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Northern Ireland Curriculum 2028

An entitlement to excellence and equity

Technology and design

Draft curriculum framework for Public Consultation

This document forms part of a suite of curriculum materials published for consultation

Contents

Vision statement

Technology and design builds pupils' knowledge of the made and engineered world: the materials, mechanisms, electronic systems and manufacturing processes that determine how products and environments function. During school study of the subject, pupils develop a repertoire of technological and design practices – such as exploratory modelling, testing and refining – selecting approaches suited to the problem. Pupils work with tools, materials and systems, developing the dexterity and confidence to bring ideas into functional form.

Pupils are equipped to shape the technological world in two complementary ways. Firstly, they learn to design, develop, model and refine their own solutions with increasing precision, drawing on subject-specific knowledge and skills to make their decisions. Secondly, they learn to think critically about technology's impact on society and the environment, interrogating ethical and sustainable implications. This builds informed, responsible judgement in selecting resources and creating designs.

Pupils learn that design problems involve users, purposes and contexts, and that contextual factors and constraints shape what a design must achieve. As pupils progress, their understanding of what makes a solution 'fit for purpose' becomes more sophisticated, moving from simple criteria to constraints, and eventually to justified design requirements. By the end of Key Stage 3, they have gained experience of testing prototypes, identifying where designs may fail or perform poorly, and using evidence and subject knowledge to refine their designs.

In technology and design, pupils learn to communicate their thinking clearly through sketches, diagrams, models and prototypes, taking pride in producing accurate, functional and purposeful work. Pupils cultivate technical curiosity by asking why things behave as they do, by exploring how designs might be improved and by using mistakes and adjustments to improve performance. They develop a habit of considering the wider consequences of design choices, including environmental impact, user needs and responsible material use. Through this cumulative knowledge and experience, they gain the satisfaction and joy of seeing their thinking take shape in models and prototypes, and producing solutions that function reliably.

By the end of Key Stage 3, pupils can apply technical concepts to new contexts and understand the role of technology in society. This foundation broadens aspirations, enabling informed choices about future study and work in Northern Ireland's technological and creative industries, and supports pupils to contribute thoughtfully and responsibly in a world shaped by continuous technological development.

Subject-specific categories

The knowledge that pupils will gain in technology and design can be grouped into four categories:

- technological-conceptual
- technological-procedural
- design-conceptual
- design-procedural

Technological-conceptual knowledge

This is knowledge of the underlying principles, ideas and concepts that explain how and why technologies work – the 'know-that' knowledge. It is the understanding of how and why products, systems and materials behave as they do. It includes knowledge of material properties, structures, functions and processes, and the cause-and-effect relationships that link these to performance and function. This knowledge enables pupils to make informed decisions, predict outcomes, troubleshoot and innovate.

Technological-procedural knowledge

This is knowledge of the established methods for working accurately and safely with tools, materials and components, including forming, joining, measuring and assembling – the 'how to' knowledge. It is the ability to carry out the actions, steps, and techniques involved in using tools, machines and equipment, materials, systems and digital technologies. It teaches processes required to produce, build, design, programme or operate something. This knowledge involves following sequences of actions, applying techniques accurately, and using equipment safely and effectively. Practical work enables pupils both to better understand technological ideas and to apply those ideas effectively through increasingly skilled action. Technological-procedural knowledge enables pupils to translate ideas into reality and to adapt processes in response to challenges or changing requirements.

Design-conceptual knowledge

This is the knowledge of the principles, relationships and underlying ideas that shape design as a purposeful human activity. It recognises how design is influenced by contexts, users, values, cultures, ethics and environmental considerations. It includes knowledge of how situations are interpreted as design opportunities, how problems are framed, and how needs, constraints and possibilities guide the direction of ideas. It involves understanding why things are designed as they are, how decisions can include or exclude users, and how design choices affect individuals, communities and the wider world. Design-conceptual knowledge supports reasoning about intent, impact and meaning in design, enabling critical evaluation of how design decisions respond to people, contexts and the consequences of these decisions.

