Curriculum Improvement Cycle
Draft Technical Framework
Technologies

November 2026

Version 1.0

These are draft materials. The content, format and style are subject to change. They are being shared as part of the co-design process and in advance of engagement and feedback during the 2026/27 session. There is no expectation on educators, schools or settings to do anything now with these drafts. It would not be appropriate to change current planning or tracking and monitoring systems in establishments at this stage.

Contents

Introduction to the Technologies Know-Do-Understand Framework 2

Technologies Purpose Statement 2

Big Ideas 2

- Understanding Our World 2
- Innovation 2
- Shaping Our Future 2

Summary of Progression 3

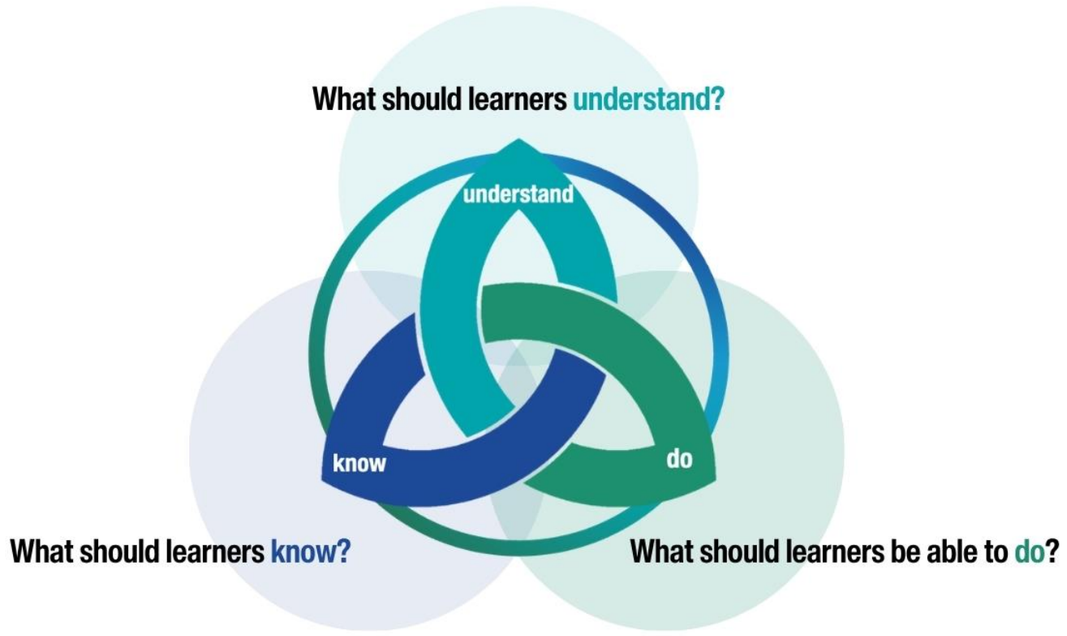
Know-Do-Understand Strands 4

- Identify, Define, Explore and Articulate (IDEAs) 4
- Make It Happen 9
- Systems 15
- People and Planet 21
- A Data Rich World 24
- Digital World 28

Declaration 30

Version History 31

The Know-Do-Understand (KDU) framework



How the KDU knots are written

Understand:
Statements that decribe the relationship between concepts.

Know:
Facts, definitions or **case studies** that learners need to know to develop the understanding above.

Do:
Skills, **processes** and **procedures** learners need to know to develop the understanding above.

Notes:
Information that helps practitioners in their planning for this KDU knot.

Return to Contents

Introduction to the Technologies Know-Do-Understand Framework

The Technologies Know-Do-Understand Framework sets out the knowledge, skill and understanding that learners develop from Early to Fourth Level. The framework is organised around three Big Ideas, which capture the purpose of the curriculum area.

At Early and First Level, an integrated approach supports broad and rich experiences across the Technologies. This integrated approach allows teachers and practitioners to draw on connections between key ideas across the curricular area in ways that are responsive to context, setting and the needs of the learning community.

From Second Level onwards, the organisation of learning broadens to recognise some of the distinctive knowledge, vocabulary, techniques and processes associated with each subject within the Technologies. The Technologies subjects offer opportunities for interdisciplinary, connected and collaborative learning while laying the foundations for subject specific learning at Third Level.

From Third Level knowledge and skills are presented in subject specific sub-strands that support progression but also offer further opportunities for interdisciplinary learning across the Technologies.

Technologies Purpose Statement

Learners use ethical, sustainable and innovative approaches to address real-world challenges, connecting theory and practice through technological activity. This supports them to become adaptable and socially aware citizens who can participate in and contribute to a dynamic, inclusive and rapidly evolving world.

Big Ideas

Understanding our World	Innovation	Shaping our Future
We live in a complex world full of physical, digital, social and economic systems. Modern living requires critically evaluating the products and decisions that shape the world around us and understanding how data is created and used and how systems recognise patterns.	Engaging with our world requires the confident use of tools, materials and processes to create products and services. Practical skills such as designing, making, testing and refining are essential to tackling real-world challenges.	Every technological decision has economic, environmental and social impacts. By critiquing the implications of technology, learners develop the capacity to make responsible choices and actively shape a more sustainable and equitable future.

DRAFT

Return to Contents

Summary of Progression

Strand	Statements of understanding				
	Early	**First**	**Second**	**Third**	**Fourth**
Identify, Define, Explore and Articulate	Ideas can be developed into solutions that address needs and solve problems.	Creativity, curiosity and open-minded thinking help people identify problems and generate new ideas.	Creativity and problem solving involve planning, creating, testing, refining and sharing ideas with others.	Ideas are developed through an iterative process of analysing needs, generating solutions, testing outcomes and refining designs based on evidence.	Successful innovation is achieved through a structured and evidence-based design process that balances user needs, testing evidence and real-world constraints
Make It Happen	The way materials, tools and technologies are used affects how ideas can be realised as products, experiences or solutions.	The selection of resources, tools and techniques affects the quality and effectiveness of digital and physical products.	Specialist skills, tools and resources are required to create and improve high-quality solutions.	Reliable solutions are created through the skilled use of tools, processes and resources within a design and development process.	Successful solutions require technical skill, precision and informed decisions about how tools, resources and technologies behave and interact.
Systems	Systems achieve their purpose through parts working together.	Systems rely on people, processes and parts working together to achieve a purpose.	Systems use interconnected parts to receive inputs, process information and produce outputs.	The behaviour and performance of a system are influenced by the interaction of its people, processes and resources.	Interactions between technological, social and digital systems can create complex outcomes that are difficult to predict or control.
People and Planet	Everything we make and use comes from materials and resources found in the world around us.	Making and using products requires resources and energy, which can affect the environment.	Technological developments can create consequences for people, communities and the environment.	Technology and innovation decisions require balancing the needs of people, communities and the environment.	Responsible technological decisions require balancing ethical, social, environmental and economic considerations.
A Data Rich World				Data has value and decisions become more informed when data sources, quality and patterns are critically analysed.	The quality, quantity, structure and balance of data determine how reliably analyses can be performed and how accurately technologies, including AI systems, generate outputs.
Digital World	Digital technologies enable people to communicate, create and access information and media in different ways.	Digital skills enable people to participate effectively by accessing, creating and sharing information using technology.	Digital skills support safe, effective and collaborative participation in an increasingly digital world.		

DRAFT

Return to Contents

Know-Do-Understand Strands

<table>
<tr><th>Strand</th><th colspan="2">Identify, Define, Explore and Articulate (IDEAs)</th></tr>
<tr><td rowspan="3">Early Level</td><td colspan="2">Understand: Ideas can be developed into solutions that address needs and solve problems.</td></tr>
<tr><td>Know:
A design is a plan showing how something is to be built or carried out, or the way that something is put together.

A designer is a person who makes or draws plans for creating something, especially physical objects or structures.

Ideas can be expressed through visual, physical and digital representations.

Ideas do not always work out as planned.

Creativity is using imagination to invent new ideas or things.

Materials, tools, media and technology need to be risk assessed to ensure they can be used safely.</td><td>Do:
Experiment with materials, tools and technology to share design ideas.

Express thinking behind design ideas.

Represent design ideas through mark making and sketching.

Retry, persevere and experience different outcomes in different conditions.

Explore the properties of materials using the body and senses.

Use materials and technology to create reflections, projections and shadows on solid surfaces/materials and in water.

