Design and Technology

Victorian Certificate of Education **Study Design**

Victorian Curriculum and Assessment Authority
2006

COVER ARTWORK WAS SELECTED FROM THE TOP ARTS EXHIBITION. COPYRIGHT REMAINS THE PROPERTY OF THE ARTIST.

Latoya BARTON
The sunset (detail)
from a series of twenty-four
9.0 x 9.0 cm each, oil on board

Tarkan ERTURK
Visage (detail)
201.0 x 170.0 cm
synthetic polymer paint, on cotton duck

Liana RASCHILLA
Teapot from the *Crazy Alice* set
19.0 x 22.0 x 22.0 cm
earthenware, clear glaze. lustres

Nigel BROWN
Untitled physics (detail)
90.0 x 440.0 x 70.0 cm
composition board, steel, loudspeakers,
CD player, amplifier, glass

Kate WOOLLEY
Sarah (detail)
76.0 x 101.5 cm, oil on canvas

Chris ELLIS
Tranquility (detail)
35.0 x 22.5 cm
gelatin silver photograph

Christian HART
Within without (detail)
digital film, 6 minutes

Kristian LUCAS
Me, myself, I and you (detail)
56.0 x 102.0 cm
oil on canvas

Merryn ALLEN
Japanese illusions (detail)
centre back: 74.0 cm, waist (flat): 42.0 cm
polyester cotton

Ping (Irene VINCENT)
Boxes (detail)
colour photograph

James ATKINS
Light cascades (detail)
three works, 32.0 x 32.0 x 5.0 cm each
glass, flourescent light, metal

Tim JOINER
14 seconds (detail)
digital film, 1.30 minutes

Lucy McNAMARA
Precariously (detail)
156.0 x 61.0 x 61.0 cm
painted wood, oil paint, egg shells, glue, stainless steel wire

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Design and Technology

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Contents

IMPORTANT INFORMATION

Accreditation period

Units 1–4: 2007–2011

The accreditation period commences on 1 January 2007.

Other sources of information

The *VCAA Bulletin* is the only official source of changes to regulations and accredited studies. The *VCAA Bulletin*, including supplements, also regularly includes advice on VCE studies. It is the responsibility of each VCE teacher to refer to each issue of the *VCAA Bulletin*. The *VCAA Bulletin* is sent in hard copy to all VCE providers. It is available on the Victorian Curriculum and Assessment Authority's website at www.vcaa.vic.edu.au

To assist teachers in assessing school-assessed coursework in Units 3 and 4, the Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The current year's *VCE and VCAL Administrative Handbook* contains essential information on assessment and other procedures.

VCE providers

Throughout this study design the term 'school' is intended to include both schools and other VCE providers.

Photocopying

VCE schools only may photocopy parts of this study design for use by teachers.

Introduction

RATIONALE

Design plays an important part in our daily lives. It determines the form and function of the products we use and wear. Designing transforms ideas into drawings and plans for the creation and manufacture of useful products. Designer-makers use processes to develop products that fulfil human needs and wants. The combination of design and technical skills is vital if we are to create and use sustainable products, and add value to these products through commerce. In Design and Technology students assume the role of a designer-maker and develop knowledge and skills to produce effective and creative responses to design challenges.

Students acquire and apply knowledge of a range of design factors and fundamentals to develop solutions to meet specific requirements. They draw upon knowledge and methods associated with determining human needs and wants, product purpose and function, visual and aesthetic factors, properties and characteristics of materials, production processes and technologies, economic, environmental and ecological impacts, and innovation through design and technology.

Design and Technology focuses on developing an understanding of the social, economic and environmental consequences of design choices and decision making. Students develop skills to critically analyse the purpose, processes and products associated with design and technological innovation and activity. They develop the ability to understand, communicate and develop creative solutions while using tools, resources and human capabilities to complete a task for a given context.

The study of Design and Technology can provide a pathway to a range of related fields such as industrial, product and interior design, engineering, fashion, furniture, jewellery, textile and ceramic design. An understanding of design and its application can provide opportunities for students interested in undertaking further study in related fields in vocational education and training.

AIMS

This study is designed to enable students to:

- understand design practice and product development and how this occurs in a variety of contexts and environments;
- acquire cognitive and practical skills to solve problems creatively;

- generate and communicate ideas, concepts and design options using a range of techniques to develop a viable solution to problems;
- develop appropriate design, research and analytical skills;
- explore and determine properties and characteristics of natural and synthetic materials that make them suitable for use, including timber/wood, metal, polymer plastics, fibres, yarns, fabrics and textiles, ceramics and glass;
- explore methods of extracting, sourcing, processing, production and assembly using materials;
- apply appropriate and safe methods of working with materials with due consideration of risk management and efficiency in the work environment;
- produce solutions using a project management approach and through the application of appropriate techniques and processes using materials, tools, equipment and machines;
- test the appropriateness of solutions through a range of analytical and evaluative techniques;
- understand the requirement for ethical and legal considerations involved in designing for the needs of the broader community;
- examine the social, economic and environmental implications of using resources and production methods.

STRUCTURE

The study is made up of four units.

Unit 1: Design modification and production

Unit 2: Collaborative design

Unit 3: Design, technological innovation and manufacture

Unit 4: Product development, evaluation and promotion

Each unit deals with specific content and is designed to enable students to achieve a set of outcomes. Each outcome is described in terms of key knowledge and skills.

A glossary defining terms used across Units 1 to 4 of Design and Technology is included on pages 37–42.

A table of design factors, fundamentals and applications is included on page 36.

ENTRY

There are no prerequisites for entry to Units 1, 2 and 3. Students must undertake Unit 3 prior to undertaking Unit 4. Units 1 to 4 are designed to a standard equivalent to the final two years of secondary education. All VCE studies are benchmarked against comparable national and international curriculum.

DURATION

Each unit involves at least 50 hours of scheduled classroom instruction.

CHANGES TO THE STUDY DESIGN

During its period of accreditation minor changes to the study will be notified in the *VCAA Bulletin*. The *VCAA Bulletin* is the only source of changes to regulations and accredited studies and it is the responsibility of each VCE teacher to monitor changes or advice about VCE studies published in the *VCAA Bulletin*.

MONITORING FOR QUALITY

As part of ongoing monitoring and quality assurance, the Victorian Curriculum and Assessment Authority will periodically undertake an audit of Design and Technology to ensure the study is being taught and assessed as accredited. The details of the audit procedures and requirements are published annually in the *VCE and VCAL Administrative Handbook*. Schools will be notified during the teaching year of schools and studies to be audited and the required material for submission.

SAFETY

This study may involve the handling of potentially hazardous substances and/or the use of potentially hazardous equipment. It is the responsibility of the school to ensure that duty of care is exercised in relation to the health and safety of all students undertaking the study. Teachers should refer to the Safety School website www.eduweb.vic.gov.au/hrweb/ohs/accp/plantm.htm and *Student Safety Guidelines Technology* (Department of Education & Training 2003) or subsequent publications. For information about risk assessment and risk management refer to the WorkSafe website www.worksafe.vic.gov.au

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

In designing courses for this study teachers should incorporate information and communications technology where appropriate and applicable to the teaching and learning activities. The Advice for Teachers section provides specific examples of how information and communications technology can be used in this study.

KEY COMPETENCIES AND EMPLOYABILITY SKILLS

This study offers a number of opportunities for students to develop key competencies and employability skills. The Advice for Teachers section provides specific examples of how students can demonstrate key competencies during learning activities and assessment tasks.

LEGISLATIVE COMPLIANCE

When collecting and using information, the provisions of privacy and copyright legislation, such as the Victorian *Information Privacy Act 2000* and *Health Records Act 2001*, and the federal *Privacy Act 1988* and *Copyright Act 1968* must be met.

Assessment and reporting

SATISFACTORY COMPLETION

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's performance on assessment tasks designated for the unit. Designated assessment tasks are provided in the details for each unit. The Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment for Units 3 and 4.

Teachers must develop courses that provide opportunities for students to demonstrate achievement of outcomes. Examples of learning activities are provided in the Advice for Teachers section.

Schools will report a result for each unit to the Victorian Curriculum and Assessment Authority as S (Satisfactory) or N (Not Satisfactory).

Completion of a unit will be reported on the Statement of Results issued by the Victorian Curriculum and Assessment Authority as S (Satisfactory) or N (Not Satisfactory). Schools may report additional information on levels of achievement.

AUTHENTICATION

Work related to the outcomes will be accepted only if the teacher can attest that, to the best of their knowledge, all unacknowledged work is the student's own. Teachers need to refer to the current year's *VCE and VCAL Administrative Handbook* for authentication procedures.

LEVELS OF ACHIEVEMENT

Units 1 and 2

Procedures for the assessment of levels of achievement in Units 1 and 2 are a matter for school decision. Assessment of levels of achievement for these units will not be reported to the Victorian Curriculum and Assessment Authority. Schools may choose to report levels of achievement using grades, descriptive statements or other indicators.

