



Victorian Essential Learning Standards

Interdisciplinary Learning
Strand

DESIGN, CREATIVITY AND TECHNOLOGY

REVISED EDITION JANUARY 2008



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This edition incorporates minor amendments to the domain introductions and learning focus statements to indicate their relationship with the National Statements of Learning.

Interdisciplinary Learning

The Interdisciplinary Learning strand identifies a range of knowledge, skills and behaviours which cross disciplinary boundaries and are essential to ensuring students are prepared as active learners and problem-solvers for success at school and beyond. This strand focuses on ways of thinking, communicating, conceiving and realising ideas and information. It assists students to develop the capacity to design, create and evaluate processes as a way of developing creativity and innovation.

Within the Interdisciplinary Learning strand the learning domains are:

Communication

Communication helps to construct all learning and is central to the capacity to demonstrate and convey what one has learned in different contexts and to different people. This domain assists students to understand that language and discourse differ in different disciplines and that there is a need to learn the particular literacies involved in each.

Design, Creativity and Technology

Students develop the knowledge, skills and behaviours related to investigating and designing using appropriate planning processes and design briefs; creating and developing ideas, applying information, and seeking and testing innovative alternatives; producing, including the selection and safe use of appropriate tools, equipment, materials and/or processes to meet the requirements of design briefs; analysing and evaluating both processes and products including, where relevant, any broader environmental, social, cultural and economic factors.

Information and Communications Technology

The knowledge, skills and behaviours in this domain enable students to use information and communications technology (ICT) to access, process, manage and present information; model and control events; construct new understandings; and communicate with others. Students use ICT and strategies to monitor learning patterns, to process data to create solutions and information products that demonstrate understanding, and to share their work with others in ethical, legal and respectful ways.

Thinking Processes

This domain encompasses a range of cognitive, affective and metacognitive knowledge, skills and behaviours which are essential for effective functioning in society both within and beyond school. The study of thinking enables students to acquire strategies for thinking related to enquiry, processing information, reasoning, problem solving, evaluation and reflection.

Design, Creativity and Technology

Introduction

The domain of Design, Creativity and Technology emphasises engagement in designing, creating and evaluating processes, products and technological systems using a range of materials as a way of developing creativity and innovation. Creativity in this domain can be described as applying imagination and lateral and critical thinking throughout design and development processes. Innovation is an outcome of the broad exploration of ideas, materials/ingredients, and technical processes that can occur when individuals are involved in investigating, designing, producing, analysing and evaluating their own and others' products and/or systems.

Design is a vital step in transforming ideas into creative, practical and commercial realities by optimising the value of products and systems. Designing and its application involve planning and organising production, and evaluating products in a real context. Contexts may relate to; for example, what we grow, eat, wear, build, make, our health and safety, and how we travel and spend our leisure time. Designers consider problems, needs, wants and opportunities and respond to them by developing a range of ideas, which are developed into utilitarian products or systems.

Development of capability in this domain includes the ability to use, manage, assess and understand design, creativity, technology, and their relationship to innovation. In more detail, this involves students:

- posing problems and actively identifying needs, wants, opportunities and areas for improvement
- gathering information and building knowledge about the nature of needs, wants, opportunities and areas for improvement and the best routes to take towards designing a solution
- developing and using design and technology skills, knowledge and processes, including proposing, experimenting, learning from results and synthesising, to create new and/or improved products and/or systems
- using tools, equipment, materials/ingredients and systems components safely and creatively to make quality products and/or systems
- understanding that design, creativity and technology leads to innovation
- assessing the outcomes of design and technology processes, and the resulting products and technological systems in relation to environmental, social and economic factors.

Definitions of underlined terms are provided in the Glossary (page 22)

This domain involves experiential, practical and applied knowledge as well as theoretical understanding. It requires students to be autonomous and creative problem-solvers, as individuals and as members of a team. Students combine an understanding of design, functionality, aesthetics, social, cultural, economic and environmental issues, and industrial practices with practical skills. As they do so, they reflect on and evaluate past and present design and technology, its uses and effects.