Recognise and manage risk when selecting tools, materials, media and technology.</td></tr>
<tr><td colspan="2">Includes, but not limited to
Materials, tools and digital technology that support exploration through play, such as:

Materials: textiles, fabrics, cardboard, paper, wood, loose parts, clay/dough, natural materials, construction resources, manufactured materials, glow-in-the-dark materials, reflective materials, transparent materials, magnetic materials, subject to setting risk assessment.

Tools: safety goggles, hammer, saw, scissors, safety knives, screwdriver, screws, nails, glue, sticky tape, sticky tack, sewing needle, hole punch, paper clips, pegs, bulldog clips, suction hooks, weaving frame, subject to setting risk assessment.

Digital technology: talking buttons, audio-recording toys, cameras, cause-and-effect toys that light up and make sounds, torches, handheld projectors, light tubes, bubble tubes, push-button lights, colour-changing lights, submersible lights, moving-light projectors, UV light or torch, light tables or boxes, magnifier, microscope, projector or visualiser, solar water fountain, bubble machine, rotating-display turntable, moving or programmable toys, music-playing devices, old pieces of technology, such as phones, computer keyboards, card payment machines, subject to setting risk assessment, taking particular care with battery-operated resources.</td></tr>
</table>

DRAFT

<table>
<tr><td rowspan="3">First Level</td><td colspan="2">Understand: Creativity, curiosity and open-minded thinking help people identify problems and generate new ideas.</td></tr>
<tr><td>Know:
Curiosity is being interested, asking questions and trying to find answers.

Open-mindedness involves listening to others, considering different perspectives and exploring different ways of doing things.

Needs are things people must have to live and wants are things that makes life more enjoyable but are not essential.

Strategies can be used to solve problems, such as failing and fixing, working systematically, pattern spotting, working backwards, reasoning logically and visualising and conjecturing.</td><td>Do:
Identify a problem or opportunity and predict what might solve it.

Generate a range of potential solutions to challenges or problems.

Test a solution or idea against predictions.

Identify what is working and what is not working in a solution or idea.

Make changes and improve the design.

Identify and explore real people who invent new things such as designers, entrepreneurs and engineers.</td></tr>
<tr><td colspan="2">Includes, but not limited to</td></tr>
<tr><td rowspan="2">Second Level</td><td colspan="2">Understand: Creativity and problem solving involve planning, creating, testing, refining and sharing ideas with others.</td></tr>
<tr><td>Know:
Designers, engineers and entrepreneurs use creativity, curiosity and open-minded thinking to solve problems, improve existing ideas and generate new ones.

Entrepreneurship is about spotting opportunities and coming up with new ideas and ways of doing things.

Computational thinking is an approach to solving problems using techniques, such as decomposition, pattern recognition, abstraction and algorithms.

Engineering design processes use stages, such as questioning, imagining, planning, creating and improving to develop solutions to problems.

Design challenges or problems set restrictions, such as scenario, opportunity, budget that need to be met, for a solution to be successful.</td><td>Do:
Use the restrictions or information in a challenge to develop a set of success criteria.

Develop a range of potential solutions.

Sequence the steps to create s solution.

Test if a solution works.

Gather feedback from potential users and make improvements.

Share ideas, solutions and improvements with others.</td></tr>
<tr><td colspan="2"></td></tr>
</table>

DRAFT

Return to Contents

<table>
<tr><th>Sub-Strand</th><td colspan="2">Business</td><td colspan="2">Design and Engineering</td><td colspan="2">Computing Science</td></tr>
<tr><td rowspan="3">Third Level</td><td colspan="6">Understand: Ideas are developed through an iterative process of analysing needs, generating solutions, testing outcomes and refining designs based on evidence.</td></tr>
<tr>
<td>Know:
Entrepreneurial thinking is about identifying opportunities to create or improve products, services or processes.

A business pitch is a presentation used to share an idea and gain support or gather feedback.

Entrepreneurs evaluate the success of an enterprise by gathering feedback and identifying areas for improvement.

Branding enables an organisation to stand out and be recognised in the marketplace such as through the name, logo, design or slogan.

Marketing and promotion methods, such as advertising, are used by organisations to attract, persuade and inform.</td>
<td>Do:
Work with others to solve an identified problem or respond to a brief within an enterprise activity or event planning context.

Organise resources, such as materials, people, time and equipment, to carry out the enterprise activity.

Make changes to a product, service or process as needed based on feedback received.

Evaluate the outcomes of the enterprise activity, what worked well and what could be improved.

Reflect on personal skills and qualities developed while taking part in enterprise.

Prepare a business pitch for the idea, initiative or solution.

Develop a suitable brand for a product or service.

Develop a promotional strategy for the idea, initiative or solution using different ways to attract, persuade and inform possible users.</td>
<td>Know:
Briefs identify opportunities and constraints to a scenario or situation.

Effective analysis involves breaking down a situation into different elements to understand any requirements more clearly.

Design ideas can be generated using different approaches and techniques.

Design ideas can be improved through cycles of testing and refinement.

Different forms of modelling are used for communicating and testing.

Critique should be constructive and evidence based.

Existing designs can be used to identify useful features, limitations and opportunities for improvement.</td>
<td>Do:
Identify design requirements based on the brief and research.

Follow a strategy to complete design activities.

Use idea-generation techniques to produce initial ideas.

Use physical and digital modelling techniques to generate, explore and test ideas.

Critique existing products, services or systems against criteria.</td>
<td>Know:
Development processes are iterative and may require revisiting previous stages.

Analysis identifies requirements, constraints and resources needed to develop a solution.

Problem-solving strategies include decomposition, abstraction, pattern recognition and algorithmic thinking.

Prototypes are used to test ideas and gather feedback before implementation.

Algorithms use sequence, selection, repetition and complex conditions.

Testing is a planned process used throughout development.

Usability and performance can be used to evaluate the effectiveness of a solution.</td>
<td>Do:
Analyse problems and identify requirements, constraints and resources.

Create prototypes to communicate and test ideas.

Compare alternative solutions and justify choices using criteria.

Build solutions based on designs and requirements.

Test solutions against success criteria.

Improve solutions using feedback and evidence.

Evaluate usability and performance.</td>
</tr>
<tr>
<td colspan="2">Includes, but not limited to
Enterprise activities that include problem solving and creative initiatives that build an entrepreneurial mindset, such as:
coming up with new product or service ideas in response to a brief
taking part in an enterprise activity or organising a fund-raising event
taking part in established national enterprise programmes
project-based learning</td>
<td colspan="2">Includes, but not limited to
Idea-generation techniques, such as mood boards, lifestyle boards, biomimicry, creative toolkits (for example, kits, building blocks), brainstorming, artefact analysis.</td>
<td colspan="2">Notes
Computational thinking underpins the development process.</td>
</tr>
</table>

Return to Contents

Sub-Strand	Business		Design and Engineering		Computing Science	
Fourth Level	**Understand: Successful innovation is achieved through a structured and evidence-based design process that balances user needs, testing evidence and real-world constraints.**					
	Know: Innovation is an ongoing iterative process that continuously improves or develops new products and services to meet the needs and wants of the market. Entrepreneurs consider the feasibility of their idea by looking at the costs associated with developing it. Entrepreneurs use available data such as financial performance and feedback from the market to evaluate if the enterprise has reached its outcomes or agreed success criteria. Barriers to becoming an entrepreneur could include limited access to finance and support, cultural and social barriers and fewer professional connections. A business plan outlines key aspects of a business idea, such as the marketing plan, resources, costs, projected sales and profits. Business plans can be used to secure finance from investors such as banks, shareholders, venture capitalists and government. A customer persona is a description of the ideal customer that includes details about their lifestyle, income, wants and buying patterns and helps the organisation understand target groups. The Unique Selling Point (USP) highlights what makes a product or service different from competitors and can influence customer choice. A marketing strategy includes	**Do:** Collaborate effectively with others to solve an identified problem or respond to a brief within an enterprise activity or event planning context. Calculate simple costing of a project, event or product to determine pricing strategy and likely profitability. Evaluate the outcomes of the enterprise activity and the effectiveness of decisions made. Investigate barriers to becoming an entrepreneur and identify sources of support for certain groups. Prepare a business plan or pitch for an enterprise idea or investment opportunity. Identify products and services targeted towards different customer segments. Consider the use of customer personas to build up a picture of the target market. Develop and/or evaluate an organisations marketing strategy towards their target market.	**Know:** Designers consider constraints that apply to any proposal made. A research methodology is the overall, systematic plan a researcher follows to conduct a study and answer a specific research question. Iterative design is non-linear. Designers may return to earlier stages based on testing and feedback. Designers balance making changes to a design with constraints such as cost, safety, available materials and practical requirements. Subjective data is information based on personal experiences, feelings, opinions, or perceptions that cannot be measured or independently verified by someone else. Objective data is factual, measurable, and observable information that does not change based on personal feelings, opinions or bias.	**Do:** Plan a strategy to complete design activities. Use different forms of physical and digital modelling to test ideas. Justify why a model type is suitable for testing. Use test results and feedback to improve and refine ideas. Assess a design against given design criteria, justifying the findings and recommending improvements. Critique an existing product using subjective and objective data.	**Know:** Constraints, such as time, audience, purpose and resources, influence design decisions. Design communicates how data, processes, user interactions and system behaviour work together. Development can be undertaken collaboratively, with different roles contributing to a solution. Algorithms can be refined from high-level ideas into increasingly detailed solutions. Algorithms can use sequence, nested selection, repetition and logical operators. Testing is a planned process used to evaluate functionality, usability and reliability. Evaluation uses success criteria to judge the efficiency, reliability and suitability of a solution.	**Do:** Analyse requirements, constraints and research findings to justify design decisions. Create detailed designs that communicate data structures, processes and user interactions. Refine high-level designs into detailed algorithms and subprocesses. Build solutions that reflect planned designs and requirements. Work with others to develop and refine solutions. Create and apply test plans using defined success criteria. Evaluate solutions for usability, reliability, efficiency and suitability. Improve solutions using testing evidence and feedback.

