **motion** • how **sensors** and **control** relate to **logic** • friction and traction • power and torque • developments in robotic technology • robotic technologies in the community • similarities and differences between radio-controlled and autonomous robots • programming related to microcontrollers

Learning Standards (continued)

Curricular Competencies	Content
Testing • Identify feedback most needed and possible **sources of that feedback** • Develop an **appropriate test** of the prototype • Gather feedback from users over time to critically evaluate their design and make changes to product design or processes • Iterate the prototype or abandon the design idea *Making* • Identify appropriate tools, technologies, materials, processes, **potential funding sources**, and time needed for production, and where/how these could be available • Use project management processes when working individually or collaboratively to coordinate production *Sharing* • **Share** their progress while making to increase feedback, collaboration, and, if applicable, marketing • Decide on how and with whom to share or promote their **product**, creativity, and, if applicable, intellectual property • Critically evaluate their design thinking and processes, and their ability to work effectively both as individuals and collaboratively in a group, including the ability to implement project management processes • Identify new design issues, including how they or others might build on their concept **Applied Skills** • Demonstrate an awareness of safety issues for themselves, co-workers, and users in both physical and digital environments • Identify and evaluate their skills and skill levels, in relation to their project or design interests, and develop specific plans to learn or refine their skills over time **Applied Technologies** • Explore existing, new, and emerging tools, **technologies**, and systems and evaluate their suitability for their design interests • Analyze the role and impact of technologies in societal change, and the personal, social, and environmental impacts, including unintended negative consequences, of their choices of technology use • Analyze how cultural beliefs, values, and ethical positions affect the development and use of technologies	

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Big Ideas – Elaborations

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APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Robotics
Grade 11

Curricular Competencies – Elaborations

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- **technologies:** things that extend human capabilities

Content – Elaborations

- **subsystems:** structure, motion, power, sensor, control, logic
- **structure:** for example, stress analysis, tension, torsion, bending, shear
- **power:** 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

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Learning Standards (continued)

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Content – Elaborations

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