The Design, Creativity and Technology domain focuses on development of students' skills in managing and manipulating materials and resources using a range of tools, equipment and machines to make functional physical products or systems. These materials include food, wood, metal, timber, plastics, textiles, ceramics, plants and soil/growing media and components such as wheels and axles, pulleys and belts, gears, switches, lights, motors, connecting wires, batteries and printed circuits boards.

Structure of the domain

The Design, Creativity and Technology domain is organised into six sections, one for each level of achievement from Level 1 to Level 6. Each level includes a learning focus statement and, from Level 3, a set of standards organised by dimension. A glossary is included which provides definitions of underlined terms (see page 22).

Learning focus

Learning focus statements are written for each level. These outline the learning that students need to focus on if they are to progress in the domain and achieve the standards at the levels where they apply. They suggest appropriate learning experiences from which teachers can draw to develop relevant teaching and learning activities.

Standards

Standards define what students should know and be able to do at different levels and are written for each dimension. In Design, Creativity and Technology, standards for assessing and reporting on student achievement apply from Level 3.

Definitions of underlined terms are provided in the Glossary (page 22)

Dimensions

Standards in the Design, Creativity and Technology domain are organised in three dimensions:

- Investigating and designing
- Producing
- Analysing and evaluating.

Activities associated with the three dimensions are linked and may be applied sequentially, where students move directly from investigating to designing, producing and evaluating. Or alternatively, students may move between the dimensions as they solve a problem. For example, to assist their decision making while designing a product or system, students may evaluate the potential impact on the environment of the intended use of materials/ ingredients, components or processes required to make the product or system. Additionally, after evaluating a product they have made, students may return to the *Investigating and designing* and *Producing* dimensions to improve the product. In this way, students may work in a non-sequential manner through the dimensions in this domain. In order for students to demonstrate knowledge, skills and behaviours in this domain a 'design and make' project-based learning approach must be taken, that focuses on meeting the problem, need/s or requirements defined in a design brief.

Investigating and designing

In the *Investigating and designing* dimension, students identify ideas, problems, needs, wants and opportunities. A design brief can be a starting point or it can be developed to clearly define the idea, problem, need, want or opportunity and requirements for a solution. Students undertake research and investigation to identify the human, material, equipment, and/or energy resources available to meet the idea, problem, need, want or opportunity.

Students combine practical and design skills with knowledge, skills and behaviours from other domains to select and record creative methods of generating and depicting design possibilities and options. They devise a plan to outline the processes involved in making a product, and select and justify the option that best meets the requirements of the design brief.

Producing

The *Producing* dimension involves students in the management of the production phase and includes the appropriate selection and safe manipulation and use of tools, equipment, materials/ingredients and components to carry out processes appropriate to the materials/ingredients or assembly of systems components to produce a quality product or technological system.

Students explore, share and use both traditional and more innovative techniques. They reflect upon their progress and alter plans as appropriate. Progress and changes to plans are reflected upon and altered as appropriate.

Analysing and evaluating

In the *Analysing and evaluating* dimension, students compare the outcomes of design and production activities with earlier design work and planned intentions. Following the application of testing, improvements, modifications and alternative approaches are considered.

This dimension also involves students in describing, analysing and evaluating the impact and value of both their own and others' technological products, technological systems, processes and innovations (past, present and predicted future) on the individual, society and culture, the environment and the economy. This includes consideration of sustainability issues.

National Statements of Learning

The Victorian Essential Learning Standards (VELS) incorporate the opportunities to learn covered in the national [Statements of Learning](http://www.curriculum.edu.au/mceetya/the_statements_of_learning,11893.html) (www.curriculum.edu.au/mceetya/the_statements_of_learning,11893.html). The Statements of Learning describe essential skills, knowledge, understandings and capacities that all young Australians should have the opportunity to learn by the end of Years 3, 5, 7 and 9 in English, Mathematics, Science, Civics and Citizenship and Information and Communication Technologies (ICT).

