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
Students are expected to be able to do the following: **Applied Design** *Understanding context* • Engage in a period of **research** and **empathetic observation** in order to understand design opportunities ***Defining*** • Choose a design opportunity • Identify potential users and relevant contextual factors • Identify criteria for success, intended impact, and any **constraints** ***Ideating*** • 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 *Prototyping* • 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	*Students are expected to know the following:* • **computer hardware**, peripherals, internal and external components, and standards • distinctions between **software types,** cloud-based and desktop applications • **operating system shortcuts** and **command line operations** • **preventive maintenance** of hardware and software • **computer security risks** • hardware and software **troubleshooting** • **wired and wireless computer networking** • **evolution of technology** and the impact on traditional models of computing • **risks and rewards** associated with big data, multi-device connectivity, and the Internet of Things • principles of **computational thinking** • computer **programming concepts and constructs** • **planning and writing** simple programs • **code maintenance and documentation** • **impacts of computers and technology on society** and **ethical issues** of technology use and environmental sustainability • **digital literacy** and digital citizenship

Learning Standards (continued)

Curricular Competencies	Content
Testing • 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 *Making* • 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 *Sharing* • 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 **Applied Skills** • 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 **Applied Technologies** • 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	

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Students are expected to be able to do the following: **Applied Design** *Understanding context* • Engage in a period of **research** and **empathetic observation** in order to understand design opportunities ***Defining*** • Choose a design opportunity • Identify potential users and relevant contextual factors • Identify criteria for success, intended impact, and any **constraints** ***Ideating*** • 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 *Prototyping* • 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	*Students are expected to know the following:* • **computer hardware**, peripherals, internal and external components, and standards • distinctions between **software types,** cloud-based and desktop applications • **operating system shortcuts** and **command line operations** • **preventive maintenance** of hardware and software • **computer security risks** • hardware and software **troubleshooting** • **wired and wireless computer networking** • **evolution of technology** and the impact on traditional models of computing • **risks and rewards** associated with big data, multi-device connectivity, and the Internet of Things • principles of **computational thinking** • computer **programming concepts and constructs** • **planning and writing** simple programs • **code maintenance and documentation** • **impacts of computers and technology on society** and **ethical issues** of technology use and environmental sustainability • **digital literacy** and digital citizenship

Learning Standards (continued)

Curricular Competencies	Content
Testing • 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 *Making* • 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 *Sharing* • 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 **Applied Skills** • 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 **Applied Technologies** • 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	

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Computer Studies
Curricular Competencies – Elaborations
Grade 10

- **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

APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Computer Studies
Content – Elaborations
Grade 10

- **computer hardware:** for example, central processing unit (CPU), random-access memory (RAM), read-only memory (ROM), cache, hard drive, solid-state drive (SSD), motherboard, power supply, video card, sound card, printer, monitor, scanner, keyboard, mouse, speakers, flash memory, universal serial bus (USB) (2, 3, C), megahertz, megabytes, gigabytes
- **software types:** for example, systems software, utility software, application software
- **operating system shortcuts:** for example, cut, copy, paste, print, print window, print screen, screen refresh
- **command line operations:** for example, establishing file structures, copying, deleting, moving files
- **preventive maintenance:** for example, physical and cloud data backup solutions, digital security measures, software updates, patches
- **computer security risks:** for example, malware, trojans, viruses, phishing scams, identify fraud, ransomware
- **troubleshooting:** identifying the problem, establishing a theory of probable cause, testing the theory to determine cause, taking action, testing and preventing, reporting
- **wired and wireless computer networking:** for example, network cards, routers, switches, cables, modems, network types