Units 3 and 4

The Victorian Curriculum and Assessment Authority will supervise the assessment of all students undertaking Units 3 and 4.

In Design and Technology the student's level of achievement will be determined by school-assessed coursework, a school-assessed task and an end-of-year examination. The Victorian Curriculum and Assessment Authority will report the student's level of performance on each assessment component as a grade from A+ to E or UG (ungraded). To receive a study score, students must achieve two or more graded assessments and receive S for both Units 3 and 4. The study score is reported on a scale of 0–50. It is a measure of how well the student performed in relation to all others who took the study. Teachers should refer to the current year's *VCE and VCAL Administrative Handbook* for details on graded assessment and calculation of the study score. Percentage contributions to the study score in Design and Technology are as follows:

- Unit 3 school-assessed coursework: 12 per cent
- Unit 4 school-assessed coursework: 8 per cent
- School-assessed task: 50 per cent
- End-of-year examination: 30 per cent

Details of the assessment program are described in the sections on Units 3 and 4 in this study design.

Unit 1: Design modification and production

Design often involves the refinement and improvement of existing products. This unit focuses on the analysis, modification and improvement of a product design. It provides a structured approach towards the design process, and looks at examples of design practice used by a designer, and analysis and evaluation of a design. The design and production work students complete will need to include three points of difference to improve an existing design/product.

The role of the designer is to work through a creative problem-solving process that results in the development of a product that fulfils a human need. This involves the use of analytical, clear and concise communication skills. A systematic approach is fundamental to acquiring the confidence to justify, develop and present innovative solutions to design challenges. An understanding of the processes used to determine which materials to use in the product is essential in product design.

The processes and techniques used by a current designer will be examined to demonstrate design practice as a way of solving a design problem.

This unit focuses on the tools, processes, techniques, knowledge and skills the designer has used to develop a solution to a problem. Students investigate methods and processes used by the designer to examine the need and define the problem by generating an appropriate design brief. They consider methods and information the designer uses to generate and communicate ideas and determine the suitability of appropriate materials and processes. Students learn about the production techniques used to make the product and how it is evaluated against the needs and requirements outlined in the design brief.

Using this process as a model, the student modifies the design of a similar product. Consideration is given to protection of intellectual property implications related to design.

AREA OF STUDY 1

Redesigning an existing product

Many of the products in use today have been redesigned to suit the changing needs and demands of users. Fashions and style create a force for change. Designers and makers take advantage of new developments in materials and manufacturing processes. Safety regulations, user demands and community standards have a strong influence on product design. Therefore designers constantly update, improve and modify products.

This area of study provides students with the opportunity to examine how a designer investigates a need and explores a design problem. Students consider the methods used to develop and devise a design brief that includes an identified need or situation for the modification of a product's design, and a specification. They develop skills in devising evaluation criteria based on requirements in the design brief. Students explore how designers consider and use relevant design factors (see table of design factors, fundamentals and applications on page 36). They look at the development of the designer's ideas through, for example, the use of design sketchbooks, worksheets and image/mood boards, and how ideas are evaluated and further refined and presented as design options in response to the need or problem outlined in the design brief. They consider the methods used to determine the preferred option.

Creative ideas change the way designers devise solutions to a problem. It is important that the original idea is recognised, the designer's intellectual property (the property of one's mind or intellect) protected and the designer's efforts rewarded. Students examine issues related to protecting intellectual property of the designer as she/he works through this process in drawing on others' ideas and generating original ideas and designs.

Designers need an understanding of the properties and characteristics of materials that make them suitable for specific products. Students will gain an understanding of the factors that need to be considered in the selection and safe use of appropriate materials. They test the properties of materials to determine their suitability for a specific purpose.

Students develop working sketches or working drawings of their preferred option. They compile a list of materials and components and develop a sequenced production plan.

Outcome 1

On completion of this unit the student should be able to describe the methods used by a designer to design a product, and apply similar processes to document the redesigning of an existing product.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

Key knowledge

This knowledge includes

- methods used by a designer to define a design need or problem;
- techniques and strategies designers use to solve problems;
- the purpose, components and structure of design briefs including the context or situation, and specifications (constraints and considerations);
- methods used by a designer to determine design factors used in specifications;
- development and use of evaluation criteria by a designer to analyse and evaluate design ideas and options;
- methods used by a designer to develop ideas, including creative and critical design thinking methods and techniques;
- two- and three-dimensional drawings, sketches, dialogue and notation to develop and present design ideas, which may include the use of information and communications technology such as computer-aided design (CAD);
- conventions and standards used in product design (including technical language, symbols, and abbreviations);
- methods of generating, analysing and evaluating ideas to modify an existing design, with consideration of intellectual property;

- working sketches or drawings and scale models used to develop and present design options;
- the critical information, formats and conventions that apply to working sketches/drawings, materials and component lists and sequenced production plans;
- origins, sources, and classification of materials;
- methods used by a designer to investigate, test and analyse properties of materials to suit specified purposes, and identification of associated risks;
- methods of investigating suitable production processes.

Key skills

These skills include the ability to

- investigate and apply the techniques used by a designer to identify and explore a design need or problem;
- analyse a product with reference to the relevant design factors and determine how the design can be improved;
- explain how a designer develops a design brief and write a brief that is based on the modification of the design of a product, with at least three significant points of difference to the original design (for example, quality modification, functional modification, materials or style modification);
- describe how a designer-maker selects and uses materials for specific products, for example a furniture designer-maker may use specific types of timber and metal, while a fashion/textile designer will use particular fabrics;
- research, test, select and justify the use of materials for the redesigned product;
- generate design ideas, using creative and critical design thinking methods and techniques;
- explain how a designer evaluates designs and products, and list evaluation criteria for the product that will be redesigned;
- examine how a designer uses a range of communication and drawing techniques (including, where appropriate, information and communications technology) in the development and presentation of design ideas and apply some of these techniques in redesigning a product;
- use appropriate conventions, symbols and graphic techniques to develop and evaluate two to three design options, and evaluate these options;
- select and justify the design option that best meets the requirements outlined in the design brief for the redesign of a product;
- describe the principle of intellectual property in Australia and appropriately acknowledge the intellectual property of others;
- research, review, select and justify the use of production and assembly processes, and the tools, equipment and machines to carry out these processes and identify associated safety risks and how these can be controlled;
- produce and interpret working sketches or drawings;
- use information from the working sketches or drawings to modify patterns and/or templates;
- compile an accurate list of materials and components (including dimensions and costs) to make the product;
- develop a sequenced production plan and timeline.

AREA OF STUDY 2

Producing and evaluating a redesigned product

Referring to their materials/components lists and production plans, students apply a range of techniques and processes and develop practical skills to safely use materials, tools, equipment and machines to make the product designed in Unit 1, Outcome 1. They identify the hazards and assess the risks related to the use of tools, equipment and machines to process materials that will be used in production. Students record and reflect on their progress. They refer to their record of progress in the final evaluation of their production work.

This area of study also introduces students to methods used to critically analyse and evaluate redesigned products. Students use the evaluation criteria developed in area of study 1 to compare the features of their redesigned (completed) product with the original design, and make judgments as to the success of their design improvements.

Outcome 2

On completion of this unit the student should be able to use and evaluate materials, tools, equipment and processes to make the product redesigned in Outcome 1, and compare the finished product with the original design.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

Key knowledge

This knowledge includes

- safe and efficient application of production processes;
- processes applicable to particular materials;
- selection of tools, equipment and machines for particular purposes;
- hazard identification, risk assessment and risk control;
- safe and correct use and care of tools, equipment and machines;
- techniques used to manage and record progress through production processes;
- methods of collecting data when using comparative methods of testing;
- methods used to analyse data produced in these tests;
- methods of evaluating the efficient and appropriate use of materials, tools and techniques in production processes;
- methods of evaluating the design and development of a product against the information presented in the design brief and evaluation criteria;
- methods of reporting testing, analysis and evaluation activities.

Key skills

These skills include the ability to

- assess and control risks involved in production of the redesigned product;
- use appropriate production processes to safely make a redesigned product such as marking out, cutting, constructing/assembling and finishing;
- review and make adjustments to planned sequences, steps and timeline as required;
- record production progress using a journal and digital technology, where appropriate;

- gather comparative data (for example, observations, commentaries, questionnaires and expert opinions) to use in the evaluation of the product;
- use established evaluation criteria and a journal to review the suitability of materials, components and effectiveness of planning and efficiency of processes for the redesigned product;
- explain in an evaluation report how the product and production process may be improved;
- present a clear and concise final evaluation report using predetermined evaluation criteria, and include a comparison of the original design with the redesigned product.

ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Teachers should select a variety of assessment tasks for their assessment program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

For this unit students are required to demonstrate achievement of two outcomes. As a set these outcomes encompass both areas of study.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student's performance on a selection of assessment tasks. Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand. Assessment tasks for this unit are:

- design folios (including the use of information and communications technology as appropriate) that contain design briefs, research, design ideas and options, documentation of decisions, materials lists and production plans;
- production work and records of production and modifications;
- multimedia presentations supported by speaker's notes;
- short written reports (materials testing activities, industry visits, technical reports, product evaluation reports, process evaluation reports);
- oral reports supported by notes and/or visual materials.

Unit 2: Collaborative design

In this unit each student works as a member of a team to design and develop a product range or contribute to the design and production of a group product. This mirrors professional design practise where designers often work within a multidisciplinary team to develop solutions to design problems. Team members contribute their expertise, share research findings and develop viable solutions that conform to the needs and requirements outlined in a design brief.

Restrictions and parameters within design may be determined by end-user's needs, producer's requirements, social conventions and environmental concerns. This unit focuses on the impact of these factors on the design solution.

In this unit, the student works both individually and as a member of a small design team to address a problem, need or opportunity that requires a product within a product range or based on a theme, or component of a group product. This provides the student with the opportunity to work with others while taking responsibility for particular aspects of the design and production processes.

AREA OF STUDY 1

Designing as a team

This area of study focuses on a clearly defined need, problem, or technological challenge, outlined in a design scenario. This will set the context for the collaborative design project which involves students producing a product range, product based on a theme, or group project. The scenario may be identified by an individual, a group, a company or within society.

Each student works in a design team to generate a group design brief from a scenario that includes relevant design parameters. Individually and in teams, students develop evaluation criteria that will be used to determine the success of the product and/or product range and processes used. Students justify the criteria and devise a test/s to show how the product will be checked to determine if each criterion has been met.

Techniques such as brainstorming, concept mapping, mood boards and design sketches are used to develop design ideas. These design ideas are evaluated and may be used to develop design options. The product produced individually or by individual contributions to the team project is evaluated both individually and as a team in Outcome 2. Students will need to record their individual contribution to the team.

Students examine how design research and materials testing assists in the choice of appropriate materials and techniques to produce the product. They develop skills in using a range of communication techniques to propose, develop, trial, manage and record aspects of the design and production processes and communicate design ideas to others. Informal sketching (such as thumbnail sketches), working sketches and drawings, charts, tables and notation are used to initiate then record and convey information about the product being developed. Each specialisation area of design and technology uses specific techniques and conventions to communicate particular elements of the design process. Students continue to progress through the design process by trialling construction and production methods.

This outcome must be completed using a collaborative learning approach. Students can work individually and as a team on various key skills associated with this approach. Teachers will decide on the mix of individual and group work.

Outcome 1

On completion of this unit the student should be able to individually and as a member of a team, identify a need and collaboratively develop design options and production planning in response to a design brief for a product range based on a common theme or a group product with component parts.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

Key knowledge

This knowledge includes

- factors leading to the initial design or modification of a product, for example consumer demand, and technological innovation;
- the collaborative process used by designers to investigate particular products in satisfying human needs/requirements;
- the role, purpose, components and structure of a design brief, including specifications (considerations and constraints);
- role and development of evaluation criteria to analyse design;
- social, economic, ethical and environmental issues related to design and the selection of materials and processes;
- factors that determine choice of suitable materials;
- methods for conveying information about the suitability of materials and production processes, for example Materials Safety Data Sheets (MSDS), hazard identification, risk assessment and risk control information;
- methods used to determine efficient and effective production processes that will be used to make a product, for example marking out, cutting, shaping, joining and finishing procedures;
- methods of researching including collecting, interpreting and analysing data, for example test reports, diagrams, charts, and digital images including data sourced from the Internet;
- methods of generating ideas, including creative and critical design thinking methods and techniques;
- methods of presenting research and ideas that focus on the needs of the user to be fulfilled by the product, for example use of an image or mood board;
- factors including functional and aesthetic that influence the appeal of a product to the user (refer to page 36);
- the application of human factors (including ergonomics) to product design;

- factors to consider, including the use of design brief specifications and evaluation criteria, when selecting a preferred design option;
- methods of producing sketches or drawings of the preferred design option with notation to justify its selection;
- use of scale models and mock-ups to prove and develop design concepts;
- methods of producing working sketches or drawings from the previously developed design option (including those that show methods of assembly and exploded views), including drawings generated by computer;
- methods of compiling cutting/materials lists and making paper patterns/templates;
- the procedure for compiling a production plan that includes a procedure list detailing production methods, and/or a flow diagram that incorporates the use of appropriate materials, tools, equipment and safety requirements, and a timeline.

Key skills

These skills include the ability to

- develop a design brief from a design scenario including the need for, or purpose of, the product/ product range;
- develop evaluation criteria that includes consideration of social, economic, ethical and environmental issues related to the design and selection of materials and processes;
- develop criteria for evaluating the product or product range; and for evaluating their contribution;
- collect and present research relevant to the design brief using techniques such as a mood board, brainstorming or mind map;
- make judgments about the selection of materials based on social, economic, ethical and environmental considerations;
- devise, conduct and report on tests used to determine the suitability of materials that will be used to manufacture the product or the product range;
- generate design ideas using creative and critical design thinking methods and techniques;
- develop design options that address specifications in the design brief;
- justify the selection of a preferred design option;
- develop working sketches or drawings that shows sizes, methods of assembly and intended materials and incorporates appropriate technical language;
- devise a cutting/materials list and develop or modify paper patterns/templates, referring to the working sketches or working drawing;
- conduct basic safety hazard identification, risk assessment and determine risk controls for processes selected to make the product;
- devise a production plan that outlines in sequence the techniques to be used to make the product, and a timeline for completion.

AREA OF STUDY 2

Producing and evaluating a collaboratively designed product

In this area of study students apply techniques and processes to manufacture and assemble their team project/s designed in Outcome 1. Students need to use appropriate methods of recording production processes and modifications to production plans. They examine how design teams and individual designer-makers evaluate their use of materials, techniques and processes in transforming design

options into a product range or team-designed product. Evaluation should include comment on social, economic, ethical and environmental issues related to the product and use of materials. Products within the product range or components of the group project will be tested and evaluated to determine how well each meets the specifications within the design brief used to develop the product/product range.

Students individually and as a team evaluate the product they worked on and the production process they followed.

Outcome 2

On completion of this unit the student should be able to justify, manage and use appropriate production processes to make a product and evaluate, individually and as a member of a team, the processes and materials used, and the suitability of a product or components of a group project against the design brief.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

Key knowledge

This knowledge includes

- production techniques including hazard identification, risk assessment and risk control to safely manufacture the product;
- methods of recording progress through production including noting any modifications to the production plan;
- techniques used to evaluate the effectiveness of the production processes using a comparison of the production plan and the record of production;
- methods used to present information relating to evaluation of production processes;
- techniques used to evaluate the suitability of the product using pre-determined evaluation criteria based on the design brief developed in Outcome 1;
- methods used to present information relating to the evaluation of the product or range of products;
- techniques used to evaluate the effectiveness of the team as a group of designer-makers;
- methods of analysing feedback on the productivity of individuals within the group.

Key skills

These skills include the ability to

- work as a team member or an individual to safely make one of the products within the product range or a component part of the team-designed project based on the developmental work completed in Outcome 1;
- manage and control risks to safely use tools, equipment, machines and materials;
- use appropriate methods to record progress throughout production, such as a production journal, which includes decisions made and modifications to the preferred design option and/or production plan;
- evaluate the effectiveness of the production plan by comparing it to the journal entries;
- use predetermined evaluation criteria to produce an evaluation report on the product in terms of its function, with reference to social, economic, ethical and environmental factors related to the product and its materials;
- analyse methods used individually and collaboratively to manage the design and production processes and outcomes while producing the product/product range.

ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Teachers should select a variety of assessment tasks for their assessment program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

For this unit students are required to demonstrate achievement of two outcomes. As a set these outcomes encompass both areas of study.

Demonstration of achievement of Outcomes 1 and 2 must be based on the student's performance on a selection of assessment tasks. Where teachers allow students to choose between tasks they must ensure that the tasks they set are of comparable scope and demand. Assessment tasks for this unit are:

- design folios (including the use of information and communications technology as appropriate) that contain design briefs, research, design ideas and options, documentation of decisions, materials lists and production plans;
- production work and records of production and modifications;
- multimedia presentations supported by speaker's notes;
- short written reports (materials testing activities, industry visits, technical reports, product evaluation reports, process evaluation reports);
- oral reports supported by notes and/or visual materials.

Units 3 and 4: Design and Technology material categories

In Units 3 and 4 students design and make a three-dimensional functional product (or components of a product range) that incorporates at least one material taken from one of the following categories. Students may base their products on one of the following design specialisation areas, but are not necessarily restricted to these areas.