The Statements of Learning were developed as a means of achieving greater national consistency in curriculum outcomes across the eight Australian states and territories. It was proposed that they be used by state and territory departments or curriculum authorities (their primary audience) to guide the future development of relevant curriculum documents. They were agreed to by all states and territories in August 2006.

During 2007, the VCAA prepared a detailed map to show how the Statements of Learning are addressed and incorporated in the VELS. In the majority of cases, the VELS learning focus statements incorporate the Statements of Learning. Some Statements of Learning are covered in more than one domain. In some cases, VELS learning focus statements have been elaborated to address elements of the Statements of Learning not previously specified. These elaborations are noted at the end of each learning focus statement.

Level 1

Learning focus

As students work towards the achievement of Level 3 standards in Design, Creativity and Technology, they investigate everyday, familiar products and recognise the basic characteristics and materials/ingredients from which they are made and how they are used. They explore the differences between natural products and artefacts, and learn that materials can be recycled and reused to produce new products. They play with and manipulate materials/ingredients in both a free and focused manner to foster development of their design and technical skills. They learn appropriate terminology, including the names of materials/ingredients and their characteristics and properties (for example, rough, smooth, shiny, soft, flexible), and processes such as measure, mix, cut, join.

Students think and talk about why and how products are made. They respond to simple design briefs as a context for designing (for example, 'There is to be a teddy bears' picnic, and your teddy will have to be protected from the sun'). Students use their imagination and curiosity to generate ideas, engage in technological processes and develop imaginative design solutions for simple problems. They learn to use simple pictures and models to represent design ideas to develop simple and authentic products, such as a healthy after-school snack. While designing usually precedes producing and evaluating, students may draw their design after the product is made. Their products may be developed as a result of exploring materials rather than from a drawing.

Students independently, or in collaboration with peers or adults, explore the use of common materials such as paper, cardboard, glue, fabric, wood, soil and plants, plastic containers, string, paddle-pop sticks and food ingredients. They develop skills in the safe use of basic tools and equipment, such as safety scissors, mixing bowls, cups and rulers, to cut, join, shape, mix and follow instructions to construct simple products or models based on their design ideas.

Students think and talk about how their designs will solve a problem or meet a need, and reflect on the steps they took to design and make their product. They discuss how they could make a product better.

Standards

In Design, Creativity and Technology, standards for assessing and reporting on student achievement are introduced at Level 3. The learning focus statements for Levels 1 and 2 provide advice about learning experiences that will assist students to work towards the achievement of the standards at Level 3.

Level 2

Learning focus

As students work towards the achievement of Level 3 standards in Design, Creativity and Technology, they come to understand that people use creative, imaginative and inventive thinking to help them meet human needs and wants. They enquire about and question their world, offering ideas and suggestions based upon their experience of working with materials/ingredients and systems components. They investigate what products and systems can do, how they work, and why they are the way they are. They play with and manipulate materials/ingredients, think about, discuss and describe their characteristics and properties (using terms such as *strong*, *hard*, *stretchy* and *sweet*) and why they are suitable for use in products and systems.

In response to simple design briefs, students develop basic design ideas based on their experiences of working with materials/ingredients and components. They talk about their design ideas and thought processes and start to represent these visually by using models, pictures and words. They consider that more than one solution may be possible and begin to give reasons for changes in their thinking.

Students begin to recognise relationships between individuals and communities, and products, processes and systems; for example, a transport system. Responding to open-ended design tasks, students develop imaginative and practical design solutions to problems, needs and opportunities; for example, making a simple decorated bag for carrying personal items, modelling playground equipment, or making pots to grow herbs for use in a food product.