Design-procedural knowledge

This is knowledge of how to practically carry out design activity in an organised, purposeful and iterative manner. It includes the structured approaches needed to investigate contexts and users, translating needs into clear and justified requirements, generating and modelling design concepts, and testing assumptions through prototypes. It involves selecting and applying appropriate design strategies, managing ideas through cycles of refinement, and using evidence to inform decisions and improvements. This form of knowledge supports the development of inclusive, responsible and well-reasoned design solutions that respond effectively to people, situations and constraints.

How the categories work together

In practice, there is dynamic interplay between these four categories. Conceptual knowledge, both technological and design, underpins pupils' ability to engage in reasoning and to reach judgements when they are tackling design challenges. This conceptual knowledge also strengthens their practical skills of making or building. At the same time, as pupils engage in the work of designing or making, their conceptual knowledge is strengthened. They see principles in action, understand them better and are required to think freshly about them, thereby consolidating their conceptual knowledge as they work.

Foundation Stage

At Foundation Stage, through purposeful exploration and play, pupils interact with materials, objects and systems. In these ways, pupils begin to notice how things work, that materials behave in different ways and that simple mechanisms enable movement or change. They gain the skill and knowledge to handle basic tools safely, they make simple decisions about how to shape or assemble materials, and they test what happens when they try things out. Pupils begin to understand that more than one solution is possible and that trying again can improve their work.

Across the key stage, the four subject-specific categories naturally interweave: exploration of materials supports early making; simple making encourages pupils to notice users and purposes; and iterative play builds confidence and enjoyment as children see their ideas take shape in functional, personally meaningful outcomes.

Pupils should learn to:

- cut, shape and join basic materials (e.g. paper, card, fabric, tin foil)
- choose, use, carry and store basic tools safely (e.g. scissors, hole punch)
- stack, balance and join objects to make stable structures
- test their product, during or after making it, to check if it works as intended, and improve as necessary (e.g. does an egg fit into my egg cup?)
- identify needs or problems that become apparent during their own play or when using everyday things (e.g. something falling over or being hard to hold or carry)

Pupils should learn:

- simple vocabulary for describing properties of materials (e.g. soft/hard, shiny/dull, smooth/rough)
- that different materials can behave in different ways (e.g. squeezable, does/doesn't bend when pushed)
- that some materials are more suitable for certain uses (e.g. metals for spoons; waterproof fabric for raincoats)
- that familiar objects are designed for particular purposes (e.g. boxes to carry food, different bottles for different drinks)

- that there can be more than one effective solution to a design problem
- that simple systems have different parts which move in different ways when buttons or parts are manipulated (e.g. wheels turn, lids open, arms bend)

Key Stage 1

Pupils now build clearer technological-conceptual knowledge of how common materials, simple structures and basic mechanisms behave. They begin to understand that products work as they do because of deliberate choices. As they gain experience with tools and common making techniques, their technological-procedural knowledge grows through increasing control, accuracy and care, helping them take pride in producing solutions that function more reliably.

At the same time, pupils' design-conceptual knowledge becomes more intentional. They learn that products are created for users, purposes and contexts, and that simple criteria help guide design decisions. As pupils describe what they want to make, judge how well their designs meet criteria, and make small improvements after testing, the four subject-specific categories work together to enable purposeful making underpinned by emerging reasoning. Across Key Stage 1, this interplay helps pupils experience accomplishment and enjoyment as they satisfy their natural curiosity with structured solutions and a vocabulary for talking about them, and as they see their ideas develop into workable outcomes.