- **evolution of technology:** for example, mobile devices, smartphones, tablets, Internet of Things
- **risks and rewards:** for example, data collection, personal information, privacy concerns, remote hacking, information as a commodity, personal safety, convenience, functionality
- **computational thinking:** formulating problems and their solutions so they are represented in a form that can be solved through an algorithmic process
- **programming concepts and constructs:** classes, objects, data types, constants and variables, expressions and instructions, order of operations, precedence of arithmetic operators, assignment and relational operators, decision and looping structures, Boolean operators, comparison operators, arithmetic operators
- **planning and writing:** using visual problem-solving models; using variables, expressions, and assignment statements to store and manipulate numbers and text in a program; using decision structure for two or more choices; effectively using looping structures; distinguishing between syntax, logic, and run-time errors
- **code maintenance and documentation:** external (indentation, naming conventions for constants, variables, and expressions); internal (program header, author, revision date, program name, program description); table of variable names and descriptions
- **impacts of computers and technology on society:** global communication, social media, e-commerce, mobile payment solutions, globalization, human interactions, digital divide, digital immigrants versus digital natives, crowdfunding, technology and social change
- **ethical issues:** for example, big data use, equality of access, copyright and fair use, gender issues and technology, cyberbullying, white hat/black hat hacking, hacking for social causes, e-waste, recycling, conflict minerals
- **digital literacy:** curating a positive online portfolio, digital footprints/dossier, safe online information sharing, cyberbullying, online empathy, reporting online hate/bullying, support and resources

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Learning Standards (continued)

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Testing • 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 *Making* • 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 *Sharing* • 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 **Applied Skills** • 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 **Applied Technologies** • 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	

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- **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

- **options:** for example, Wix, Weebly, Google Sites, Wordpress, Joomla, Drupal
- **planning tools:** for example, wireframe mockups, site maps
- **tools:** for example, Notepad++, Brackets, Dreamweaver, Sublime Text, Visual Studio Code
- **UI:** user interface: focus on functionality, consistency of style, and layout
- **UX:** user experience: focus on the flow, feel, and end-user experience of the product
- **W3C:** using online World Standards Cooperation (WSC) validators to check for any errors in the HTML and cascading style sheets (CSS)
- **responsive:** consideration of how content will be displayed across multiple devices, cross-browser compatibility
- **optimized:** for speed of loading, minimal bandwidth requirements, and appropriate image compression types (jpg, gif, png)
- **domain and hosting options:** for example, web hosting options, file transfer protocols (FTP), use of CPanel for website administration, Freedom of Information and Protection of Privacy Act (FOIPPA) concerns; location of hosting

- **accessibility** removing barriers that prevent interaction with or access to websites by all users
- **functionality:** for example, colours, layout, contrast, typography, navigation, information design (ID), functionality, usability, accessibility, and CRAP (contrast, repetition, alignment, and proximity)
- **writing:** for example, user experience, calls to action, concise and persuasive writing, simple language, hyperlinking, bold words, lists for ease of scanning, keywords, tags, copywriting, metadata
- **security and privacy:** for example, secure socket layer (SSL), encryption, password management, data storage, permissions
- **database:** for example, structured query language (SQL), Microsoft Access
- **career options:** for example, account managers, user experience (UX) and user interface (UI) designers, web developers, quality assurance testers, development and operations (dev ops,) project manager, content manager
- **interpersonal skills:** for example, having the teamwork and collaborative skills necessary to succeed in project-based environments

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:	*Students are expected to know 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	• evolution of computer technology, including hardware, software, networks, and the Internet • lab procedures and tool use • internal and external **components** of computer systems, including **peripheral devices** • computer **troubleshooting**, including the incorporation of **digital tools** to aid and assist with research and diagnostics • computer assembly and disassembly best practices • ongoing preventive maintenance, including data security and online/offline backup solutions • installation and configuration of operating systems • proprietary versus open-source applications • software installations and configurations • use of correct terminology to describe the units, rates, and encoding of data communication • network planning, setup, and diagnostics • key aspects of network protocols and **standards** • laptops and mobile device technology • careers in information and communication technology (ICT), including **roles and responsibilities** of ICT professionals

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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Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following:	*Students are expected to know the following:*
Applied Design	• evolution of computer technology, including hardware, software, networks, and the Internet
Understanding context	• lab procedures and tool use
• Conduct **user-centred research** to understand design opportunities and barriers	• internal and external **components** of computer systems, including **peripheral devices**
Defining	• computer **troubleshooting**, including the incorporation of **digital tools** to aid and assist with research and diagnostics
• Choose a design opportunity and point of view	• computer assembly and disassembly best practices
• Identify potential users, intended impact, and possible unintended negative consequences	• ongoing preventive maintenance, including data security and online/offline backup solutions
• Make inferences about premises and **boundaries** that define the design space	• installation and configuration of operating systems
Ideating	• proprietary versus open-source applications
• Take creative risks to identify gaps to explore as design space	• software installations and configurations
• Generate ideas to create a range of possibilities and add to others' ideas in ways that create additional possibilities	• use of correct terminology to describe the units, rates, and encoding of data communication
• Critically analyze how competing social, ethical, and sustainability considerations impact designed solutions to meet global needs for preferred futures	• network planning, setup, and diagnostics
• Prioritize ideas for prototyping and **designing with users**	• key aspects of network protocols and **standards**
Prototyping	• laptops and mobile device technology
• Identify and use a variety of **sources of inspiration** and **information**	• careers in information and communication technology (ICT), including **roles and responsibilities** of ICT professionals
• 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	