Students follow a set of instructions and may begin to contribute to planning the main steps to make a product. They explain what they are making and which tools and equipment they are using. They safely use tools and equipment to separate, assemble, join and combine everyday materials/ingredients and systems components in a variety of ways.

Students consider whether their design solutions work and are appropriate for the purpose for which they were designed. With guidance from the teacher and feedback from peers, they reflect on how they designed and made their products.

Standards

In Design, Creativity and Technology, standards for assessing and reporting on student achievement are introduced at Level 3. The learning focus statements for Levels 1 and 2 provide advice about learning experiences that will assist students to work towards the achievement of the standards at Level 3.

Level 3

Learning focus

As students work towards the achievement of Level 3 standards in Design, Creativity and Technology, they begin to provide input into the development of design briefs. They generate ideas from a variety of sources, and recognise that their designs have to meet a range of different requirements. They learn to make realistic plans for achieving their aims and recognise that they are constrained by the availability of resources. They clarify ideas when asked, and use words, labelled sketches and models to communicate the details of their designs.

Students learn to describe ideas and concepts about design, materials/ingredients and technological systems in simple terms. For example, how and why a drawing is annotated; how materials/ingredients are classified; the systems components that are combined to create movement, such as gears and pulleys; what characteristics and properties make materials/ingredients suitable for a particular design or proposed product and how these can be combined in innovative ways to create solutions. In transforming novel ideas into products or simple systems, they are encouraged to take risks.

Students investigate what products and simple technological systems can do, how they meet people's needs, how they are used and/or work, what they look like and why they look the way they do. They learn what evaluation criteria are and, with guidance, develop simple evaluation criteria and use these to make decisions about, and assess, design ideas. With assistance, they learn to plan basic steps in production. They develop skills in the use of a variety of simple production techniques, such as cutting, mixing, shaping, joining and assembling and a range of materials/ingredients to produce products, such as a healthy breakfast cereal and its packaging and simple systems; for example, a puppet with moving parts (levers) or a pulley arrangement to lift a weight. Production techniques could include cutting with a saw or knife, weighing with scales, measuring with a jug, filing with a file or rasp, sandpapering, whisking and hand sewing with a needle and thread. Materials could include paper and cardboard, food ingredients, fabrics, wood, plants and soil or other growing media. They learn to use tools and equipment safely and hygienically, and with some accuracy, to alter and combine materials/ingredients and put together components to make a simple system with moving parts.

Students are encouraged to give and receive feedback about their own and others' products and simple systems (for example, a toy with moving parts), considering whether design solutions work and if they are appropriate for their purpose. They learn to keep simple records and reflect on the steps they took to design and make their own products and simple systems, including noting any problems encountered and changes made to accommodate these.

Definitions of underlined terms are provided in the Glossary (page 22)

Standards

Investigating and designing

At Level 3 students, individually and in teams, generate ideas based on a design brief, demonstrating understanding that designs may need to meet a range of different requirements. They use words, labelled sketches and models to communicate the details of their designs, and clarify ideas when asked. They identify simple systems components and common materials/ingredients and explain the characteristics and properties that make them suitable for use in products. Students think ahead about the order of their work and list basic steps to make the product or system they have designed.

Producing

At Level 3, students use their list of steps and are able to choose appropriate tools, equipment and techniques to alter and combine materials/ingredients and assemble systems components. They use a variety of simple techniques/processes and a range of materials/ingredients to safely and hygienically alter and combine materials/ingredients and put together components to make products and simple systems that have moving parts.

Analysing and evaluating

At Level 3, students test, evaluate and revise their designs, products or simple systems in light of feedback they have gained from others. They identify what has led to improvements and describe what they consider to be the strengths and drawbacks of their design, product or simple system. They consider how well a product or simple system functions and/or how well it meets the intended purpose.

Level 4

Learning focus

As students work towards the achievement of Level 4 standards in Design, Creativity and Technology, they contribute to the development of design briefs that include some limitations and specifications by posing questions about and identifying situations, problems, needs and opportunities for the creation of useful products and simple systems. They explore ideas and concepts about design, materials/ingredients and systems, and consider how these can be combined in innovative ways to create solutions; for example, for a model solar boat or a fun park ride.