Technological-conceptual knowledge

Pupils should learn:

- vocabulary for describing physical properties of materials (e.g. strong/weak, waterproof/absorbent, rigid/flexible, durable/not durable, natural/man-made) and how these properties relate to specific purposes, contexts and uses (e.g. indoors/outdoors, hot/cold environments)
- some ways in which shape and materials affect the stability of structures
- that basic systems have inputs, processes and outputs
- the way components are connected determines what the system does (e.g. switch + battery + bulb; syringe + balloon + load)

Technological-procedural knowledge

Pupils should learn to:

- mark out, shape, cut, join and finish materials with increasing control, choosing appropriate tools, using them safely with guidance (e.g. folding, rolling, cutting and twisting, making temporary mechanical and basic bonded joins)

- assemble parts so that specific movements occur (e.g. levers, linkages, axles and wheels)
- test their product during making, amending the process as necessary (e.g. 'is the kite frame going to be too heavy?'; 'will the wheels stay attached to the toy car?') and when finished (e.g. 'does my kite fly?'; 'can the toy car move?')

Design-conceptual knowledge

Pupils should learn:

- that everything around them in the made world has been designed intentionally (e.g. a glass is designed to hold a drink safely and comfortably, fitting a human hand; the stone towers or spires that medieval architects added to churches were designed to symbolise direct connection with god, to be a landmark, and to house bells which needed to be high up to be heard further; the sails on a windmill or blades of a wind turbine are designed to catch the wind)
- examples of things designers think about when creating solutions for everyday objects (e.g. a designer had to make this classroom chair stable, low enough for you to sit on, easy to store and built to last; the seat and handlebars of this bicycle had to be adjustable to match a rider's height)
- products can create both positive and negative impacts for users, others and the environment (e.g. a toy with a bell is fun but can be annoying for others; packaging keeps things safe but can create rubbish).

Design-procedural knowledge

Pupils should learn:

- to describe what they want to make and why (e.g. its intended purpose and who will use it) representing their ideas using basic sketches and models
- about factors that they need to think about in their design, such as size, safety, ease of use, weather, location (e.g. 'my parachute will need to be strong but light so that it will fall without breaking'; 'my paper tower will need to be stable enough to stand up on its own/ carry a weight')
- to consider modifications they could make to their design after testing a finished product or model

Key Stage 2

In Key Stage 2, pupils develop broader knowledge of the technological and designed world. They extend their technological-conceptual knowledge by exploring a wider range of material properties, system types and structural principles, they learn how these influence function, performance and suitability. Their technological-procedural knowledge becomes more refined as they work with increasing accuracy, plan sequences of making, and use a broader range of tools, techniques and basic manufacturing processes to produce components and assemblies that fit, align and function reliably.

Pupils' design-conceptual knowledge becomes more sophisticated. They learn that design decisions involve competing needs and constraints, and that evidence and knowledge are used to justify choices. Their design-procedural knowledge grows through more systematic approaches to generating, modelling, comparing and refining ideas, supported by clearer design criteria and evidence gathered from testing. Across Key Stage 2, the strands integrate more deliberately: understanding informs making, making reveals limitations, testing provides feedback, and design reasoning drives purposeful refinement. This coherent interplay helps pupils develop growing independence, confidence and enjoyment in producing more considered, responsible and well-reasoned design solutions.

Technological-conceptual knowledge

Materials

Pupils should learn:

- the physical and functional properties (e.g. elasticity, hardness, thermal insulation, conductivity, corrosion resistance, sustainability) of some commonly used materials and how these influence selection for certain functions in different contexts (e.g. weather exposure, wear and tear)
- some broad classifications of material type, including origin (e.g. natural, synthetic, recycled) and structure (e.g. manufactured boards, metals and plastics)
- how each type of material affects function and sustainability

Structures

Pupils should learn:

- that forces act on structures and that shape, form and reinforcement influence strength and stability (e.g. frames, shells, triangulation)
- about examples of rural and urban buildings in Northern Ireland where deliberate use of shape, form and reinforcement are visible (e.g. the roof structures of barns on farms – trusses, beams and triangle shapes; the triangles evident in dockside cranes; round towers such as Antrim Round Tower)
- about examples of shapes in nature which have been used as inspiration for stable or interlocking shapes (e.g. the hexagons of Giant's Causeway) and how they've been used (e.g. the honeycomb structures hidden inside wings, doors and panels in aircraft; hexagonal designs in Northern Ireland in public places, such as hexagonal paving in Belfast or architectural facades; hexagonal designs used on farms, such as lightweight shed panels, ventilated flooring, fencing mesh or storage systems)
- about examples of stable structures from periods studied in history (pyramids in ancient Egypt; ziggurats in ancient Mesopotamia)