DRAFT

	information about the target market and range of promotional techniques including advertising, sales promotion and social media campaigns.					
	Includes, but not limited to Feasibility consideration can include costing, breakeven analysis or the effects of external factors or other constraints may have on the idea. **Notes** Entrepreneurship plays a role in enabling individuals from marginalised groups to overcome social and economic barriers, build wealth and create change in their communities. People from marginalised backgrounds often face barriers to becoming entrepreneurs.		**Includes, but not limited to** Design considerations such as function, users, aesthetics, materials, safety, performance, market, safety, ergonomics and sustainability. Methodologies can be user experiences, artefact analysis, focus groups, case studies, mood-boards, user trials and questionnaires.		**Includes** Stepwise refinement, nested structures, multi-branch selection (IF / ELSE IF / ELSE).	

DRAFT

<table>
<tr><th>Strand</th><th colspan="4">Make It Happen</th></tr>
<tr><td rowspan="4">Early Level</td><td colspan="4">Understand: The way materials, tools and technologies are used affects how ideas can be realised as products, experiences or solutions.</td></tr>
<tr><td colspan="2">Know:
Crafting is a traditional way to make things using materials and tools.

Engineering uses science to make things work.

Balancing is spreading out a load to keep it stable.

Applying forces can make things move or stop.

Materials and tools need to be risk assessed to ensure they can be used safely.

Digital media can be projected onto surfaces for example, walls, floors, ceilings and structures when making.

Digital media can create a sensory effect when making.

Cameras can capture photos and videos.</td><td colspan="2">Do:
Investigate a variety of tools to discover how they work and what they can do to change materials.

Explore crafting techniques when working with textiles.

Explore science and engineering techniques to make things float, move and balance.

Recognise stable and unstable surfaces.

Notice there are permanent and non-permanent ways to join of materials when making models or structures.

Recognise and manage risk when selecting tools, materials, media and technology.

Investigate ways to express thoughts and choices through digital media.

Explore digital media through using the senses.</td></tr>
<tr><td colspan="4">Includes, but not limited to
A range of materials and tools for exploration through play.</td></tr>
<tr><td rowspan="4">First Level</td><td colspan="2">Digital Media</td><td colspan="2">Crafting</td></tr>
<tr><td colspan="4">Understand: The selection of resources, tools and techniques affects the quality and effectiveness of digital and physical products.</td></tr>
<tr><td>Know:
Digital media includes audio, images, graphics, video, text and games.

Digital devices can be used to capture media.

Digital media can be edited and stored on a device or remotely.</td><td>Do:
Capture media using a device.

Copy text and images from one application to another.

Use software to edit media by cropping, trimming and applying filters.</td><td>Know:
Tools and techniques can be used to shape, separate or join materials.

Tools, fixings and adhesives are usually suited to particular materials, such as wood, metal, plastic or fabrics.

Cutting, tearing and unpicking can be used to separate materials.

Glueing, sewing, knitting, nailing, screwing can be used to join materials.

Measuring materials can reduce waste.</td><td>Do:
Explore a range of tools and materials.

Measure materials to the correct size when shaping and joining.

Use tools and fixings to join materials, such as screws to join wood.

Use tools and techniques to separate materials, such as sawing wood or cutting fabrics.</td></tr>
<tr><td colspan="4">Notes
A making and fixing things mindset can be developed through a range of crafts, including the use of textiles, wood or paper.

Working with hands supports fine and gross motor skills, hand-eye coordination and other skills, such as proprioception and spatial reasoning.</td></tr>
</table>

Return to Contents

Sub-Strand	Media		Crafting		Computing	
Second Level	**Understand**: Specialist skills, tools and resources are required to create and improve high-quality solutions.					
	Know: Principles of graphic design can help a layout to be more effective. Scale is used to represent objects accurately when full size is not practical. Digital content can be improved through editing, feedback and design choices. Different digital formats, such as documents, slide decks, presentations, infographics, video and audio can help communicate ideas effectively. Digital media can be used to create art, such as music, films, games and graphics. Digital media can be captured, in the moment, to support thinking and express ideas. Copyright gives creators legal protection for their original creative work. Generative AI uses human-made media and art to generate media, such as audio, video, images and graphics.	**Do:** Create a graphic that uses the principles of graphic design. Identify examples of where scale would need to be used in drawings. Capture and collect digital media for multimedia projects. Plan and create a piece of art using digital media, such as music, photographs, short films, games. Capture audio, video or images observed while learning and use them to convey thoughts and feelings. Use media from licensed libraries that permit the use of the creators' work.	**Know:** Tools are specific to the materials being shaped, separated or joined. Materials can be shaped in different ways using tools and machines and different materials. Different materials require specific methods. Accuracy in marking out is critical to successful shaping and fitting.	**Do:** Use marking-out equipment and templates to create outlines for shaping materials. Use tools and techniques to shape materials into a given design. Use tools, adhesives and fixings to join materials. Use measuring tools and metric units accurately	**Know:** Programs follow instructions in order and can respond to things that happen, such as pressing a key, clicking a mouse or a sensor detecting a change. An IF statement helps a program choose what to do. Conditions compare things to see which is bigger, smaller or the same. Programs can use maths calculations such as adding, subtracting, multiplying and dividing. Loops repeat instructions. Variables store information that can change. Debugging is the process of finding and fixing errors (bugs) in a solution.	**Do:** Develop a computing solution to solve a problem using block-based coding or physical computing. Debug the solution by finding and fixing mistakes.