Individually and in small teams, students develop possible solutions in response to design briefs, using simple mind maps, sketches, plans and annotated drawings, labelled diagrams models and flow charts. They increasingly use information and communications technology tools and techniques to research, develop and communicate ideas. They are encouraged to consciously select preferred options and explain why they have chosen them, referring to materials/ingredients, function and aesthetics.

Students learn to develop step-by-step plans for production and use a variety of production techniques, tools, materials/ingredients (for example, a template for marking a shape to be cut out of fabric or wood, a tape measure, pliers for bending metal wire, a hot-melt glue gun for joining wood or fabric, a hand beater for combining food ingredients, a clamp for holding materials/ingredients to a table, a try square for squaring a piece of wood, secateurs for trimming a plant, a peeler for removing apple skin) and systems components to make products safely. They begin to record their progress using words and images. Students learn to analyse how products and systems function and what they look like, and discuss the meaning of quality in the context of design. They learn to identify evaluation criteria from the design brief and use them to justify design choices. They also use them to think about how well their completed product suits the design situation. They use simple tests to determine the suitability or performance of products and/or technological systems.

Taking into account feedback from peers and teachers, students consider how the product or system they have made, and the processes they have used, could be improved. They also reflect on the impact that products and systems and the uses of materials have on people and the environment.

Standards

Investigating and designing

At Level 4, students contribute to the development of design briefs that include some limitations and specifications. Individually and in teams, they use a range of methods to research and collect data in response to design briefs. They generate and communicate alternative design ideas in response to a design brief and use words, labelled sketches and models, to demonstrate that they are aware of environmental and social constraints.

Students take account of the views of users/consumers and produce step-by-step plans and/or modify recipes for making products and/or simple mechanical/electrical systems. They describe how their intended product will function or be used, and what it will look like in the context of the requirements of the design brief. They identify evaluation criteria from design briefs and use them to justify design choices.

Producing

At Level 4, students use their production plan and select and work safely with a variety of materials/ingredients and systems components to produce functional products and/or systems. They use a range of measuring, marking, joining/combining techniques to alter materials and finishing/presentation methods, and operate tools and equipment competently, showing consideration of safety and hygiene, and record their progress.

Analysing and evaluating

At Level 4, students reflect on their designs as they develop them and use evaluation criteria, identified from design briefs, to justify their design choices. They modify their designs/products/systems after considered evaluation of feedback from peers and teachers, and their own reflection. They describe the impact products and technological systems have on people and the environment.

Level 5

Learning focus

As students work towards the achievement of Level 5 standards in Design, Creativity and Technology, they individually and in teams, develop innovative solutions in design and technology contexts (for example, creating a low-fat biscuit and designing a three-dimensional, environmentally-friendly package for eight of the biscuits) and evaluate their decisions with reference to design brief specifications. They develop greater spatial awareness, are encouraged to think flexibly, and represent their ideas using two- and three-dimensional hand- and computer-assisted drawing and modelling techniques including the use of appropriate technical language. They further explore the properties and characteristics of materials/ingredients, and carry out tests to determine their suitability for intended products and/or systems.

In developing their understanding of systems, students learn about open- and closed-loop systems, and their control and the components used to make basic automated system; and energy sources (renewable and non-renewable) and forms that power systems. They explore how technological systems can convert energy and magnify force.

Students learn how design elements and principles can enhance their design work. Students refer to design briefs to consider and investigate aspects of function and aesthetics. They also consider how social, cultural, economic and environmental factors influence the development of their design ideas. They trial and make products and systems based on their design concepts, justifying changes in their thinking as they design, develop and evaluate products and systems, and recognise the right of others to perceive things differently.