Learning Standards (continued)

Curricular Competencies	Content
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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
- **information:** for example, other people as experts (e.g., First Peoples Elders), secondary sources, collective pools of knowledge in communities, collaborative atmospheres
- **design for life cycle:** including the 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 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

- **components:** functionality, and interdependence of internal and external components; for example, central processing units (CPUs), random access memory (RAM), video cards, printers, scanners
- **peripheral devices:** input/output devices, including devices to increase accessibility for those with physical challenges, 2D and 3D printers, scanners, and printers
- **troubleshooting:** identify the problem, establish a theory of probable cause, test the theory to determine cause, determine the next steps to resolve problem, report findings
- **digital tools:** for example, help and discussion forums, tutorial videos, online help databases, lists of frequently asked questions (FAQs)
- **standards:** International Organization for Standardization (ISO) in the creation of open standards for networking; seven layers of the Open System Interconnection (OSI) reference model; "interoperability" in the functioning of the Internet; four layers of the Transmission Control Protocol/Internet Protocol (TCP/IP); model-wide area networks (WANs) and local area networks (LANs); logical and physical network topologies, including the segmentation of networks
- **roles and responsibilities:** for example, communication, articulation of problems, collaboration, conflict resolution, workplace courtesies, interpersonal relations within digital platforms

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Learning Standards

Curricular Competencies	Content
Students are expected to be able to do the following:	*Students are expected to know the following:*
Applied Design	• **digital tools** to communicate and **solicit** information
Understanding context	• **impacts of social media** in global communications
• Conduct **user-centred research** to understand design opportunities and barriers	• **impacts on language use** of online of technology
Defining	• **issues** in digital communication
• Choose a design opportunity and point of view	• digital communication **risks**
• Identify potential users, intended impact, and possible unintended negative consequences	• **ethics and legalities** in digital communication
• Make inferences about premises and **boundaries** that define the design space	• influences of **digital marketing** in online content creation and curation
Ideating	• **changes** in journalism and reporting
• Take creative risks to identify gaps to explore as design space	• **persuasive writing** for the web
• Generate ideas to create a range of possibilities and add to others' ideas in ways that create additional possibilities	• **critical evaluation** of online resources
• Critically analyze how competing social, ethical, and sustainability considerations impact designed solutions to meet global needs for preferred futures	• technology and **wellness** in relation to digital communication tools
• Prioritize ideas for prototyping and **designing with users**	• **technology to support collaboration** and interaction with others
Prototyping	• strategies for developing a **digital dossier**
• Identify and use a variety of **sources of inspiration** and **information**	• **career opportunities** in digital communications
• 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	

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	

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:	*Students are expected to know 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	• **digital tools** to communicate and **solicit** information • **impacts of social media** in global communications • **impacts on language use** of online of technology • **issues** in digital communication • digital communication **risks** • **ethics and legalities** in digital communication • influences of **digital marketing** in online content creation and curation • **changes** in journalism and reporting • **persuasive writing** for the web • **critical evaluation** of online resources • technology and **wellness** in relation to digital communication tools • **technology to support collaboration** and interaction with others • strategies for developing a **digital dossier** • **career opportunities** in digital communications

Learning Standards (continued)

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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
- **information:** for example, other people as experts (e.g., First Peoples Elders), secondary sources, collective pools of knowledge in communities, collaborative atmospheres
- **design for life cycle:** including the 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
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- **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