DRAFT

Sub-Strand	Business		Design and Engineering		Computing Science		Cyber	
Third Level	**Understand:** Reliable solutions are created through the skilled use of tools, processes and resources within a design and development process.							
	Know: Software applications can be used to create, edit, format content and communicate ideas and information to different users and audiences. A range of tools and formats can be used to lay out text, images and other media in different ways to create functional, professional and visually attractive documents. Software applications have help features to support users. Digital platforms can be used to communicate and collaborate with others. Frontier technologies are new or developing technologies that can help solve problems and change how people learn, live and work.	**Do:** Independently create content for a purpose and for different users. Enter and edit text and insert graphics, choosing the right tools and features to format and edit documents. Use templates and design features to support layout and presentation. Troubleshoot basic problems using help features. Safely collaborate with others by sharing files, feedback and ideas using digital platforms. Identify examples of new and powerful technologies and explore how they can be used by organisations and individuals.	**Know:** Drawings can be used for different purposes and audiences. Graphic layout decisions influence how information is read, interpreted and prioritised. Illustrations use line quality, tone, colour, texture and proportion to enhance understanding and visual communication. Information is communicated visually using standardised conventions, symbols and scales such as BSI standards and conventions. 2D and 3D models can be created using digital applications. Digital design and making integrates tools and processes to represent and produce virtual or physical products. Materials have classifications that describe their origins or properties The choice of material is influenced by its properties, intended function, environment, cost and sustainability. Tools and machines are	**Do:** Create a promotional graphic to meet a brief. Create orthographic views in third-angle projection of simple shapes. Create a pictorial view to clearly explain design ideas. Use shading, colour and texture to make a pictorial drawing look realistic. Create a 2D or 3D model using digital tools from given dimensions. Navigate a digital asset library to find, select and insert components into a digital model Demonstrate methods for fixing two or more pieces of material permanently and non-permanently. Prepare materials and use finishes to protect or improve the look of materials. Demonstrate the safe use of common tools and machines identify potential risks of misuse.	**Know:** Programs are built using branching selection, repetition, complex conditions with logical operators and predefined functions. Selection includes branching using IF/THEN/ELSE statements. Complex conditions combine two or more conditions in a single decision. Logical operators are used to join conditions (AND, OR). Variables can have different types, such as string or integer, which affect how they behave. Predefined functions are built-in commands that perform tasks. Interactive computing solutions work by following a sequence. An event or trigger occurs, a rule or condition is checked, and then an action is carried out. Debugging techniques include checking expected and actual outcomes, testing and tracing step by step, changing one thing at a time and using outputs or feedback to identify and fix errors.	**Do:** Develop a computing solution to solve a problem. Use tools to structure, organise and display data and information. Configure rules/conditions to respond to inputs or changes and/or control behaviour. Use a variety of techniques to identify and debug errors in computing solutions. Use iterative prompting to create an AI prototype.	**Know:** Passive reconnaissance is the process of gathering information from publicly available sources without directly contacting or accessing a system. Open-Source Intelligence (OSINT) is about finding useful information from publicly available sources such as websites, news articles, social media or satellite images to identify vulnerabilities. Active reconnaissance is the process of collecting information by directly communicating with a system or network such as scanning a network for devices and identifying open ports. Security testing is when an organisation hires someone, for example an ethical hacker, to try to break into the system to discover weaknesses and strengthen security. Security testing should be carried out regularly as new vulnerabilities and threats continue to emerge and evolve Security testing is legal and ethical when a tester has permission to hack into the system, there are clear boundaries in place	**Do:** Safely and ethically carry out passive reconnaissance to gather information on a system. Use OSINT to gather information on a person, organisation or computer system.

			designed for specific making processes that, when used correctly, can improve consistency and precision.		Generative AI tools can be used to create high-fidelity prototypes.		and there is a defensive purpose.	
	Includes, but not limited to Word-processing, desktop publishing, presentation and other multimedia software. **Notes** Common digital platforms or virtual learning environments, that are used to connect users, share resources and work collaboratively, may vary between Local Authorities.		**Includes, but not limited to** Using the anatomy of the page and layout features supports the design including orientation, layout, flow text, cropped images and hierarchy of information. Simple geometric forms include cuboids and cylinders. Complexity can be added by using additional profiles and addition and subtraction. Permanent methods include glueing, riveting and welding. Temporary methods include screws, bolts, knock-down fittings, tack-stitching and pinning. This could include common finishes such as wax, stain, dyes and dip-coating.		**Includes, but not limited to** Computing solutions: • Block-coding, programming or web development environments where young people can write, test, debug and improve their code. • No-code or low-code solutions, such as interactive dashboards, apps, websites, interactive prototypes, simple games or AI or data solutions. • Physical computing solutions where the code created controls inputs, outputs, and behaviour in physical systems (see Systems strand). **Exclude** Nested or highly complex conditional structures. Writing custom functions. **Notes** Young people use the PRIMM approach to coding by first predicting, running, investigating and modifying existing programs before making their own.		**Notes** Hacking techniques can be explored safely through online educational network simulations, cyber security labs and ethical hacking exercises.	

DRAFT

Sub-Strand	Business		Design and Engineering		Computing Science		Cyber	
	Understand: Successful solutions require technical skill, precision and informed decisions about how tools, resources and technologies behave and interact.							
Fourth Level	**Know:** Administrative functions require a high level of skill in using different software applications. Business documents use a variety of tools to support accuracy, professional presentation and the image of the organisation. Tools and features in software such as settings menus, templates and shortcuts can be customised to give users control over appearance and functionality and make the software more efficient and user-friendly. Digital platforms support communication, collaboration and productivity in workplaces. Frontier technology is the newest and most advanced form of innovation and may require significant upfront investment. Frontier technology has the potential to Improve efficiency, communication, decision-making and productivity in the organisation. Frontier technology can create new industries and jobs and lead to economic growth. Frontier technology can	**Do:** Reflect on how skills are improving over time and how they can be used to help the operation of an organisation. Make informed decisions and justify the choice of application for completing a task. Combine tools and features and use them across different applications to create professional-looking documents. Consider the implications for the organisation and workforce of using digital platforms to communicate and collaborate. Imagine ways frontier technologies can be applied in business environments to improve business operations, efficiency or customer experience. Consider the potential risks and rewards to an organisation of investment in and adoption of frontier technology. Investigate potential new careers in new industries.	**Know:** Sectional views reveal internal features that are not visible externally. Graphical representations of assemblies represent how components fit and interact. The tools and precision of the techniques used affect the cutting, shaping and assembly of materials to a desired size. The maximum allowed deviation from a desired size is called the tolerance.	**Do:** Create orthographic and pictorial-drawings which include appropriate dimensions and sectional views . Extract information from a working drawing to measure and mark accurately when laying out materials. Make and assemble virtual and physical models to a tolerance.	**Know:** Interactive systems are based on computational ideas such as logic, events and data. Nested selection is used to handle hierarchical decisions within other decisions. Nested repetition is used to repeat actions inside other repeated actions. Logical operators include NOT, which reverses a condition. Different types of errors such as logic, input or system errors, require different approaches to identify and resolve them. In a human-centred design process, AI can help create prototypes and solutions, but the designer has a role in ensuring the design meets users' requirements.	**Do:** Create data-driven and interactive systems that allow users to explore and understand information. Combine multiple interactions or rules to create behaviours for a system. Refine and optimise how a system responds to improve performance and usability. Debug systematically, explaining the process and reasoning. Create AI solutions using structured prompts that define inputs, conditions and outputs. Refine AI prompts iteratively to improve accuracy, usability and reliability and ensure user requirements are met.	**Know:** An organisation can employ a security tester to target specific areas of a system and report identified vulnerabilities. Operating systems are used by devices, including smartphones, cars, supercomputers, home appliances and desktops. They manage the hardware, software and applications on the device. A command line lets users control a computer by typing commands rather than clicking with a mouse.	**Do:** Demonstrate that a security test agreement has been followed and present the information gathered to the client. Research examples of where independent, ethical hackers have highlighted vulnerabilities in large tech companies' computer systems. Control the functions of the computer using the command line within an operating system or simulation to perform file management tasks or gather system information.

	raise ethical, environmental, social and security concerns and issues over equal access.							
			Includes, but not limited to Design principles, such as alignment and contrast. Design elements, such as typography; photographs and graphics. Techniques such cropping and colour matching Line types such as outline, hidden detail, centre lines and cross hatching and symbols, which may include ☐, ⌀ or r . Constraints such mate, align and centre axis. Modelling techniques such as extrude or revolve. Editing techniques such as mirror, fillet, chamfer or pattern.		**Includes, but not limited to** Programming or web development environments where young people can write, test, debug and improve their code. No-code or low-code solutions include creating or editing websites and apps using markup or styling syntax, querying data with basic SQL, building interactive games or simulations with development tools, and training and using AI models to create dashboards, apps, websites, prototypes, games, and data solutions. Physical computing solutions where the code created controls inputs, outputs and behaviour in physical systems (see Systems strand). **Excludes** Deeply nested or highly complex structures that reduce readability. Advanced list operations, for example, sorting algorithms or multi-dimensional arrays.		**Includes, but not limited to** Basic command-lines tasks, such as listing files and folders, navigating between folders, creating, copying and renaming files and folders, running programs and scripts.	

/

DRAFT

<table>
<tr><th>Strand</th><th colspan="4">Systems</th></tr>
<tr><td rowspan="4">Early Level</td><td colspan="4">Understand: Systems achieve their purpose through parts working together.</td></tr>
<tr><td colspan="2">Know:
A system is a group of parts that work together.

Technology is made by people.

People use technology for different purposes.

Organisations are groups of people working together to help others or do a job.</td><td colspan="2">Do:
Notice familiar technology in and around the setting and at home using the senses.

Experiment with controlling technology in different way, such as using hands or voice.