The product should not include significant mechanical/electrical/electrical systems components. It should not be a food, agricultural, horticultural (plant or animal) or information technology product. The purpose/function of the product should not be solely to visually communicate, or be purely decorative or aesthetic (for example, a wall hanging) or an artwork (for example, a sculpture).

Material categories	**Examples of design specialisation areas**
Wood/timber Hardwoods Softwoods Manufactured/composite boards	Furnishing (indoor and outdoor)
Metal Ferrous metals Non-ferrous metals	Gold and silver smithing (for example, jewellery, flat ware and hollow ware)
Polymers (plastics) Thermoplastic polymers Thermosetting polymers	
Textiles/yarns/fibres/fabrics Natural Manufactured	Clothing/fashion/accessories Soft furnishing
Ceramics Stoneware Porcelain Bone china Terracotta Raku	Bath/laundry/kitchenware
Glass Soda lime Lead glass (crystal) Borosilicate	
	Additional areas, for example: • musical instruments • children's toys • homewares • outdoor/gardenware • lighting • sporting equipment.

Unit 3: Design, technological innovation and manufacture

The design and development of a product that meets the needs and expectations of a client or an end-user is influenced by a range of complex factors. These include client or community requirements; innovation, social and economic trends, availability of resources and technological developments in industry. Design, product development and manufacture occur in a range of settings. An industrial setting provides a marked contrast to that of a 'one-off situation' in a small 'cottage' industry or a school setting.

In this unit, students investigate a client or end-user's needs, prepare a design brief, devise evaluation criteria, carry out research and propose a series of design options. They justify the choice of a preferred design option and develop a work plan, and commence production of the product, which will be completed and evaluated in Unit 4.

This unit also examines how a range of factors influence the design and development of products within industrial/commercial settings.

AREA OF STUDY 1

The designer, client and end-user in product development

This area of study focuses on the role of the designer and the relationship between a designer, client and end-user/s of a product resulting from design and production activities. It includes methods used to establish a client's and/or end-user's needs and requirements for the development of a solution to a design problem. Students examine the needs and requirements associated with the intended function and appeal of the product to be designed and how these can be expressed in a design brief.

The development of a design brief, including specifications (considerations and constraints) based on this information is vital for the development of a viable solution. Students refer to the design factors, fundamentals and applications on page 36; and write a brief based on a scenario presented by the teacher. Students then annotate the design brief to show the components of the brief (context and specifications) and how information in the brief will lead the designer through the developmental stage of the design of a product including how it would be evaluated. This design brief should not be the same brief developed for Outcome 3.

Outcome 1

On completion of this unit the student should be able to explain and demonstrate the role of a designer by writing a design brief, developing evaluation criteria, and identifying and explaining areas for research and methods that would be used to develop design ideas.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

Key knowledge

This knowledge includes

- factors that influence the designer;
- the roles and relationship between the designer, client and end-user/s;
- methods of exploring and establishing problems, needs and requirements, relating to the function and appeal of a product, specified by the client or identified for a user group through the use of appropriate market research;
- how a designer collects and develops relevant information about the design situation or context, and the specific needs and requirements of the client and/or end-user/s, including purpose and function of the product, visual and aesthetic requirements, material requirements (including their characteristics and properties), cost and time restrictions, environmental concerns, and safety requirements;
- the role, purpose, structure and components of a design brief including a situation or context, and specifications (considerations and constraints);
- purpose and structure of relevant evaluation criteria, including (for each criterion) the evaluation criterion written as a question, its justification and relevance to specifications, and how the completed product could be tested or checked against the criterion;
- the relationship between the design brief, evaluation criteria and design development activities.

Key skills

These skills include the ability to

- explain the role of a designer and the relationship between a designer, client and end-user of a product;
- develop a design brief (from a given scenario that contains a situation or context), including specifications (considerations and constraints) to meet the needs and requirements of the client or end-user/s;
- annotate the design brief to show its constituent components, and outline methods and activities that the designer could undertake in the process of researching, exploring and developing creative design ideas and design options that meet the requirements of the design brief;
- develop evaluation criteria based on the identified specifications (considerations and constraints) in the design brief including (for each criterion) an explanation of the relevance of the criterion to the design brief, and a brief description of how the completed product would be tested or checked against the criterion.

AREA OF STUDY 2

Product development in industry

This area of study focuses on the factors that influence the design and development of products within industrial/commercial settings. Students explore specific manufacturing industries and the role of design in value adding. They also examine how industry reacts to market demands and technological developments. Students look at the role of market research in determining consumer needs in relation to social, economic, environmental and ecological issues.

Students investigate the use of computer-aided design and manufacturing tools (CAD/CAM), and emerging technologies used in industry. The stages of the product development process and the people involved in the design and development of a product are included. Other aspects in this area of study include manufacturing systems (one-off, batch, and continuous), health and safety, Quality Management, Australian Standards, production time and costs management.

Students develop understanding of the issues relating to designing, research and development in an industrial manufacturing context including technological innovation, selection and procurement of materials, manufacturing energy requirements, quality and speed of production, transportation, reliability, employment, maintenance, waste management and sustainable use and disposal of materials and products.

Outcome 2

On completion of this unit the student should be able to explain the factors that influence the design, development and manufacture of products within industrial/commercial settings.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

Key knowledge

This knowledge includes

- the function of manufacturing industries in society;
- an understanding of market research methods in determining market demand;
- reasons for new product development and manufacturing methods such as agile manufacturing and how technological innovation and technology influences product design;
- the role and importance of research and development activities in industry;
- the use of new and emerging technologies, materials and processes (such as Design for Manufacturing (DfM) and rapid prototyping) in industry;
- methods and purposes of Quality Management;
- the role, purpose and benefits of Australian Standards to manufacturers and users of products;
- the product development process and the people involved in the design and development of a product manufactured in an industrial/commercial setting;
- aspects influencing design, production, distribution and use of industrially produced products including manufacturing costs, ethical, environmental management and ecological factors such as the use of Life Cycle Analysis (LCA), and social factors, health and safety, availability and use of physical resources, labour and energy;
- style obsolescence and technical or functional planned obsolescence, and the benefits and problems for the producer and consumer, and associated environmental issues;
- methods and suitability of manufacturing systems, including one-off, batch and continuous (volume) production.

Key skills

These skills include the ability to

- define the role and importance of market research in product development in an industrial/commercial setting;
- explain the role of research and development in industry;
- explain reasons for new product development and how design can add value in the product cycle in an industrial/commercial setting;
- explain the use of new and emerging technologies including new materials and processes in an industrial setting;
- describe how Quality Management is used and Australian Standards applied and their importance to manufacturing industries;
- graphically represent and describe the product development process and people involved in the design and development of products manufactured in an industrial/commercial setting;
- describe how manufacturing industries are affected by design and production costs and considerations including social, environmental and ecological (including LCA), economic, technological and time factors;
- compare one-off, batch and continuous manufacturing systems and the types of products that result from these production methods.

AREA OF STUDY 3

Designing for others

This area of study focuses on the procedures used by the designer to meet the needs of a client or the requirements of an end-user. It includes the application of investigation and research methods to identify specific needs of the client or end-user; appropriate techniques for recording and communicating data, information, ideas, proposals and design options; obtaining client or end-user feedback; and selecting and justifying the preferred design option. Design and production planning will include material testing, selection and procurement, approaches to design and production planning, selection of appropriate production processes, health and safety including hazard identification, risk assessment and risk control, and quality considerations, and analysing and justifying production modifications.

At least one material from a material category (see page 22) should be included in the designed product.

Outcome 3

On completion of this unit the student should be able to present a folio that documents the procedure and decision-making processes used while working as a designer to meet the needs of a client or end-user, and commence production of the designed product.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 3.

Key knowledge

This knowledge includes

- methods of accessing, analysing and presenting relevant data and information used to determine the needs of a client or end-user;
- design factors, fundamentals and applications relevant to identified problems, needs or requirements;

- methods used by designers to develop, use and present a design brief;
- development of an appropriate method of weighting criteria for the evaluation of design options to meet specific needs;
- methods used in the evaluation of the efficiency and effectiveness of production processes;
- development of evaluation criteria for the final product;
- methods of developing design ideas including use of creative and critical design thinking techniques and ways of communicating these and gaining feedback from the client or an end-user;
- methods of exploring, researching and testing the characteristics and properties of materials, use of fittings and fastenings, and processes relevant to the development of the design;
- methods of creatively developing and presenting viable design options;
- factors influencing productivity (such as availability of tools, equipment, machinery and other facilities);
- techniques used to ensure an appropriate quality of construction and finish of a product;
- relevant health and safety issues, including hazard identification, risk assessment and risk control;
- techniques used to record progress during the production process;
- methods of, and reasons for, modification of design plans;
- effective project management strategies to implement the design plan.