Systems

Pupils should learn that:

- systems can be described as input–process–output
- different system types (e.g. mechanical, electrical, digital) use components (e.g. wheels, levers, switches, and simple programmable devices) to control movement or behaviour (e.g. gears change speed; circuits change light or sound)
- systems follow planned sequences (e.g. turning one gear causes another to turn; pulling a lever causes something to lift)

Technological-procedural knowledge

Tools and equipment

Pupils should learn to:

- follow basic safe working practices (e.g. using tools with care, maintaining safe distances, keeping workspaces organised) and understand why these routines keep themselves and others safe

- select and use a range of common hand tools and simple equipment (e.g. junior hack saw, coping saw, bench hook, hand file) with growing accuracy and control, with guidance to match tools to intended tasks

Planning, making and testing

Pupils should learn to:

- plan sequences for making their designs
- measure and mark out accurately to ensure parts fit correctly
- cut, shape (e.g. file, bend, layer materials) and join (e.g. nuts and bolts, screws or glued) different materials with care, adjusting their working processes to ensure the finished product functions as intended or required
- name and apply reinforcement techniques (e.g. folding, layering or basic triangulation) to secure modifications, such as improving the strength or stability of structures
- assemble components so that the system or product functions as required

Design-conceptual knowledge

Design intentions and users

Pupils should learn:

- that the term 'design criteria' describes the kinds of things that designers think about when creating solutions, including function, sustainability, user needs, aesthetics, values such as inclusion (e.g. Sam Farber's kitchen tools used the design criteria of user needs, inclusion and function, when he designed thick, soft handles for his wife who had arthritis; the attention to aesthetics, beliefs about God, natural light and requirements of space in the deliberate artistry and craftsmanship of medieval cathedral architects and stone masons)
- examples of how designs have evolved over time because of social, environmental or technological factors (e.g. Bronze Age peoples in ancient Mesopotamia found that they could make better tools and weapons by combining copper and tin to make a stronger metal – bronze; the Romans perfected the arch to meet the needs of a growing empire as seen in aqueducts, bridges and large public buildings; the evolution of the penny farthing into the modern safety bicycle; attaching lids to disposable bottles has arisen from awareness of environmental impact of more efficient recycling)

Design reasoning and judgement, including consequences

Pupils should learn:

- that designers work with constraints and so must prioritise, balance purposes and/or make compromises in their designs (e.g. a bag design which needed to be strong yet light; a bridge adapted to allow water traffic underneath; a foldaway chair strong enough to support weight but light and compact enough to carry)
- about solutions to design problems which have emerged from adaptations and accretions of existing designs (e.g. how the architects of Córdoba's first mosque solved the problem of supporting the roof without walls or heavy pillars: the use of Roman and Visigothic arches sitting on top of each other)
- about intended and unintended impacts of designs on people, society and the natural world (e.g. the mobile phone has transformed accessible communication but may isolate people from those around them; a new playground feature may improve play for some but make an area too crowded for others; using more packaging protects a product but creates extra waste)

Design-procedural knowledge

Design contexts and needs

Pupils learn to:

- develop a design which takes account of constraints and user needs (e.g. design a toy suitable for a young child from specified materials available; design a wooden nesting box for a particular size of bird)

Research and evidence

Pupils should learn to:

- interpret and prioritise what they learn from users and existing products, helping them define needs and create design criteria (e.g. when designing a torch, pupils notice from users that it must be easy to hold and from existing torches that a protective casing is needed, helping them decide which features matter most; pupils conduct a survey with a group of adults about what they do and don't like about a desk lamp, pupils then develop the design criteria for a new desk lamp)

Design communication

Pupils should learn to:

- indicate measurements and materials on their sketches and models

Idea generation, development and testing

Pupils should learn to:

- use strategies to generate a range of possible ideas (e.g. seeking inspiration from designers and makers throughout history, from other parts of the world or from nature; studying existing models; combining existing ideas; analysing and improving existing solutions)
- refine or modify their ideas in response to testing them against the design criteria (e.g. where appropriate adding features, improving shapes, adjusting sizes, trying different materials)
- test parts, materials and simple prototypes during development to see whether they meet the design criteria (e.g. testing strength, movement, fit or stability)

Key Stage 3

In Key Stage 3, pupils' technological-conceptual knowledge expands to include more advanced ideas about materials, systems, control and manufacturing, enabling them to analyse how products and systems behave and anticipate the consequences of particular design or technical choices. Their technological-procedural knowledge strengthens through the purposeful use of specialist tools, processes and digital technologies, with increasing attention to accuracy, tolerances, efficiency and safe working practices.

Pupils' design-conceptual knowledge deepens as they evaluate complex contexts, identify competing needs and constraints, and consider ethical, environmental, cultural and social implications across a product's life cycle. Their design-procedural knowledge becomes more independent and strategic: pupils select and adapt creative and systematic approaches to generate ideas, use models and prototypes to test assumptions, and refine solutions using evidence, technical judgement and user feedback. Across Key Stage 3, the four strands function as a coherent and interconnected disciplinary toolkit, enabling pupils to design and make with growing autonomy, insight and responsibility. Working in collaboration, these strands help pupils draw simultaneously on creative, technical and critical capabilities, equipping them to engage confidently with an increasingly complex and technologically rich world.

Technological-conceptual knowledge

Materials

Pupils should learn about:

- physical, functional and technical properties (e.g. toughness, ductility, brittleness, malleability, machinability, electrical/thermal conductivity, environmental impact) and how these determine suitability for specific functions (e.g. heat resistance in cookware, systems, environments and manufacturing processes)
- the technical classification of materials (e.g. ferrous and nonferrous metals, pure and alloy, thermoplastics and thermosets, hardwoods and softwoods, and composite materials) and the common properties and behaviours of different categories

Structures

Pupils should learn:

- how design choices in shape, form and reinforcement (including frames, triangulation and shell structures) influence overall strength, stability and performance under load, shaping the effectiveness of the final product

- about the structural efficacy of specific examples of geodesic domes (e.g. the pioneering structure, Climatron, Missouri Botanical Gardens, USA; the Eden Project in Cornwall, England; the bubble domes beside Lough Erne in Northern Ireland; the Forest Domes in Teapot Lane, Republic of Ireland) including: stability, highly efficient strength-to-weight ratio, maximised enclosed space with minimum material, and heating and cooling performance

Systems

Pupils should learn:

- that systems are made of components that interact, and the way these components are arranged (e.g. gear ratios, cam profiles, lever positions, circuit layouts) changes how the system behaves
- that digital and physical systems can interact
- that simple control logic can automate how systems respond when something changes (e.g. lighting that comes on when a room goes dark or on the activation of movement sensors)

Processes/manufacturing

Pupils should learn:

- that multiple steps and processes are required to produce a product
- about sequences that are used for making industrial products efficiently (e.g. production planning in factories and workshops; grouping tasks and refining workflow)
- about professional designers' use of templates, jigs and digital technology (e.g. CNC equipment such as laser cutters and 3D printers) to create products efficiently and consistently
- that production scale and assembly choices affect cost, consistency and environmental impact (e.g. batch *vs* mass production; use of standard parts; repair and recycling)

Technological-procedural knowledge

Tools and equipment

Pupils should learn to:

- use safe working procedures and develop an understanding of how to adapt their procedures to be safer
- select and use tools and equipment (e.g. tenon saw, chisel) correctly, safely and purposefully (e.g. to meet accuracy requirements of their designs and intended products)
- use powered equipment safely (e.g. pillar drill, band facer, 3D printer, laser cutter), deciding when these offer advantages over hand tools and equipment for accuracy or efficiency