Notice how technology is used in local organisations.

Experiment with technology to solve problems.

Explore cause and effect, and input and output, when using technology.

Tinker to discover what is inside some technology.

Demonstrate awareness of where technology is used and how it works though imaginary and symbolic play.</td></tr>
<tr><td colspan="4"></td></tr>
<tr><td rowspan="4">First Level</td><td colspan="2">Engineering</td><td colspan="2">Computing</td></tr>
<tr><td colspan="4">Understand: Systems rely on people, processes and parts working together to achieve a purpose.</td></tr>
<tr><td>Know:
Engineers design and improve things to help people.

A mechanism is a system of moving parts that performs a specific task.

Simple machines such as levers, pulleys, wheels and axles make tasks easier.

Strength and stability are key features of structures.

The materials used in construction affect the strength of a structure.</td><td>Do:
Explore and build simple mechanisms.

Build a simple structure or engineered product, such as a tower, bridge or vehicle.

Identify structures in the local environment, for example, famous landmarks that have key structural features and common shapes.</td><td>Know:
Physical computing systems, such as robots or drones, use information collected from real-world inputs to control outputs.

Inputs, such as buttons, switches or light and temperature sensors capture external data.

Outputs, such as LED displays, buzzers, speakers or motors perform physical actions based on instructions.

Computers and devices can be connected in networks, allowing them to communicate and share information.</td><td>Do:
Experiment with controlling devices that respond to inputs and produce outputs.</td></tr>
<tr><td></td><td></td><td>Notes
There are six simple machines and mechanisms that multiply forces or multiply speed or distance, or change the direction of a force: levers, wheels and axles, pulleys, inclined planes (ramps), wedges and screws.</td><td></td><td></td></tr>
</table>

<table>
<tr><td>Sub-Strand</td><td colspan="2">Engineering</td><td colspan="2">Computing</td></tr>
<tr><td rowspan="3">Second Level</td><td colspan="4">Understand: Systems use interconnected parts to receive inputs, process information and produce outputs.</td></tr>
<tr><td>Know:
A machine is a physical device that uses energy, force or motion to perform work or help people carry out tasks more easily.

Engineers use certain shapes, such as triangles, circles and cylinders, and materials in their designs to make structures stronger</td><td>Do:
Design and build a machine using simple mechanisms in response to a design challenge.

Design and build a free-standing, load-bearing structure, such as a bridge or tower that can support a weight.</td><td>Know:
Inputs capture data, processors and memory handle instructions via code, and outputs deliver the result.

Data can be stored locally on a physical device or remotely over a network.

The internet is a global network of interconnected computers and devices that allows information and services to be shared worldwide.

The Internet of Things (IoT) is a network of physical devices, or ‘smart’ objects and appliances, that can be connected to a network.

Routers are hardware devices that pass data along a network. Wi-Fi is the wireless link connecting a device to the router, which then connects to the internet.

The World Wide Web (WWW) is a service on the internet that allows people to access websites and information using a web browser.</td><td>Do:
Identify and discuss examples of computer systems in the real world, including robotic and automated systems, and explain their purpose.

Describe systems by identifying their inputs, processes and outputs, including systems that respond to environmental input.

Store, organise and retrieve data using local and remote storage.

Describe how devices are connected in a network.

Share experiences with smart devices and the tasks they perform in a home network.

Describe steps that can be taken to protect a home network from unauthorised users.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

DRAFT

Sub-Strand	Business		Design and Engineering		Computing Science		Cyber	
Third Level	**Understand:** The behaviour and performance of a system are influenced by the interaction of its people, processes and resources.							
	Know: Prosperity is when people in a country have the resources, opportunities and support they need to live happy, healthy and successful lives. Industrial and economic activity in Scotland is grouped into primary, secondary and tertiary sectors based on the products produced, the services provided or the stage in the production process. Demand refers to the quantity of a product or service that consumers are willing and able to buy at different prices over a period of time. Supply refers to the quantity of a product or service that producers are willing and able to offer for sale at different prices, over a period of time. Demand and supply interact to determine market price and quantity of products and services. Accounting statements support an organisation to plan and report on financial performance by showing income, outgoings and what is owned and owed.	**Do:** Explore what prosperity means to the people of Scotland. Identify examples of businesses operating in the primary, secondary and tertiary sectors of industry and explain their contribution to Scotland's economy. Explore how and why demand for products and the supply of products change over time and start to consider the impact of these changes. Use financial documents to assess business performance and identify ways to improve it.	**Know:** A system, such as a machine, is a group of interacting, interdependent parts that work together to achieve a specific purpose. A subsystem is a smaller, independent system that operates as a distinct part of a larger, more complex system, such as a mechanism. Energy transfer is the movement of energy from one place, object or system to another. Energy transformation, or energy conversion, is the process of changing energy from one form to another.	**Do:** Draw a systems diagram. Identify subsystems within a more complex system. Identify the forms of energy used in a system and describe how energy is transferred or transformed between components.	**Know:** Computer systems represent all data and instructions using binary code. Computer systems consist of interacting hardware components, including processors, memory and storage, whose combined performance affects system behaviour, such as speed, responsiveness and multitasking. Data collected by sensors can be used to control how a system behaves and responds to changes in its surroundings. Data storage is measured using standard units, for example, bits, bytes, kilobytes, megabytes and gigabytes. Data centres house large numbers of high-performance computers, servers and networking equipment that store, process and manage data that users access remotely. Networks use hardware such as switches, routers, wireless access points and repeaters to connect devices and transmit data between them. Networked devices have a unique Internet	**Do:** Explain the role of the components of a system, including the processor, memory and storage. Build physical computing systems that that respond to real-world conditions and integrate multiple inputs, processes and outputs. Set up two or more devices to communicate by sending and receiving data using simple code or network rules. Trace the journey of data through a network and explain how packets are created, transmitted and reassembled. Identify the network hardware that connects devices and enables data to travel across a network. Identify the factors affecting system and network performance.	**Know:** Cyber security is about keeping data and systems safe from cyber threats, such as malware, hacking and viruses. Malware (malicious software) is any software or program designed to harm, disrupt or gain unauthorised access to a computer system, network or device. Social engineering is an attack that tricks people into giving up information or access to systems. Defensive cyber security is used to protect users and computer systems.	**Do:** Outline the measures that can be used to reduce the effects of cyber threats. Describe the different types of malware. Describe how social engineering can be used to gain access to a computer system. Identify signs that an email, message, website or request may be suspicious. Outline steps that could be taken when an account, device or data has been compromised.

					Protocol (IP) address to identify them. Protocols are the rules that devices follow to communicate with each other across a network. Data is broken into packets and sent across a network. Network performance depends on bandwidth, number of users and connection type.			
	Excludes Market equilibrium diagrams. **Includes, but not limited to** At this level, knowledge of only one type of account is required. • period end financial statements • budgets • costing (job costing, break-even) • inventory monitoring **Notes** ICT could be used to access, edit or produce financial statements.		**Includes but not limited to** Engineering, digital, manufacturing and graphical systems. **Notes** Depending on the type of system studied, feedback could include sensor data, quality control data or user feedback.		**Excludes** Binary to decimal conversions.		**Includes, but not limited to** Malware types include viruses, trojans, worms, spyware, botnet malware and ransomware.	