Key skills

These skills include the ability to

- adopt the role of the designer and either work with a client and/or use research data to determine the end-user/s;
- profile the client and/or end-user/s;
- determine the needs and requirements of the client and/or end-user/s, using appropriate research and communication methods;
- develop a design brief to match the needs of a client or end-user/s;
- establish evaluation criteria, justify their relevance to the information in the design brief, and establish the weighting of criteria in terms of their importance;
- describe methods that will be used to test or check the completed product against the product specifications and evaluation criteria;
- establish the relative importance of the specifications (considerations and constraints), identifying those of primary and secondary importance;
- conduct and present research relevant to the design brief;
- use a range of methods to creatively and critically develop and present design ideas (for example, concept mapping, brainstorming, sketching, image/mood boards, and modelling, including digital techniques where appropriate);
- research, test and experiment with materials and trial processes to ascertain their suitability for the development of the design;
- use visual and aesthetic factors, fundamentals and applications in the development of the design;
- generate and present design options to the client or an end-user;
- record the response of the client or an end-user to the proposed design options and use weighted criteria to rank the design options and justify the selected design option;
- develop working sketches or drawings based on the preferred design option using appropriate conventions and prepare templates and patterns as required;

- prepare a work plan to document a sequence of proposed production steps to safely make the product (including hazard identification, risk assessment and risk control procedures), a timeline, and a materials list (including fittings and fastenings as required) with reference to the working sketches or drawings;
- safely and efficiently begin to implement production activities using at least one material from a material category to specified standards of quality, to satisfy client requirements or end-user needs;
- record progress of design and production activities and explain and justify modifications and improvements;
- use appropriate information and communications technology in the design and development of the folio that documents the design process.

ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit. The Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

To demonstrate satisfactory completion of Unit 3, Outcome 3, students must present a folio of design development work based on meeting the needs of a client or end-user and have commenced production of the designed product.

Assessment of levels of achievement

The student's level of achievement in Unit 3 will be determined by school-assessed coursework, a school-assessed task and an end-of-year examination.

Contribution to final assessment

School-assessed coursework for Unit 3 will contribute 12 per cent to the study score.

The level of achievement for Unit 3 is also assessed by a school-assessed task, which will contribute 50 per cent to the study score, and an end-of-year examination, which will contribute 30 per cent to the study score.

School-assessed coursework

Teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student's level of achievement.

The score must be based on the teacher's rating of performance of each student on the tasks set out in the following table and in accordance with an assessment handbook published by the Victorian Curriculum and Assessment Authority. The assessment handbook also includes advice on the assessment tasks and performance descriptors for assessment.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Where optional assessment tasks are used, teachers must ensure that they are comparable in scope and demand. Teachers should select a variety of assessment tasks for their program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

Outcomes	Marks allocated*	Assessment tasks
Outcome 1 Explain and demonstrate the role of a designer by writing a design brief, developing evaluation criteria, and identifying and explaining areas for research and methods that would be used to develop design ideas.	30	A structured, annotated design brief, evaluation criteria and diagrammatic explanation of how the designer could develop design ideas from the design brief, with reference to key words and phrases.
Outcome 2 Explain the factors that influence the design, development and manufacture of products within industrial/commercial settings.	30	Any one or a combination of: • a test (short and/or extended response) • a short written report • a report in multimedia format • an oral presentation accompanied by speaker notes.
Total marks	**60**	

*School-assessed coursework for Unit 3 contributes 12 per cent to the study score.

School-assessed task

Assessment for Design and Technology includes a school-assessed task. The student's level of performance in achieving Outcome 3 in Unit 3 and Outcomes 2 and 3 in Unit 4 will be assessed through a school-assessed task. This assessment will be subject to review by a panel appointed by the Victorian Curriculum and Assessment Authority. Details of the school-assessed task for Units 3 and 4 are provided on page 34 of this study design.

Unit 4: Product development, evaluation and promotion

Evaluations are made at various points of product design, development and production. When judging the suitability and viability of design ideas and options designers refer to the design brief and evaluation criteria in collaboration with a client. Designers may also base design decisions on intuition and experience.

With increased focus on environmental, economical and social viability, the impact of products throughout their life cycle can be analysed and evaluated.

Comparisons with similar products help to judge the success of a product in relation to a range of design factors and fundamentals. In this unit, students use comparative analysis and evaluation methods to make judgments about product design and development.

Students continue to develop and manufacture the product designed in Unit 3, Outcome 3, and record the production processes and modifications to the work plan and product. They evaluate the effectiveness and efficiency of techniques they used and the quality of their product with reference to evaluation criteria. Students make judgments about possible improvements. They promote their work by highlighting the product's features to the client and/or end-user.

AREA OF STUDY 1

Product analysis and comparison

In this area of study students examine factors that are used to determine the success of a commercially available product in the context of comparison with similar product types. Products are analysed and compared for aesthetic appeal, function, ease of use, repair and maintenance requirements, cost, innovative features, and consideration of social and environmental impacts. The student judges appropriateness of materials and construction techniques through the use of suitable tests. The appeal of a product in terms of function, aesthetics, finish, cost, popularity and reputation are also considered.

Outcome 1

On completion of this unit the student should be able to analyse similar product types through a comparison of innovative features, function, aesthetic and visual appeal, and any economic, social and environmental benefits and costs.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 1.

Key knowledge

This knowledge includes

- factors in establishing the purpose and appeal of a product including function, aesthetics, finish, cost, popularity and reputation;
- methods of comparative testing used to determine the function and performance of a product in relation to other solutions designed to meet similar needs;
- environmental and social issues associated with products;
- factors that need to be considered when establishing the quality of a product.

Key skills

These skills include the ability to

- develop criteria for analysing the function, purpose and appeal of a product;
- evaluate the function, performance and appeal of a product in relation to other products designed to meet similar needs;
- analyse the impact on society and the environment of a product and one other similar product in terms of materials and energy used to make and/or maintain the product, safety and disposal at the end of its life, and its recyclability or reuse;
- evaluate the quality of a product compared with at least two other similar products.

AREA OF STUDY 2

Product manufacture

This area of study focuses on the skills, production techniques and processes used to make a product to suit the needs of a client or end-user/s. This includes the continued implementation and management of the production plan covering the application of skills and processes, safe use of tools, equipment, machines and materials, and demonstration of skill in completing the product to specified standards of quality.

At least one material from a material category (see page 22) should be included in the product developed in Unit 3, Outcome 3, and made in Unit 4, Outcome 2.

Outcome 2

On completion of this unit the student should be able to competently and safely apply a range of production skills and processes to implement the production plan, make the product designed in Unit 3, Outcome 3, and manage time and resources efficiently.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 2.

Key knowledge

This knowledge includes

- risk assessment processes including identification of hazards, and control of risks associated with selecting, using and maintaining tools, machinery, equipment, materials, chemicals and other substances involved in making products;
- processes and techniques associated with the manufacture of a specific product;
- goal setting, time and resource management techniques;

- quality management techniques used in the production process;
- techniques of monitoring efficiency and effectiveness of planning and production activities;
- methods used to record progress through the manufacturing process.

Key skills

These skills include the ability to

- identify hazards, assess and control risks throughout the production processes;
- safely use materials, fittings and fastenings (as appropriate), tools, equipment and machinery to make the product developed in Unit 3, Outcome 3, using at least one material from a material category;
- competently use appropriate processes (such as marking out, cutting, constructing and applying finishing techniques), including some processes with a degree of difficulty, to make a safe, functional product;
- use basic quality management techniques to ensure a quality outcome is achieved;
- use appropriate communication techniques to report and gain feedback on the progress of production activities to the client, or end-user/s, including decisions made and reasons for any modifications and/or changes to the product or processes;
- record clear and concise details of progress (that may include electronic and digital methods) related to design, planning and production effectiveness and efficiency.

AREA OF STUDY 3

Product evaluation and promotion

This area of study focuses on how evaluation criteria and client or end-user feedback are used to determine how well the product meets the needs and requirements outlined in the design brief developed in Unit 3, Outcome 3. Tests and checks are conducted and client or end-user feedback gathered to ascertain whether the product matches the requirements outlined in the design brief. The effectiveness of planning and efficiency of the production processes are also evaluated. Students consider how their findings can be used to inform the design process for future projects.

Students highlight features of the design and product in a product promotion. The product promotion will draw on knowledge of the five Ps of marketing: people, product, place, promotion, and price. Methods of caring for the product to maintain its appearance and function are also covered.

Outcome 3

On completion of this unit the student should be able to evaluate the outcomes of the design and production activities, and promote the product's design features to the client and/or end-user.

To achieve this outcome the student will draw on knowledge and related skills outlined in area of study 3.