Students further develop an understanding of the creative problem solving process. Individually and collaboratively, they apply imaginative and innovative strategies to develop creative design options, including those that are not immediately obvious, and plans for production.

Students continue to develop a variety of drawing and modelling techniques and computer assisted methods to visualise design ideas and concepts, and generate alternative options. After selecting and justifying the best design option, they develop a logically sequenced outline of the major stages of production and a list of materials/ingredients and/or systems components and quantities required. Students use numeracy skills to calculate quantities, sizes and/or expected outputs. They produce the product/system, using tools, equipment, machines and materials/ingredients safely and wear personal protective clothing and equipment if appropriate. Students develop a basic

Definitions of underlined terms are provided in the Glossary (page 22)

understanding of the risk assessment process. With direction, they choose and use increasingly complex production techniques and equipment; for example, a soldering iron, wire cutters, a food processor and electric beater, a hand plane, pedestal drill, overlocker, and report faults with tools and equipment. They reflect on and record the progress of their production activities, and make changes if required.

Concentrating on the aesthetic, functional features and/or performance of the product/system, students consider how it, and the processes used to develop it, could be improved, and compare it to other similar products/systems. They discuss and develop evaluation criteria to analyse and evaluate their completed product/system and consider the social and environmental impacts of their own and others' products. They analyse and evaluate an innovative, recently developed and commercially available product or system and consider its benefits and drawbacks to user/consumer and manufacturer/producer.

Standards

Investigating and designing

At Level 5, students use various strategies and sources of information to investigate and research a range of factors relevant to more sophisticated design briefs to which they have contributed. During the design process they clarify their understanding of design brief requirements and their design ideas by gathering, responding to and providing feedback to others. They develop evaluation criteria from the design brief to inform their judgments during the design process. They use a variety of drawing and modelling techniques to visualise design ideas and concepts. Students demonstrate understanding of design elements and principles and use appropriate technical language.

Students understand and logically sequence major stages of production, and calculate and list materials/ingredients and quantities needed for production. They record and communicate their ideas using a variety of media that includes information and communications technology equipment, techniques and procedures.

Producing

At Level 5, students work safely/hygienically with a range of tools and equipment, including some which are complex, and manage materials/ingredients, components and processes to produce products and systems, taking full account of the appropriateness of their properties, characteristics or expected outputs in meeting requirements of design briefs.

They make modifications during production, providing a sound explanation for changes that demonstrates reflection, research, responsiveness to feedback, and use of evaluation criteria.

Definitions of underlined terms are provided in the Glossary (page 22)

Analysing and evaluating

At Level 5, students select appropriate equipment and techniques to safely test and evaluate the performance of their products/systems. They suggest modifications to improve their products/systems in light of evaluation of their performance, function and appearance. They recommend improvements to the performance, function and appearance of others' product/systems. They describe and analyse the social and environmental impacts of their own and others' designs, products and technological systems.

Level 6

Learning focus

As students work towards the achievement of Level 6 standards in Design, Creativity and Technology, they specialise in a specific area of design and technology. Specialisations could focus on specific materials areas (such as wood, metal, plastics, food, ceramics or textiles) or technological systems (such as computer-controlled systems, electronics or mechanisms or combinations of these), or particular design/technology areas (such as home economics, fashion, robotics, furniture, agriculture and horticulture).

They continue to pose and define design problems by working with a variety of design briefs within various contexts including those that have transferability into the workplace and broader community.

Students develop design briefs within open-ended design guidelines. Referring to the design brief, they consider and investigate aspects of function and aesthetics. Students become discerning and discriminating thinkers, able to address controversial, complex and ethical design and technology issues and dilemmas, such as trade-offs in the selection and use of materials. They further develop the capacity to model, assemble and disassemble products and systems, and communicate their ideas verbally, and with two-dimensional drawing and three-dimensional modelling, including computer-aided design (CAD).