DRAFT

Return to Contents

Sub-Strand	Business		Design and Engineering		Computing Science		Cyber	
Fourth Level	**Understand:** Interactions between technological, social and digital systems can create complex outcomes that are difficult to predict or control.							
	Know: Economic growth is the increase in a country's production of products and services over time. Gross Domestic Product (GDP) measures economic growth and is the total value of everything a country produces. GDP does not measure the economic value of the paid and unpaid work taking place in the care economy. The size and importance of Scotland's industrial sectors have changed over time. Inflation is the sustained increase in prices over time. Inflation affects the cost of living. Inflation can be caused by changes in demand and supply. Public, private and third sector organisations have different objectives, ownership, control and sources of finance. Financial statements can be compared over time to identify changes in performance or to measure the success of decisions. Organisations will compare their financial performance with competitors to make	**Do:** Consider the positive and negative effects of economic growth on the people of Scotland. Explore the role of the care economy in economic growth and prosperity. Consider the pattern and possible causes of change in Scotland's industry over time. Reflect on the effects of industrial change on the Scottish economy and on the people of Scotland. Examine changes in prices over time and consider the causes and effects of these changes on the people of Scotland. Identify and compare the features and objectives of organisations in different economic sectors. Analyse financial statements to uncover trends and patterns in performance over time. Compare the financial performance of different organisations based on analysis of financial statements.	**Know:** Systems can be expressed using recognised conventions such as flow charts, logic gates, truth tables and Boolean expressions. An open-loop system is a type of system in which the output has no effect on the input or control action. A closed-loop system uses feedback to automatically monitor its output and make real-time adjustments to reach a target without human intervention. Energy wastage is the use of more energy than needed, or the loss of energy as unusable heat, sound or light during a conversion process.	**Do:** Construct or simulate a system with and without feedback. Explore how closed-loop systems use feedback to react to changes. Identify energy wastage in a system.	**Know:** System performance depends on the interaction of hardware, data and processes. Constraints such as processing capacity, storage, data volume and bottlenecks affect system performance. Some systems operate using predefined rules while others use data to identify patterns and adapt outputs. Data processing may occur locally or across distributed systems, creating trade-offs in performance, scalability, security and efficiency. Network communication relies on addressing, protocols and packet transmission. Data is transmitted using packet switching across interconnected networks. Transmission media and distance influence signal quality and reliability. Network performance depends on interacting factors including bandwidth, latency, traffic and demand. Network hardware manages, routes and controls data flow.	**Do:** Analyse how hardware, data and processes influence system performance. Evaluate systems and recommend improvements based on identified constraints. Compare rule-based and data-driven systems. Develop and test physical systems that use feedback to control behaviour. Explain how network hardware and services support communication. Analyse factors affecting network performance and reliability.	**Know:** Cyber resilience is an organisation's ability to anticipate, withstand, recover from and adapt to adverse cyber events, attacks or data breaches. A resilience framework provides a structured process for identifying and assessing cyber risks and planning how to recover. Digital forensics is the process of collecting and analysing digital evidence after a cyber incident.	**Do:** Respond to evolving cyber-attack scenarios or simulations and explain the decisions made. Explain the need to balance security with other considerations including usability, cost and ethics.

	decisions about improving efficiency, profitability or both. Financial statements provide a clear record of how money is managed and may be shared with stakeholders.							
	Includes, but not limited to Measures relating to the standards of living for the people of Scotland could include inflation, unemployment and interest rates. **Excludes** Ratio analysis. **Notes** UK Generally Accepted Accounting Practice (GAAP) provides guidance on the types of financial statements that may be shared with different groups of stakeholders.		**Includes, but not limited to** Logic gates at this level could include AND, OR NOT. External conditions could include weather, website traffic or changes in production demand.				**Notes**	

DRAFT

Return to Contents

<table>
<tr><td>Strand</td><td colspan="2">People and Planet</td></tr>
<tr><td rowspan="3">Early Level</td><td colspan="2">Understand: Everything we make and use comes from materials and resources found in the world around us.</td></tr>
<tr><td>Know:
Materials can be made by people or come from the natural world.

People can make things from natural materials.

Some materials can be combined to make new materials.

Some materials can be reused and recycled to reduce waste.

Technology can use energy from different sources, such as electricity, batteries and solar power.

Switching off electronic devices when they are not needed helps reduce electricity use.</td><td>Do:
Identify materials that can be reused and repurposed instead of using new materials.

Turn off or lock technology when it is not in use to save energy.</td></tr>
<tr><td colspan="2"></td></tr>
<tr><td rowspan="3">First Level</td><td colspan="2">Understand: Making and using products requires resources and energy, which can affect the environment.</td></tr>
<tr><td>Know:
The manufacture and use of products and technology can damage the environment.

The ways we produce, buy, use and dispose of products can help to protect the natural world.

Upcycling and repurposing can transform waste into useful materials.</td><td>Do:
Identify the materials used in products or devices.

Design a product that uses sustainable or recycled materials.

Repair items, reuse materials or repurpose materials into new items.</td></tr>
<tr><td colspan="2">Includes, but not limited to
Materials used in products and packaging could include glass, plastic, metal, wood and paper.

Notes
This may complement enterprise and Learning for Sustainability.</td></tr>
<tr><td rowspan="2">Second Level</td><td colspan="2">Understand: Technological developments can create consequences for people, communities and the environment.</td></tr>
<tr><td>Know:
The materials used to make things come from the Earth and some of these resources are finite.

Sustainable materials can be grown again, replaced, reused or recycled more easily than others.

Making, packaging and transporting products use resources and energy.

Digital technologies require energy, materials and infrastructure to operate.

Some digital technologies use large amounts of energy and water to store and process data.

The extraction of raw materials and the production of products can affect people and communities.

Digital devices may contain stored data when they are no longer in use.</td><td>Do:
Investigate who and what is affected by the production of materials and products.

Investigate forms of renewable energy and ways of reusing materials.

Identify sustainable choices that can affect individuals and communities.</td></tr>
</table>

DRAFT

Sub-Strand	Business		Design and Engineering		Computing Science		Cyber	
Third Level	**Understand:** Technology and innovation decisions require balancing the needs of people, communities and the environment.							
	Know: Ethical marketing is the practice of promoting products, services or brands in a way that is honest, fair and respectful of consumers, society and the environment. Marketing activity may increase consumption by encouraging consumers to replace products more often. In a circular economy, products are made to last longer and materials are reused, repaired, refurbished and recycled. This reduces the need for new raw materials and produces less waste. A social enterprise is an organisation that aims to achieve social or environmental goals while also generating revenue.	**Do:** Recognise ethical and unethical marketing practices. Distinguish between persuasive and misleading messages in marketing materials. Explore the effects on the environment of increasing consumption of products. Consider the benefits to the environment, to the organisations and to individuals of adopting a circular economy approach. Investigate an example of a Scottish social enterprise, considering its goals, how it generates revenue and the effect it has on the local or wider community.	**Know:** A circular life cycle is a regenerative economic and manufacturing model designed to eliminate waste. A circular life cycle keeps products, parts and materials in use for as long as possible through continuous reuse, repair, remanufacturing, and recycling. The right to repair enables users to repair products or replace components rather than replace the whole product. The Rs of sustainability include recycle, reduce, refuse, renew, repair, repurpose, rethink and reuse. Green technology contributes to industrial activity in Scotland.	**Do:** Discuss the social and environmental effects of circular and linear life cycle products, low-cost products and changes in technology. Consider the Rs of sustainability when critiquing an existing product.	**Know:** Human-centred design of AI and data systems are designed around the needs, experiences and wellbeing of people. Digital and AI systems use data and algorithms to personalise content, meaning different users may receive different information and experiences. AI can improve inclusivity by adapting services, information and technologies to meet the needs of diverse users and increase accessibility. Networks, digital infrastructure and data centres depend on energy and limited natural resources, such as water, to function. Frontier technologies are new and advanced technologies that are made possible by improvements in computing power, data processing and connectivity.	**Do:** Describe possible consequences of targeted or personalised content for users. Identify the reasons why frameworks exist to regulate data and AI systems. Consider how AI can be used to improve accessibility for a diverse range of users. Consider the environmental effects of networks, digital infrastructure and data centres. Explore how frontier technologies, such as AI, machine learning, robotics, automation and IoT devices, can affect how people live and work in Scotland.	**Know:** Older devices that have become obsolete or are replaced with new versions can be vulnerable to cyber threats because they often no longer receive security updates or patches. Failing to wipe an old device properly could expose sensitive data, such as personal, financial or organisation details. Cyber attacks often target sensitive information such as customer or employee data and intellectual property.	**Do:** Consider measures that can be taken to ensure older devices remain secure. Explore how data and devices are securely disposed of. Explore real-life examples of cyber attacks and consider the effects on individuals.
	Notes The Advertising Standards Authority (ASA) lays out the rules and guidance for marketing including the Committee of Advertising Practice (CAP) Code and UK Code of Broadcasting Advertising (BCAP Code).		**Includes, but not limited to** The study of the effect of low-cost products might include factors, such as workforce exploitation and child labour, materials, pollution, natural resources and supply chains. Green technology is environmentally friendly innovation designed to reduce pollution, conserve natural resources and promote sustainable development.					

Return to Contents

<table>
<tr><th>Sub-Strand</th><th colspan="2">Business</th><th colspan="2">Design and Engineering</th><th colspan="2">Computing Science</th><th colspan="2">Cyber</th></tr>
<tr><td rowspan="3">Fourth Level</td><td colspan="9">Understand: Responsible technological decisions require balancing ethical, social, environmental and economic considerations.</td></tr>
<tr>
<td>Know:
Many organisations have an aim of corporate social responsibility (CSR). They consider the effects of their actions on communities, society and the environment.