Key knowledge

This knowledge includes

- methods of testing and/or checking the outcomes of the design and production activities using evaluation criteria;
- techniques used to gather client or end-user feedback;
- methods of identifying and reporting on specific design features that may be used in product promotion;

- design evaluation and analysis that may be used to improve future products and design and production processes;
- ethical considerations in product promotion;
- methods of explaining the use and care requirements of the product to the end-user (for example a care label);
- basic understanding of methods of product promotion, including the five Ps of marketing.

Key skills

These skills include the ability to

- devise tests and gather data on the outcomes of design and production activities and analyse this information;
- gather feedback from the client or end-user with reference to the evaluation criteria developed in Unit 3, Outcome 3;
- evaluate the extent to which the product successfully meets the needs and requirements outlined in the design brief and in relation to the client and/or end-user feedback;
- report on the effectiveness of planning and efficiency of the design and production activities;
- analyse and evaluate the design, product, work plan and processes and discuss improvements that were and could be made, and that could inform future design and production activities;
- produce a presentation for the client or end-user, with reference to the five Ps of marketing, promoting the features of the product and explaining its care requirements.

ASSESSMENT

The award of satisfactory completion for a unit is based on a decision that the student has demonstrated achievement of the set of outcomes specified for the unit. This decision will be based on the teacher's assessment of the student's overall performance on assessment tasks designated for the unit. The Victorian Curriculum and Assessment Authority publishes an assessment handbook that includes advice on the assessment tasks and performance descriptors for assessment.

The key knowledge and skills listed for each outcome should be used as a guide to course design and the development of learning activities. The key knowledge and skills do not constitute a checklist and such an approach is not necessary or desirable for determining the achievement of outcomes. The elements of key knowledge and skills should not be assessed separately.

Assessment of levels of achievement

The student's level of achievement for Unit 4 will be determined by school-assessed coursework, a school-assessed task and an end-of-year examination.

Contribution to final assessment

School-assessed coursework for Unit 4 will contribute 8 per cent to the study score.

The level of achievement for Unit 4 is also assessed by a school-assessed task, which will contribute 50 per cent to the study score, and an end-of-year examination, which will contribute 30 per cent to the study score.

School-assessed coursework

Teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student's level of achievement.

The score must be based on the teacher's rating of performance of each student on the tasks set out in the following table and in accordance with an assessment handbook published by the Victorian Curriculum and Assessment Authority. The assessment handbook also includes advice on the assessment tasks and performance descriptors for assessment.

Assessment tasks must be a part of the regular teaching and learning program and must not unduly add to the workload associated with that program. They must be completed mainly in class and within a limited timeframe. Where optional assessment tasks are used, teachers must ensure that they are comparable in scope and demand. Teachers should select a variety of assessment tasks for their program to reflect the key knowledge and skills being assessed and to provide for different learning styles.

Outcome	Mark allocated*	Assessment tasks
Outcome 1 Analyse similar product types through a comparison of innovative features, function, aesthetic and visual appeal, and any economic, social and environmental benefits and costs.	40	Any one or a combination of: • a test (short and/or extended response) • a short written report • structured questions • a multimedia report • an oral presentation accompanied by speaker notes • an annotated visual report.
Total mark	**40**	

*School coursework for Unit 4 contributes 8 per cent to the study score.

School-assessed task

Assessment of Design and Technology includes a school-assessed task worth 50 per cent of the study score. For this assessment teachers will provide to the Victorian Curriculum and Assessment Authority a score representing an assessment of the student's level of performance in achieving Outcome 3 in Unit 3 and Outcomes 2 and 3 in Unit 4 according to criteria published annually by the Victorian Curriculum and Assessment Authority. This assessment will be subject to review by a panel appointed by the Victorian Curriculum and Assessment Authority.

Outcomes		Components of the school-assessed task
Unit 3 **Outcome 3** Present a folio that documents the procedure and decision-making processes used while working as a designer to meet the needs of a client or end-user, and commence production of the designed product.	Subject to external review	A design folio comprising: A client and/or end-user profile, a design brief, evaluation criteria, research, design ideas and options, presentation drawing of final option, production plan, timeline, materials list and record of progress and modifications. The design folio must include documentation of decisions.

Unit 4 **Outcome 2** Competently and safely apply a range of production skills and processes to implement the production plan, make the product designed in Unit 3, Outcome 3, and manage time and resources efficiently.	Subject to external review	Production work accompanied by a record of production progress, documentation of decisions and modifications with justification of these changes (text and images should be included). **AND** A functional product that conforms to standards of quality, performance, ease of use, and safety.
Outcome 3 Evaluate the outcomes of the design and production activities, and promote the product's design features to the client and/or end-user.	Subject to external review	An evaluation report that includes evaluation of the product and production processes. **AND** A visual display (e.g. poster) to promote features and care requirements of the product. **OR** A storyboard with captions to promote features and care requirements of the product. **OR** A multimedia presentation to promote features and care requirements of the product.

End-of-year examination

Description

All outcomes and the key knowledge and skills that underpin the outcomes in Units 3 and 4 are examinable. Students will not be required to demonstrate practical skills using tools, equipment and machines that are related to the production of their projects; however, their knowledge and understanding of these is examinable.

The examination will be set by a panel appointed by the Victorian Curriculum and Assessment Authority.

Format

Students will answer a series of questions in a question and answer booklet. Questions may require students to respond to stimulus material such as design briefs and visual images. There will be a variety of question types such as those requiring short, extended and diagrammatic responses.

Conditions

The examination will be completed under the following conditions:

- Duration: one and a half hours.
- Date: end-of-year, on a date to be published annually by the Victorian Curriculum and Assessment Authority.
- Victorian Curriculum and Assessment Authority examination rules will apply. Details of these rules are published annually in the *VCE and VCAL Administrative Handbook*.
- The examination will be marked by assessors appointed by the Victorian Curriculum and Assessment Authority.

Contribution to final assessment

The examination will contribute 30 per cent to the study score.

DESIGN FACTORS, FUNDAMENTALS AND APPLICATIONS

The table below identifies design factors, fundamentals and applications which are referred to throughout the study design.

Design factors	Fundamentals	Applications
Human needs and wants	physical, safety, social, personal, sensory, emotional, perceptual, image, driving values and motivations	anthropometrics, protection, comfort, satisfaction, individuality, fashion/trends/style, cultural sensitivity, smell, noise, touch
Purpose, function, and context	reason, need, security, safety, operation, reliability, ergonomics, context and environment of product use	understanding the problem in context, formulation of a design brief, useability, wearability, control, storage, hazard identification, maintenance, utility, domestic, user requirements and performance analysis
Visual, tactile and aesthetic	point, line, shape, form, texture, tone, colour, transparency, translucency, opacity	balance, emphasis, repetition, movement/ rhythm, pattern, proportion, space/ composition/spatial organisation, surface qualities
Materials – characteristics and properties	ceramics, glass, composites, compounds, fabric, fibres and yarns, textiles, metals, polymer plastics and timber/wood and other material resources required in the production process	natural and synthetic identification/classification sourcing, extraction, refining, stock sizes/ standards and conventions properties and characteristics such as strength, durability, thermal resistance, hardness, density, rigidity, compatibility of materials occupational health and safety
Tools, processes, technologies and manufacturing methods	tools, machinery, consumables, planning, techniques, production management systems, Quality Management, quality assurance, project management	skills, competence, effectiveness, quality, accuracy, efficiency one-off, batch production, automation, flexible production, rapid prototyping, computer aided design (CAD), computer numerical control (CNC) occupational health and safety marking/setting out, cutting/shaping/forming, joining/assembling/constructing, decorating/ embellishing/finishing
Economics – time and financial	value, pricing, packaging, position, target group (people), distribution (place), promotion and time management	cost, worth, demand, market, production time and efficiency
Environmental and ecological	ecosystem, input, process, output, environmental management	sustainability, Life Cycle Analysis (LCA), Design for Environment (DfE), energy use, reduce, recycle, reuse, renewable resources, degradation and rectification
Innovation	opportunity, research and development, productivity, using new ideas/knowledge and emerging technologies, standards, product design, manufacture, promotion, distribution, user feedback	invention, improvement, modification, progress, experimentation, inquiry, community expectation, legislation, regulation, problem solving and the design process
Legal compliance	intellectual property (IP) standards occupational health and safety	patents, legislation WorkCover Authority guidelines, regulations and legislation

GLOSSARY

For the purposes of this study design the following definitions will apply.