- **digital tools:** for example, spreadsheet, databases, word processors, social media, blogs (e.g., Wordpress, SquareSpace), infographics, polls and surveys, reliance on text and graphics to communicate visually
- **solicit:** for example, polls, surveys, crowdsourcing ideas (e.g., Quirky.com)
- **impacts of social media:** creation, sharing, or exchange of information; sharing, co-creating, discussing, and modifying user-generated content; quality of information, content reach, frequency of access, usability, immediacy, and permanence; virality of content
- **impacts on language use:** for example, text based and instant messaging, emojis, short-form communication, memes, gifs, evolution of grammar, spelling
- **issues:** for example, netiquette, online courtesies, moderation, free speech, differences between digital, analog, and face to face communication; impacts of technology on interpersonal communication, relationships, and organizations
- **risks:** for example, over-sharing, impulsive reactions, copy (Cc) versus blind copy (Bcc), personal and private information, immediacy of the message
- **ethics and legalities:** for example, fair use rights, image use, copyrights, trademarks, creative commons licensing, anonymous authorship
- **digital marketing:** for example, email, newsletters, mobile media marketing, social media marketing, videos, graphics, digital ad campaign strategies, measurement in clicks, analytics and metrics, audience reach, virality, generational targeting
- **changes:** changing dynamic of journalism, reporting, and content curation
- **persuasive writing:** for example, writing for scanners, using the inverted pyramid method, avoiding jargon and repetition, using bold text, hyperlinking, underlining, contrast, clarity and direction, writing with a digital audience in mind, summarizing, writing with search engine optimization in mind
- **critical evaluation:** relevance, accuracy, bias/perspective, reliability, safety
- **wellness:** for example, self-image, social connections (real versus imagined), mental health, cyber addictions, and other risks and potential side-effects of overuse of digital tools, including games, social media
- **technology to support collaboration:** for example, Google Docs, Prezi, One Note, Wikispaces, Slack, Padlet, Trello
- **digital dossier:** maintaining a positive public profile that highlights career objectives and showcases work and experience
- **career opportunities:** for example, copywriting, Internet marketing, UX, SEO

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Learning Standards (continued)

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Big Ideas – Elaborations

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APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Computer Programming
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

- **structures:** for example, key elements such as variables, functions, use of Whitespace
- **modify existing code:** for example, altering values of variables, parameters of a function or loop
- **strategies:** hand tracing code, guess and test (experimentation)
- **requirements:** a complete set of requirements that will support the rest of the software development cycle without the need to revisit the problem statement in the future
- **transform requirements into algorithms:** for example, pseudocode, iterative refinement, flowcharts, UML, other design entities
- **design specifications:** for example, pseudocode, algorithms, flow charts, unified modeling language (UML)
- **tools:** for example, integrated development environment (IDE), computer language appropriate for problem/project
- **pre-built libraries:** for example, external libraries for graphical user interfaces or gaming, sensor libraries for hardware such as Arduino/Genuino
- **documentation:** interpretation of library documentation/application programming interface (API)
- **use:** for example, running test cases to compare expected versus actual output and printing the value of variables to aid in the debugging process

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Learning Standards (continued)

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Content – Elaborations

- **ubiquity of online access:** for example, a globally connected planet, societal and political implications of Internet access as a human right
- **impacts:** for example, paper consumption, e-waste, conflict minerals, fuel use, carbon offsets
- **digital security risks:** for example, digital footprints, hacking, piracy, identity theft, phishing scams, ransomware
- **soft skills:** for example, communication, collaboration, follow-ups, courtesies, record keeping
- **documentation:** for example, a network map or blueprint (name, internet protocol (IP), and machine access control (MAC) address for each device)
- **maintenance:** upgrading a network (e.g., user stations and network hardware and software), protecting data and programs, purchasing, acquiring, licensing, and distributing hardware and software, providing user support (e.g., help desk, technician, LAN tech, online)
- **functional and operational differences between hardware servers:** for example, web applications, file servers, proxy servers, mail servers, dynamic hosts configuration protocol (DHCP), domain name servers (DNS)