Environmental, social and governance (ESG) frameworks provide a way to assess an organisation’s ethical and sustainable impact.

Greenwashing Is when organisations make exaggerated claims for marketing purposes.

A wellbeing economy is an economic approach that prioritises the wellbeing of people and the health of the environment, rather than focusing only on economic growth or Gross Domestic Product (GDP).</td>
<td>Do:
Consider the advantages of CSR aims for organisations, employees, society and the environment.

Critically examine environmental claims made by organisations by comparing CSR aims with measurable outcomes or performance indicators.

Explore different ways of implementing a wellbeing economy in Scotland.

Consider the effects of a wellbeing economy on communities, society and the environment.</td>
<td>Know:
A user persona is an imaginary person who represents a group of people who might use a product.

A persona helps designers understand what users need, like and find important when creating something.

Planned obsolescence is the deliberate design of a product to have a limited useful life.

Emerging material technologies offer new opportunities, scope and possibilities when designing products.

Globalisation of manufacturing is the process in which companies spread design, sourcing, production and assembly across different countries.

Supply chains are used by companies to build items using parts and labour from all over the world.</td>
<td>Do:
Create personas to understand the needs and requirements of specific users.

Investigate the social, environmental and ethical drawbacks of mass manufacturing or production.

Consider the Rs of sustainability when designing a new product.

Investigate the social, environmental and ethical drawbacks of globalisation of manufacturing and international supply chains.

Investigate how local industries and traditional craft practices contribute to sustainable and responsible product manufacture.</td>
<td>Know:
Human-centred design requires a balance between the needs, experiences and wellbeing of people. It must also support organisational aims, such as creating AI and data-driven systems that drive innovation and profit.

AI systems learn from data. Some data may contain social bias, leading to decisions and outputs that may be unfair to some people or groups.

AI, data-driven systems and other advances in technology can transform industries and affect the jobs people do and how tasks are completed.</td>
<td>Do:
Identify the competing aims of users, organisations and designers of AI and data-driven systems.

Identify how social bias within data sets can affect the outputs of AI systems and consider the effects on equalities.

Identify the reasons why frameworks exist to regulate data and AI systems.

Consider the effects of advances in AI, data-driven systems and other technologies on people living and working in Scotland.</td>
<td>Know:
Cyber attacks can cause data breaches and system outages, that disrupt operations and lead to production stoppages, financial losses and damage to supply chains.

National security cyber threats are risks posed by malicious groups or individuals using digital technologies to disrupt, damage or gain unauthorised access to systems that are critical to the nation’s infrastructure, institutions, services, economy and public safety.</td>
<td>Do:
Explore real life examples of cyber attacks and consider their effects on organisations.</td>
</tr>
<tr>
<td colspan="2">Notes
Scotland’s National Strategy for Economic Transformation and National Performance Framework (NPF) outline how a wellbeing economy could be achieved and measured in Scotland.</td>
<td colspan="2">Notes
Knowledge from this strand can be applied in context through design tasks in IDEAs.</td>
<td colspan="2"></td>
<td colspan="2">Notes
The UK government identified cyber security as a Tier 1 threat in its National Security Strategy.</td>
</tr>
</table>

Return to Contents

Strand	A Data Rich World							
Sub-Strand	Business		Design & Engineering		Computing Science		Cyber	
Third Level	**Understand:** Data has value and decisions become more informed when data sources, quality and patterns are critically analysed.							
	Know: Primary and secondary methods of market research can be used to gather data to identify gaps and opportunities and understand the needs of customers. Primary market research, or field research, gathers first-hand information which has been collected for a specific purpose. Secondary market research, or desk research, is when the business collects and uses information from published sources. It has been produced by someone else for a different purpose. Critical evaluation of online sources reduces the risk of misinformation. AI prompts are the input or instruction, given to an artificial intelligence system, to tell it what task to perform and how to respond. Data analysis software is used to record, process and analyse numerical data for a range of administrative purposes. Numerical data and information can be	**Do:** Exploring different ways market research can be gathered. Identify reliable and unreliable sources of information when researching online. Check and verify results considering authorship, evidence, bias and purpose. Use AI tools to generate summaries or gather information and verify this information using other sources. Edit and perform calculations by selecting appropriate functions, formatting and formulae in data analysis software. Explore tools and functions that help to present data and information visually. Write and execute simple queries, for example, on one or two criteria, to elicit data to solve a problem. Amend and update data management structures, for example, changing data type or field labels.	**Know:** Designers use multiple forms of data to guide every choice from the start to the finish of a design. Primary data collection methods include taking measurements, undertaking surveys, testing, observation and experimentation. Secondary data collection methods include internet searches and the use of existing sources of information such as books, journals, technical data sheets, catalogues, standards, reports and data sets. Quantitative data is any information that can be counted, measured and written down with numbers. Qualitative data is information that tells us what something is like. It describes people's thoughts, feelings, opinions or observations using words instead of numbers.	**Do:** Identify where primary and secondary data are used throughout the design of a product or system. Gather and use quantitative data to make design decisions. Gather and use qualitative data to make design decisions.	**Know:** Data can be collected in different ways, for example, volunteered data (given by users) or captured data (collected automatically). Data types such as number, text, date, image, audio, determine how data is encoded, stored and used. Data can be stored in different formats depending on its use. A database stores related data in a structured way, allowing users and applications to add, retrieve and update information Structured data relies on consistent formatting and fields to organise data. Hierarchical structures organise data in levels, allowing it to be found using a path. Digital systems use identifiers such as cell references, memory locations, IP addresses to locate data. Retrieved data can be sorted and filtered.	**Do:** Compare different sources of data and the value that this data has. Select the most appropriate file format for a specific task. Select appropriate data types for different kinds of data and adjust incorrect types when needed. Identify and fix errors in a data set before using, ensuring it is clean for use. Use digital tools to manipulate data sets to answer questions. Use names, references or addresses to locate, compare and manipulate data. Use paths or references to locate data within a hierarchical arrangement. Train and test a machine learning model. Improve an AI model's performance by adding more training data. Explain the difference between training and test data.	**Know:** UK General Data Protection Regulation (GDPR) helps protect people's personal data by requiring organisations to use cyber security measures and handle data responsibly. Data is often the target of a cyber attack. Data such as personal information including bank details and company information is stolen for various reasons including identity theft, extortion, industrial spying or to sell data on to other criminals. Data flowing through systems and networks can be intercepted or altered. Encryption is the process of turning readable data into unreadable data to keep it secure.	**Do:** Discuss different motives for a cyber attack that steals data. Encrypt and decrypt data using a simple cipher

	presented in different digital displays, such as tables, charts, graphs and other visual tools. Data management software enables users to store, manage, update and retrieve data for a range of administrative purposes. Querying is the process of finding relevant information by using structured search techniques in data management software.				Data cleaning before input improves accuracy of the output. AI systems are developed by humans who control their design. AI systems use data and algorithms (rules) to make decisions, predictions, or create content. Machine learning is a type of AI where systems learn patterns from data instead of being given step-by-step instructions. A data set is a collection of example data used to train an AI system. How well an AI system works depends on the quality, size and balance of its training data. Generative AI creates outputs by predicting what is most likely based on patterns in the training data and the prompt. Some AI follows fixed rules where the same input produces the same answer. Other AI considers possibilities and chooses an answer based on what is most likely.	Recognise when an AI system gives the same or variable outputs.		
	Notes Digital tools can be used to support market research type activities. **Includes, but not limited to** Data analysis software could include spreadsheets, business intelligence (BI) systems or programming environments for statistical analysis.		**Notes** Knowledge and skills with data should be integrated into learning experiences within other strands, where they can be applied in authentic design and engineering contexts.		**Includes, but not limited to** Digital tools to manipulate data include simple querying using structure query language (SQL), preparing data for use within an AI system, using data in a spreadsheet application and interrogating a data set using a high-level language.		**Includes, but not limited to** Ciphers, coded messages and unplugged activities.	