Term	Definition
Aesthetics	The perception, appreciation of and sensitivity towards works of art, designs, products, objects or artefacts; usually associated with the notion of beauty.
Agile manufacturing (AM)	Agile manufacturing is defined as the capability of surviving and prospering in a competitive environment where there is continuous and unpredictable change, by reacting quickly and effectively to changing markets, driven by customer-designed products and services. Critical to successfully accomplishing AM are a few enabling technologies such as the standard for the exchange of products (STEP), concurrent engineering, virtual manufacturing, component-based hierarchical shop floor control system, information and communication infrastructure, etc.
Anthropometrics	A branch of ergonomics that deals with body measurements, particularly those of size, strength and physical capacity.
Batch production	Limited volume production (a set number of items is produced in a given time).
Brainstorming	A method of generating a large number of divergent ideas individually or collectively. The ideas may be random and judgment is deferred. Evaluation of the ideas usually comes at a later stage.
Client	A person who requests a product and provides information to a designer about the requirements for the product.
Computer-aided design (CAD)	The use of computers to aid the design process.
Computer-aided manufacturing (CAM)	The use of computers to aid manufacturing.
Computer numerically controlled (CNC)	A numerical control system within which a dedicated, stored computer program is used to perform some or all of the basic numerical control functions.
Consideration (in the context of a design brief specification)	Issues or aspects to be taken into account when planning a product but are not necessary for the functional or safety aspects of the product. For example, the colour scheme may be drawn from a range of possibilities but is not specifically stipulated by the client. Flexible aspects within the specifications of a design brief.
Constraint (in the context of a design brief specification)	Limitations that may effect the development of the product. For example, size of client (garment), size of space (furniture), and ergonomic requirements. Factors over which the designer has little control. Fixed aspects within the specifications of a design brief.

Construction methods	Specific methods of joining constituent parts and sub assemblies.
Copyright	The exclusive right given by law to be the only producer or designer etc. to make copies of the original work.
Creative and critical design thinking	Thinking skills used to solve problems in a creative and indirect manner – often associated with 'lateral thinking'. Creative thinking involves the creation or generation of ideas, processes, experiences or objects. Critical thinking is used to evaluate these. Examples of creative thinking include evolution (incremental improvement; new ideas that stem from other ideas), synthesis (two or more ideas are combined into a third), revolution (completely new approach), reapplication (look at something that exists in a new way), and changing direction (shifting attention from an angle or a problem to another).
Design process/designing	Human activity that involves transforming functional requirements through analysis, synthesis and evaluation and documenting a course of action for a solution concept that fulfils these requirements.
Design brief	The formal starting point for the design of a product. It is a clarification of what a new product is expected to be and to do. In design practice it is the instruction to the designer from a client to take on a project. A design brief contains an outline of a context, problem, need or opportunity, and specifications that applies 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 the information is presented.
Design factors	Aspects that must be considered when designing products. The relative importance of the design factors will vary according to the product being designed. Design factors include human, purpose and function of the product to be designed, visual and aesthetic, materials, processes, technologies and manufacturing methods, economics, environmental and ecological, innovation and legal. (Refer to page 36.)
Design for Environment (DfE)	Designing in a way that takes account of the environmental impact of the product throughout its life.
Design for Manufacturing (DfM)	DfM is a methodology that encourages designers, engineers and development teams to investigate alternative processes and materials and to develop designs that may be more economical to produce. With more information about viable processes and materials, users can quantify manufacturing costs for competing design alternatives and decide which design is best.

Design elements and principles	Design elements are line, shape, form, tone, texture, value, colour, sound, smell and 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.
Designer-maker	A person involved in designing products, who uses a range of skills, processes, methods, procedures and routines when using tools, machines and materials to make the designed products.
Design registration (Design Act 2003)	Protects the visual appearance of manufactured products. Design refers to the features of shape, configuration, pattern or ornamentation, which give a product a unique appearance. (See www.ipaustralia.gov.au/smartstart/glossary.htm)
End-user	A person who will use or wear a product or garment when it is completed.
Ergonomics	The application of scientific information about the interaction and relationship of human beings to design of objects, systems and work and recreational environments.
Evaluation criteria	Criteria used to evaluate designs, products and/or processes used to manufacture a product. Evaluation criteria are written as questions. Criteria to evaluate a design or product are drawn from a design brief.
Hardness	The resistance of a material to penetration or scratching.
Innovation	The conversion of knowledge and ideas to create new products, services, practices and processes. The innovation process may incorporate research and development, commercialisation and technology diffusion.
Intellectual Property (IP)	Intellectual property is property generated through intellectual or creative activity. Types of intellectual property protection include patents, trade marks, design registration, confidential information/trade secrets, copyright, circuit layout rights and plant breeder's rights. (See www.ipaustralia.gov.au/smartstart/glossary.htm)
Isometric drawing	A three-dimensional representation of an object drawn from a corner, with the both sides receding at 30° to the horizontal plane.
Life Cycle Analysis (LCA)	The measurement and assessment of the effect a potential or existing product has on the environment from the initial concept to disposal.
Manufacturing process	A general term for making products. It includes the use of a range of production techniques.

Mass production	Generally related to the large-scale mechanised production of items. It is economical because of the high numbers of products produced. There is little need to adjust machinery and processes which produce a time benefit.
Market research	Gathering of information to ascertain the preferences, purchasing power or other aspects, of consumers or potential users of a product, prior to developing and/or putting a product on the market.
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 the materials that students learn about and use in Design and Technology are timber, fibres/ fabrics/yarns/textiles, metals, plastics, ceramics, glass and composites. The characteristics and properties of materials can influence the nature of the product. In choosing materials, designer-makers need to think carefully about technical, social, cultural, economic, legal, environmental and ecological considerations. These considerations influence decision-making about the appropriateness of materials.
Materials Safety Data Sheets (MSDS)	A MSDS is a document that describes materials/goods and provides vital information to assist in their safe use, storage and handling.
Model/modelling	A standard or example for imitation or comparison; representation in miniature to show the construction of something; a typical or specific form of style; to form a plan according to a model.
Mood board	A form of visual stimulus material, such as a large board covered with images (often cut from magazines or digital photographs) to represent a mood, atmosphere or feeling. A mood board can be used to represent the 'feel' of an intended product or to explore alternatives (for example bright, sharp and fresh, or natural and organic). A useful tool to research ideas for products that have not yet been produced.
Oblique drawing	A three-dimensional representation of an object drawn front on and sides usually receding at 45 degrees to the horizontal.
One-off production	A single (often craft produced) article or a scale model.
Orthogonal drawing	A series of separate but aligned two-dimensional views of a three-dimensional object showing it from the top, front and side.
Patent	An agreement from a government office to give someone the right to make or sell a new invention for a certain number of years.

Performance testing and reporting	Observations and recordings of how a material or product acts or performs (usually in relation to standards, requirements or criteria).
Planned (or built in) obsolescence	Planned obsolescence is the conscious decision on the part of an agency/business to produce a consumer product that will not be functional or desirable in a defined time frame.
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. In the context of Design and Technology a wearable garment is a product.
Product cycle	The stages of a product's development, introduction, growth, maturity and decline, usually related to its profitability.
Product development process	The development of a new, updated or modified product from the initial design concept to its production.
Prototype	The first physical expression/iteration of a design concept used to evaluate its (physical) attributes.
Quality Management (QM)	The implementation and management of systems, procedures and staff training that aim to result in a high-quality product which is designed to satisfy end-user needs, is cost effective, and waste and energy efficient. The International Standards Organisation (ISO) defines Quality Management in ISO 9001.
Renewable resources	Resources that are naturally replenished, through natural ecological cycles or sound management practices.
Research and development	A broad and evolving system of investigating existing, new and evolving processes, materials and technologies that may contribute to faster, environmentally friendly and cheaper technologies or products.
Risk Assessment	Process used to determine the likelihood that people may be exposed to a hazard/s, which may result in injury, illness or disease. Hazard identification is the process used to identify all possible situations where people may be exposed to the risk of injury, illness or disease. Risk assessment is the process used to determine the likelihood that people may be exposed to injury, illness or disease arising from any situation identified during the hazard identification process. Risk control is the process used to identify all practicable measures for eliminating or reducing the likelihood of injury, illness or disease to implement the measures and monitor them. (The Victorian WorkSafe website: www.worksafe.vic.gov.au)
Scale model	A three-dimensional representation of a design concept usually made in a proportional size to the intended final outcome.

Specification/s	A set of precise limits for the range of performance requirements that need to be considered in the design of a product. Specifications include considerations (factors that are flexible) and constraints (factors that are fixed). Specifications may include such things as materials available, expected completion date and the maximum size of the product to be designed.
Sustainable development	Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
Technological innovation	Technological innovation occurs through the introduction of new or improved products and processes. A Technological Product and Process (TPP) innovation has been implemented if it has been introduced on the market (product innovation) or used within a production process (process innovation). TPP innovations involve a series of scientific, technological, organisational, financial and commercial activities.
Technique/process	Human activity (for example, cutting, shaping, soldering, joining etc.) that brings about a change in a material usually carried out using tools, equipment and machines.
Technology push	Where the impetus for a new design is derived from a technological development.
User trial	The observation and analysis of reactions to and comments made by people who have used a particular product.
User-centred design	A design methodology in which designers observe and record how the user interacts with a product to increase their understanding and inform the design process, rather than relying on their tacit knowledge.
Value adding	An economic term which describes how a raw material is processed into a product which is of more value than the material in its raw state, usually through the use of tools, machines and equipment.
Volume production	Continuous flow, large-scale production.
Weighted evaluation criteria	The scaling of evaluation criteria based on their importance to the client to produce an end-user focused decision when evaluating a product.