Students, individually and in teams, investigate systematic and creative and critical thinking approaches for generating innovative technological products (for example, educational games, toys or equipment for a local kindergarten, or a solar model car), including time and resource management. They explore and assess the past, and potential future, consequences of technology on society, culture and the environment.

Using annotations (including the use of appropriate technical language) and through discussion, students explain and justify design features, characteristics and properties of selected materials/ingredients, systems components and their interrelationships, performance, energy requirements and production techniques in relation to the design brief. Students at this level are open to the iterative nature of the design process and the importance of continuous reflection when addressing design and technology situations and problems. They develop an increasing range of investigation (including testing), questioning and checking techniques when investigating, designing, planning and evaluating products and systems.

Students safely and efficiently construct products, models or prototypes to specifications and standards. They make decisions about safety precautions and wear personal protective clothing and equipment when necessary. Students

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further develop skills in using a range of techniques, equipment, tools, some of which are complex; for example, the lathe, computer-aided milling machine, and vacuum former. They also develop skills in using suitable materials/ ingredients and/or systems components (or combine simple sub-systems to produce more complex systems) to specified levels of accuracy and precision, and with consideration to risk assessment processes. They are encouraged to make adjustments to tools and equipment and carry out basic maintenance. They learn to use time and resources economically and try to minimise waste.

Students are encouraged to document their design, production and evaluation activities in an electronic or manually-produced portfolio. They participate in and lead discussions on evaluating their own and other people's thinking in relation to creative and innovative products. Through creative processes, reflection and evaluation, they examine and acknowledge a range of perspectives, and consider the value of diverse opinions about design and technology.

Students develop appropriate evaluation criteria and use them to assess design ideas, choice of materials/ingredients and/or systems components, production techniques and/or performance of a system. They learn to analyse and evaluate a new material or process and discuss innovation and emerging technologies in primary industry or the manufacturing industry.

Standards

Investigating and designing

At Level 6, students identify considerations and constraints within a design brief. They undertake research relevant to the design brief. They locate and use relevant information to help their design thinking and identify the needs of a variety of client/user groups. When designing, they generate a range of alternative possibilities, use appropriate technical language, and justify their preferred option, explaining how it provides a solution to the problem, need or opportunity. They make critical decisions on materials/ingredients, systems components and techniques based on their understanding of the properties and characteristics of materials/ingredients and/or of the relationship between inputs, processes and outputs. They effectively use information and communications technology equipment, techniques and procedures to support the development of their design and planning. Students take account of function and performance, energy requirements, aesthetics, costs, and ethical and legal considerations that address the requirements of design briefs. They identify a range of criteria for evaluating their products and/or technological systems. Students plan a realistic and logical sequence of the production stages, incorporating time, cost and resources needed for production.

Definitions of underlined terms are provided in the Glossary (page 22)

Producing

At Level 6, students implement a range of production processes accurately, consistently, safely/hygienically and responsibly, and select and use personal protective clothing and equipment when necessary. They produce products/systems using complex tools, equipment, machines, materials/ingredients and/or systems components with precision. They clearly explain decisions about the suitability of materials/ingredients, systems components, energy requirements and production techniques based on their understanding of the properties and characteristics of materials/ingredients, and the inputs, processes and outputs of systems.

In response to changing circumstances, they adapt their methods of production and provide a sound explanation for deviation from the design proposal. They make products/systems that meet the quality, aesthetic, functionality and performance requirements outlined in the design brief.

Analysing and evaluating

At Level 6, students use evaluation criteria they have previously developed, and critically analyse processes, materials/ingredients, systems components and equipment used, and make appropriate suggestions for changes to these that would lead to an improved outcome. They use a range of suitable safe testing methods in this analysis. They relate their findings to the purpose for which the product and/or system was designed and the appropriate and ethical use of resources.

They synthesise data, analyse trends and draw conclusions about the social, cultural, legal and environmental impacts of their own and others' designs and the products/systems, and evaluate innovative new technology in the manufacturing industry.