Sub-Strand	Business		Design & Engineering		Computing Science		Cyber	
Fourth Level	**Understand:** The quality, quantity, structure and balance of data determine how reliably analyses can be performed and how accurately technologies, including AI systems, generate outputs.							
	Know Primary and secondary methods of market research each have value and help to inform decision-making. Understanding the advantages and disadvantages of each helps organisations choose the most effective approach. Good decisions rely on a range of data and information and balancing from balancing evidence, context and human judgement. Critical evaluation of online sources can lead to more informed decision-making in an organisation. Effective AI prompts can improve clarity and quality of outputs. Data analysis software is used to analyse, sort and filter large sets of numerical data combining functions including lookup and referencing formulas. Data analysis software can be used to present complex data in visual ways such as in charts, conditional formats and pivot tables to help communicate patterns, comparisons and trends. Data management software allows users to create input forms or interfaces to input	**Do:** Evaluate market research methods and select the most suitable for a specific purpose. Explore tools and functions that help to present data and information visually to help users identify trends, patterns and make comparisons between data sets. Write and execute multi-criteria queries to elicit data to solve specific problems. Design a form to capture data for entry. Create a report to display the results of a query for a user.	**Know:** Human and user data provide evidence about people's characteristics, interactions and experiences that can inform design decisions. The reliability of these decisions depends on the quality and representativeness of the data. Design decisions depend on the quality, accuracy and appropriateness of data gathered from modelling and testing. Safety regulations, environmental requirements, costs and the availability of materials and parts ensure products are legal, safe, affordable and practical to manufacture.	**Do:** Identify where different types of data would be used throughout the design of a product or system. Gather and use a range of data to support design decisions.	**Know:** Data can be represented in different formats without changing its underlying meaning, although quality, structure or metadata may be affected. Data formats influence file size, quality, compatibility and transmission efficiency. Validation improves data quality by identifying data that does not meet defined constraints. Data quality affects the reliability of analysis, processing and decision-making. Structured data models support efficient storage, retrieval, linking and querying of data. Data can be queried, transformed and visualised using code. AI systems use algorithms and data to generate predictions, classifications and decisions. The behaviour of AI systems is influenced by both algorithms and training data. Data set size, quality and representation affect AI system performance and outcomes.	**Do:** Import, export and convert data between file formats. Select and justify appropriate file formats for a given purpose. Create, modify and use structured data models. Apply validation techniques to improve data quality. Use code to query, filter, transform and visualise data. Evaluate the quality and suitability of data for a specific purpose. Train and test AI models using different data sets. Compare how training data affects model outputs. Investigate the effects of data set size, quality and balance on outcomes. Evaluate the accuracy, reliability and fairness of AI outputs. Explain the limitations of AI models using evidence from testing. Evaluate the suitability of AI outputs for different purposes.	**Know:** UK GDPR requires organisations to consider data security and data protection at all stages of data handling. End-to-end encryption is a secure communication method that locks data on a device, keeps it scrambled while travelling and unlocks it only on the recipient's device. It ensures that no third party can read or tamper with messages. A digital certificate is an electronic statement that proves the identity of a person or organisation on a network. It is used to establish trust and enable secure communication over the internet. Data poisoning is a cyber security attack that targets machine learning and AI systems by deliberately injecting false, misleading or malicious data into a data set used to train a model.	**Do:** Explore the advantages and disadvantages of using end-to-end encryption. Explore how to identify a digital certificate. Identify real-world examples or possible contexts where a data poisoning attack could cause serious harm.

	information. This reduces errors and makes systems easier to use. Data management software can present data in a clear, organised and readable way. It can be used to summarise, analyse and communicate information to a specific audience.				AI models may perform well during training but poorly when presented with new data.			
	Notes		**Notes** This is not intended to be taught as a standalone unit. Instead, its knowledge and skills should be integrated into learning experiences within the Systems, IDEAs and Make it Happen strands, where they can be applied in authentic design and engineering contexts.		**Notes** Digital tools to manipulate data include simple querying using structured query language (SQL), preparing data for use within an AI system, using data in a spreadsheet application and interrogating a data set using a high-level language.			

DRAFT

<table>
<tr><th>Strand</th><th colspan="4">Digital World</th></tr>
<tr><td rowspan="3">Early Level</td><td colspan="4">Understand: Digital technologies enable people to communicate, create and access information and media in different ways.</td></tr>
<tr><td colspan="2">Know:
Consent means asking for or giving permission before media is captured or shared.

Devices can be secured and protected from threats.</td><td colspan="2">Do:
Ask others for consent before taking photos, videos or audio recordings.

Give or decline consent to be included in photos, videos or audio recordings.

Lock and unlock different types of security tools.

Lock devices when not in use and put them in a safe place.</td></tr>
<tr><td colspan="4">Includes, but not limited to
Computers, laptops, interactive panels, tablets and mobile devices.

Notes
Security tools could include passwords, passkeys, facial recognition and PINs.</td></tr>
<tr><td rowspan="3">First Level</td><td colspan="2">Digital Skills</td><td colspan="2">Information Skills</td></tr>
<tr><td colspan="4">Understand: Digital skills enable people to participate effectively by accessing, creating and sharing information using technology.</td></tr>
<tr><td>Know:
Devices use software to perform tasks.

A software application, or app, is a tool on a digital device the user carry out tasks, such as drawing, writing, learning, playing or creating.

Personal data is information about an individual and is sometimes stored on a device or online.

Devices can be secured to reduce the risk of data being accessed, damaged or lost.</td><td>Do:
Control a device using an input, such as a mouse or touchscreen.

Open, close and switch between applications.

Copy text and images from one application to another.

Access saved files and media such as images, video or audio.

Use accessibility features to make a device or app easier to use.

Use passwords or other details to log in to or unlock a device.

Recognise examples of personal data.</td><td>Know:
Anyone can create and share information, media or content online.

Misinformation is information that is inaccurate, false or misleading.

Oline and offline information should be checked for reliability and accuracy.</td><td>Do:
Use a web browser to access reliable information, media or content online.

Identify examples of misinformation.</td></tr>
<tr><td></td><td></td><td></td><td></td></tr>
</table>

<table>
<tr><td>Sub-Strand</td><td colspan="2">Digital Skills</td><td colspan="2">Information Skills</td></tr>
<tr><td rowspan="3">Second Level</td><td colspan="4">Understand: Digital skills support safe, effective and collaborative participation in an increasingly digital world.</td></tr>
<tr>
<td>Know:
A file is a piece of information saved on a device.

Different files can store different things, such as pictures, writing, music or videos.

Digital media and files are stored on devices using file names and they can be organised into folders.

Files can be stored in different locations, such as on computers, tablets, USB drives or online.

Metadata is descriptive information about a picture or file.

Software is a collection of instructions that tells a device what to do.

Devices need system software, such as an operating system, to function.

The operating system manages the hardware and software enabling users to interact with a digital device.

Different apps help users complete different tasks, such as writing, drawing, coding, playing games or communicating.

Multiple applications, windows and digital tools can be used together to complete tasks efficiently.

Most devices, software and apps have built-in guides to help the user solve problems.

Accessing devices and their data without permission is called hacking and is illegal.</td>
<td>Do:
Use software and applications to communicate, collaborate and support learning.

Find and open applications and switch between applications and tasks.

Name and organise files in folders and manage permissions to allow others to access them.

Access the metadata of a picture or file.

Access and change settings.

Plan steps to keep familiar digital devices and home networks secure.</td>
<td>Know:
A web browser is a tool that helps find, open and view websites on the internet.

The words and keywords used in a search affect the quality of the results.

Some sources of information are more reliable and trustworthy than others.

Disinformation is information that is deliberately inaccurate or false.

Disinformation is intended to cause harm, such as causing alarm or upset or damaging health.

Generative AI (GenAI) uses information and patterns from existing data to generate content, so its outputs should be checked for accuracy, bias and reliability.

An email is a digital message that people can send and receive using the internet.</td>
<td>Do:
Use bookmarks to save useful websites in a browser.

Access reliable online information and media.

Evaluate the reliability of information, media or content by considering using the Currency, Relevance, Authority, Accuracy and Purpose test.

Identify examples of disinformation.

Explore GenAI by writing prompts and comparing responses.

Recognise AI can be inaccurate or biased and question reliability of its outputs.

Compose and send emails for a particular audience and purpose.</td>
</tr>
<tr><td colspan="2"></td><td colspan="2">Notes</td></tr>
</table>

Declaration

The content of this document was written by the author, exercising full professional judgement. Education Scotland approved AI tools were used to support review, clarity and quality assurance. Education Scotland staff retain full responsibility and have reviewed and approved all content.

Version History

Version	Date	Detail
Version 1.0	4 November 2026	First released