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Applied Design	• **2D**, **3D**, **audio**, and **video** digital media editing tools, including paid, freeware, open source, and cloud-based solutions
Understanding context	• **principles of 2D graphic design**
• Conduct **user-centred research** to understand design opportunities and barriers	• tools and techniques for **image manipulation**
Defining	• methods and **principles of 3D graphic design**
• Choose a design opportunity and point of view	• **methods for digital animation**
• Identify potential users, intended impact, and possible unintended negative consequences	• **methods for 3D modelling**
• Make inferences about premises and **boundaries** that define the design space	• **digital sound** and **audio data compression**
Ideating	• digital animation techniques
• Take creative risks to identify gaps to explore as design space	• computer-assisted versus computer-generated
• Generate ideas to create a range of possibilities and add to others' ideas in ways that create additional possibilities	• **desktop video production**
• Critically analyze how competing social, ethical, and sustainability considerations impact designed solutions to meet global needs for preferred futures	• principles of user-centred design
• 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	
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• 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	

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	

- **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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- **2D:** for example, Photoshop, InDesign, Gimp, Paint, Sketch, Adobe Experience
- **3D:** for example, 3D Studio, Blender, Maya, Sketchup
- **audio:** for example, Garage Band, Audacity
- **video:** for example, iMovie, Windows Movie Maker, Adobe Premiere
- **principles of 2D graphic design:** proximity, alignment, rhythm/repetition, balance, contrast, white space, vector/raster images, guides and rulers (grid systems), cyan magenta yellow black (CMYB) and red green blue (RGB) colour systems, fonts and typography
- **image manipulation:** for example, adjustment and resizing, resolution, cropping, masking, soft light adjustment, layers, cloning, retouching, filters, painting, managing text
- **principles of 3D graphic design:** harmony, contrast/variety, rhythm/repetition, emphasis, continuity, balance (asymmetrical/symmetrical), proportion
- **methods for digital animation:** squash and stretch (exaggerating body formations for a comedic effect), anticipation (e.g., guiding the audience's eyes toward upcoming action), staging (e.g., using the characters' poses to set the mood of a scene), straight-ahead action or pose-to-pose action (two techniques for moving the action forward), follow-through and overlapping action (e.g., showing detail by giving characters' reactions), slow-in and slow-out (acceleration and retardation of a scene for effect), arcs (moving characters in curved paths for a more realistic look), secondary action (e.g., using smaller motions to complement the main action, using layers), timing (the precise amount of time spent on an action), exaggeration (e.g., squash and stretch), solid modeling and rigging (originally called solid drawing, this emphasizes a clear representation of the shapes), character personality (creating a personality that will connect with the audience)
- **methods for 3D modelling:** polygonal modeling (points in 3D space, called vertices, are connected by line segments to form a Polygon mesh), curve modeling (surfaces are defined by curves, which are influenced by weighted control points), digital sculpting (displacement, volumetric and dynamic tessellation)
- **digital sound:** sampling, sampling rates, aliasing, bit depth, bit rate, microphones
- **audio data compression:** MP3, Windows WAVE format (WAV), advanced audio codec (AAC), Ogg Vorbis, free lossless audio codec (FLAC), loss versus lossless, binary format, analog-to-digital conversion
- **desktop video production:** pre-production (e.g., storyboarding, layout, model sheet and animatics, script writing), production (e.g., layout, modelling, texturing, lighting, rigging and animation, green screen techniques, videography), post-production (e.g., compositing, sound editing and video editing, titling, special effects, over-dubbing)

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:	*Students are expected to know 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	• **problem decomposition** • advanced **programming structures** • standardized source code **documentation** • **self-documenting** code • **collaboration tools** for programming • elements for interface design that is efficient and intuitive for the user • error handling • **debugging** tools • **management of complexity** • uses of **pre-built data structures** • bug reports and feature requests from users

Learning Standards (continued)

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Big Ideas – Elaborations

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APPLIED DESIGN, SKILLS, AND TECHNOLOGIES – Computer Programming
Grade 12

Curricular Competencies – Elaborations

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Content – Elaborations

- **problem decomposition:** subdivide a problem into manageable, self-contained tasks
- **programming structures:** higher-level structures, such as functions, methods, or classes, that help improve the organization of source code
- **documentation:** documenting source code in an industry acceptable way, such as PyDoc or JavaDoc
- **self-documenting:** writing source code in such a way that makes inline comments seem unnecessary
- **collaboration tools**: for example, Git, svn, mercurial (or sites such as GitHub, Bitbucket, Cloud9)
- **debugging:** use of a debugger that is capable of stepping through code and monitoring variables
- **management of complexity:** for example, a project whose scale requires multiple source files or functions
- **pre-built data structures:** the data structures that are provided (e.g., from a standard library)