Glossary

aesthetics

The appreciation of, and sensitivity towards, works of art, designs, products, objects or artefacts.

component

A part that makes up a whole, particularly in reference to a system. Examples of mechanical components include gears and pulleys and electrical/electronic components include batteries, switches and diodes.

design

A vital step in transforming ideas into creative, practical and commercial realities. Design optimises the value of products and systems and is therefore an important key to economic, social and cultural development.¹ Other definitions of design include to plan or fashion artistically or skilfully, usually in working detail; to form or conceive in the mind; a scheme of attack; to intend for a definite purpose; an adaptation of means to ends; an outline, sketch or plan. Design may also involve production, and evaluating products in a real context.

design brief

A statement that contains an outline of a situation, context, problem, need or opportunity, and specifications that apply to the problem. It is a means by which students can develop and apply knowledge and skills to solve problems. Design briefs can vary in the amount of information they provide and the way in which this information is presented. Both of these are usually determined by the level at which the students are working. Design briefs can be developed entirely by the teacher, or with varying degrees of student input.

design elements and principles

Design elements are line, shape, form, tone, texture, value and colour, sound, smell, taste. Design principles are used to arrange or organise the design elements. They include emphasis, harmony, repetition, rhythm, pattern, dominance, unity, proportion, scale, hierarchy, balance, contrast, variety and focal point.

innovative/innovation

To be innovative is to do something different, to explore new territory or to take a risk and is often seen as an outcome of the broad exploration of ideas, materials, and technical processes that can occur during the design and technology process.² Technology has also been defined as 'human innovation in action'.³ Creativity, defined as 'the

application of knowledge and skills in new ways to achieve a valued goal',⁴ is frequently linked with innovation.

material/s

A material is a natural or synthetic resource that can be processed into a product by the use of tools and equipment. Examples of materials that students learn about and manipulate are wood, fibres/fabrics/textiles, soils, metals, plastics, foods, plants and a variety of composites. The characteristics and properties of materials can influence the nature of products. In choosing materials, students need to think carefully about technical, social, cultural, economic, legal, environmental and ecological considerations. These considerations influence student decision making about the appropriateness of materials.

model/modelling

A standard or example for imitation or comparison; representation in miniature to show the construction of something; a typical or specific form or style; to form or plan according to a model.

product/s

The output of human activity in the form of an artefact. A technological product is an artefact created to meet an identified need or want.

prototype

An original or model after which anything is formed.

risk assessment

Process used to determine the likelihood that people may be exposed to injury, illness, or disease from any situation identified during the hazard identification process. A hazard is the potential to cause injury, illness or disease. Hazard identification is the process used to identify all possible situations where people may be exposed to injury, illness or disease.⁵

specifications

Outline of the constraints (aspects that are fixed) and considerations (aspects that are flexible) in a design brief. Specifications may include such things as the materials available to make a product, expected completion date, and maximum size of the product to be designed or cost restrictions, or the expected level of performance.

system

A combination of elements that work together so that a specific outcome is achieved. Systems are used, applied and developed in all areas of human activity. Especially important are environmental,

engineering, energy, manufacturing and information systems. Examples of technological systems are a television, a sewing machine, a bicycle, a conveyor belt, and an electronic alarm. All technological systems have specific inputs, processes and outputs that are controlled manually or automatically. Management and programming of systems are important in technology.

Each system contains separate elements that are connected in a specific way so the system will work. In some systems; for example a door lock, the elements or components are within the one system. In others; for example a car, the elements are a series of subsystems and might, as in the thermostat control of a heating system, contain feedback components.

Whether a system is appropriate depends on the technical, economic, environmental and social and cultural consequences of its application/s as well as on how well it meets human needs. Students have to consider these factors on both a local and global level and estimate their future impact on societies and environments.

(technological) technique/process

Human activity (for example, cutting, shaping, soldering, blending, and digging) that brings about a change in a material or to a system; usually carried out using tools, equipment and machines when working with materials and components.

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