Making process

Pupils should learn to:

- cut and shape materials, refining technique based on material behaviour and required tolerances
- select and apply joints (e.g. temporary, mechanical, bonded or fabricate), using judgement about accuracy, alignment and their intended purpose and function
- select and apply material-appropriate finishes, making decisions about surface preparation and application so that the finish meets the required criteria
- assemble components (e.g. such as electronic, digital or mechanical pre-manufactured parts) accurately (e.g. checking alignment, intended function and fit)

Manufacturing processes

Pupils should learn to:

- use guides (e.g. templates, jigs and fixtures) to help carry out actions accurately
- use digital manufacturing processes (e.g. laser cutter, 3D printer) under supervision

Measurement, refinement and quality control

Pupils should learn to:

- mark out with precision, choosing material-specific tools and reference faces or datum points for accuracy
- carry out quality control and tolerance checks to ensure components are accurate and meet required standards during making

Design-conceptual knowledge

Design intentions and users

Pupils should learn that:

- good designs balance interacting factors, including context, users' needs, materials, sustainability, aesthetics and values (e.g. designing controls that all users can reach; selecting materials that are sustainable; choosing textures or finishes suitable for different users)
- complex systems must balance performance, sustainability, cost and usability (e.g. electric cars, trains, aeroplanes, transport systems)
- different users may have conflicting needs (e.g. physical, cultural, social and economic) and this may require designers to make reasoned choices about which needs to prioritise (e.g. when Harry Beck designed the London Underground map, clarity was prioritised over geographical accuracy; a small city car prioritises running costs and small size for manoeuvrability over passenger space and performance)

Design reasoning, judgement including consequences

Pupils should learn:

- about real examples of designs where competing priorities such as needs, constraints, values, ethics and environmental considerations interact, and that several responses may be valid (e.g. improving accessibility may increase cost; choosing a sustainable material may reduce durability, such as paper *versus* metal straws; prioritising safety may limit aesthetic options)
- how a design brief can influence the kinds of solutions that are possible (e.g. a closed brief with fixed materials limits options; an open brief that states only the purpose allows a wider range of ideas)
- how constraints, whether of necessity or by choice, foster creativity (e.g. how Frank Lloyd Wright sought to blend striking architecture into its surroundings; the opportunities arising from his determination to use glass to replace heavy solid walls)
- that design decisions affect people, communities and the environment (e.g. who could benefit or who could be excluded; whether production processes treat workers fairly; how waste and pollution are created), and that these effects can occur at different points in a product's life (e.g. when materials are extracted, where it is manufactured, how it is transported, when the product is used, or when it is thrown away)

Design-procedural knowledge

Design contexts and needs

Pupils should learn to:

- analyse contextual factors (e.g. ethical, environmental, cultural, social), identify competing needs and constraints, and construct justified design requirements, including inclusive considerations

Research and evidence

Pupils should learn to:

- choose and use appropriate methods to investigate users, contexts and general requirements before developing ideas
- critically evaluate evidence (e.g. from users, observations, existing similar and dissimilar products), recognising that data (e.g. anthropometrics, research collected, and surveys) can challenge assumptions and is used to define design requirements (e.g. design criteria and specifications)

Design communication

Pupils should learn to:

- use appropriate basic drawing conventions (e.g. dimensions, scale, exploded views) when increased precision or clarity is required (e.g. with Computer-Aided Design (CAD))
- select appropriate communication methods for purpose (exploring, developing, or presenting ideas)
- communicate alternative design ideas clearly using a range of techniques (e.g. accurate annotated drawings, physical or CAD models or digital media)

Idea generation, development, testing and evaluation

Pupils should learn to:

- apply criteria, constraints, user needs and technical considerations to explore and compare alternative ideas
- plan and carry out a range of relevant tests on developing ideas, components, systems or prototypes (e.g. functional testing, user trials, performance checks)
- use criteria, constraints, user needs and technical considerations to review test results and judge how well ideas are working

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