Advice for teachers

DEVELOPING A COURSE

A course outlines the nature and sequence of teaching and learning necessary for students to demonstrate achievement of the set of outcomes for a unit. The areas of study broadly describe the learning context and the knowledge required for the demonstration of each outcome. Outcomes are introduced by summary statements and are followed by the key knowledge and skills which relate to the outcomes.

Teachers must develop courses that include appropriate learning activities to enable students to develop the knowledge and skills identified in the outcome statements in each unit.

For Units 1 and 2, teachers must select assessment tasks from the list provided. Tasks should provide a variety and the mix of tasks should reflect the fact that different types of tasks suit different knowledge and skills and different learning styles. Tasks do not have to be lengthy to make a decision about student demonstration of achievement of an outcome.

Additional (out of class) time could be used by students to work on activities related to Outcomes 1 and 2 in Unit 3 and Outcome 1 in Unit 4. Students will require appropriate school-based facilities and equipment when completing the folio and production (Unit 3, Outcome 3 and Unit 4, Outcome 2).

In all units it is recommended that activities be designed so outcomes in each unit are addressed. Where feasible, a context for the unit can be selected and activities planned around that context.

In Unit 1, the teacher will need to guide students in the choice of a suitable design brief. Students will make modifications to the design of a product taking into consideration intellectual property guidelines. Types of intellectual property relevant to design and technology are:

- patents for new or improved products or processes;
- trade marks for letters, words, phrases, sounds, smells, shapes, logos, pictures, aspects of packaging or a combination of these, to distinguish the goods and services of one trader from another.

Design registration protects the features of shape, configuration, pattern or ornamentation which, when applied to a product, gives the product a unique appearance. A registered design can be a valuable commercial asset – registration of a design gives the owner protection for the visual appearance of the product but not how the product works (Australian Government IP website: www.ipaustralia.gov.au).

Students should refer to the design factors, fundamentals and applications on page 36 and the definitions in the glossary to encourage creative and critical thinking during the design phase. The use of visualising thinking tools such as Venn Diagrams and Plus, Minus, Interesting (PMIs) and other graphic organisers are useful tools for the analysis of existing products.

In Unit 2 it is expected that the students will work as both an individual and member of a team to respond to a design brief and further refine it to create a product range or a collaborative product. Projects for Unit 2 can be a product range or a collaborative product where team members work together to design individual components of a product and produce the product using an assembly line technique. Team building skills are an integral component of Unit 2. The teacher will need to provide students with strategies that allow and encourage each individual to contribute. Shared responsibility of tasks is expected and is to be documented and evaluated by students. Products that could be developed as part of a product range include leisure wear, garden furniture, uniform (range), bathroom furnishing, indoor/office furniture or a jewellery body adornment range. Larger scale products that have 'component parts' include modular furniture such as cabinets, and sets and costumes for a school dramatic production.

In Units 3 and 4, assessment is more structured. For some outcomes, or aspects of an outcome, the assessment tasks are prescribed. The contribution that each outcome makes to the total score for school-assessed coursework is also stipulated.

Unit 3, Outcome 3, and Unit 4, Outcomes 2 and 3, are based on the development of a product from a design brief. A design brief should define a situation or outline a need or a problem. It should include considerations and constraints such as physical size, weight, cost, colour, form, constructional material and properties such as strength, toughness and rigidity. Specifications may be outlined in the design brief or be developed from information provided in the design brief. The design brief should not describe a final solution or design project. It is through the use of the design brief that judgments can be made of the completed product, including the successful use of materials and application of processes. The judgments about the finished product are made in relation to the design brief as part of Unit 4, Outcome 3.

In Unit 3 the student should develop a design brief in conjunction with their client or define and profile an end-user. The product design will be developed from the design situation, problem or need, and its considerations and constraints, possibly with reference to similar designs. A single product or product range over Units 3 and 4 of the study is to be developed from the Unit 3 design brief.

USE OF INFORMATION AND COMMUNICATIONS TECHNOLOGY

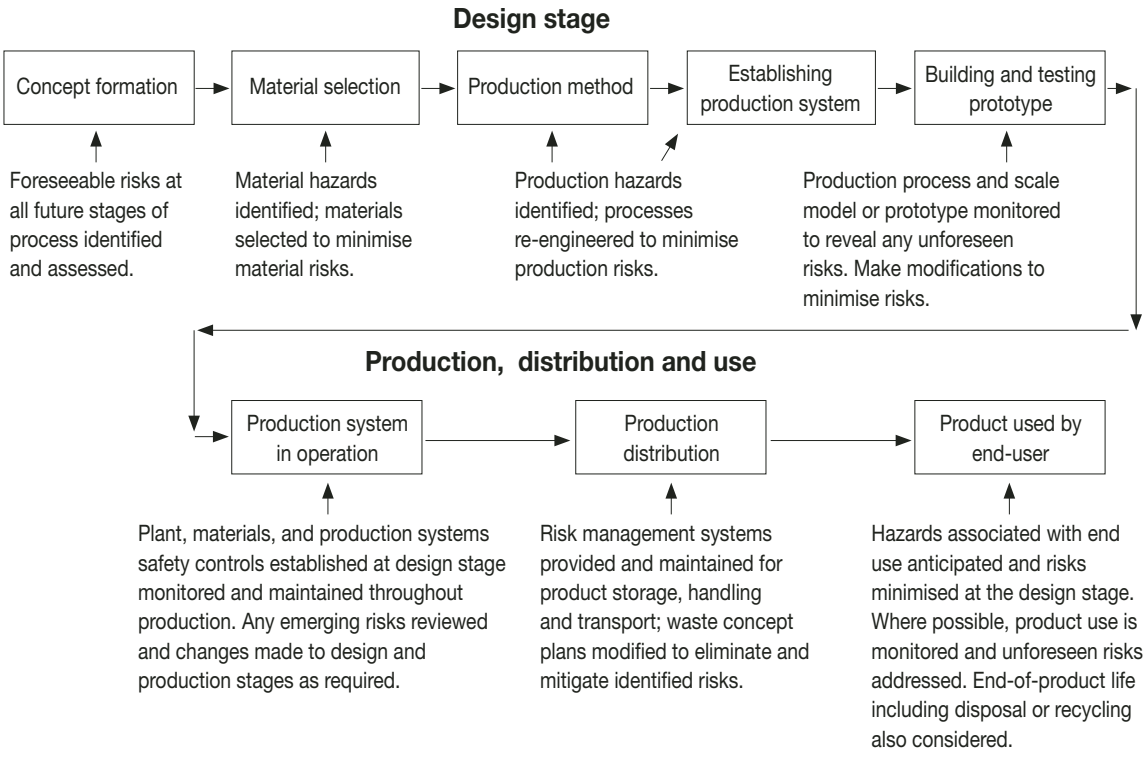
In designing courses and developing learning activities for Design and Technology teachers should make use of applications of information and communications technology and learning technologies, such as computer-based learning, multimedia and the World Wide Web, where appropriate and applicable to teaching and learning activities.

It is expected that students will use the computer and peripherals in accessing information about design, materials, techniques and related technology information using multimedia applications and the Internet. Students could use a visualising thinking/concept mapping software package such as Inspiration to represent and link concepts related to research and design. Computer-aided design (CAD) software can be used in conjunction with other methods of drawing, designing and communicating ideas in the developmental stages. Software programs such as TurboCAD and AutoCAD LT, TriCAD, Prodesktop, SolidWorks and CADKEY can be used for two-dimensional technical drawings and three-dimensional modelling, with associated software for computer-aided manufacturing (CAM). Software programs

such as Corel Draw, Photoshop and Illustrator can be used for drawing, visual display and marketing applications. Flowcharter or a similar software program could be used to show the sequence of production processes to make a product. A spreadsheet application such as Excel could be used to set out a list of material requirements, while use of a digital camera and word processing could document the progress of production activities. Documentation of all facets of work developed during the design process can be presented in a digital multimedia portfolio.

RISK MANAGEMENT

Students need to include risk assessment throughout design and product development. In addition, they must consider safety of the end-user of the product. The following diagram shows risk assessment at the design stage and risk management in production.



Source: Paul O'Halloran, *Employee Health*, Department of Education & Training, Victoria. (2006)

KEY COMPETENCIES AND EMPLOYABILITY SKILLS

Students undertaking the following types of assessment, in addition to demonstrating their understanding and mastery of the content of the study, typically demonstrate the following key competencies and employability skills.

Assessment task	Key competencies and employability skills
Design folio	Planning and organisation, self management, written and visual communication
Essay	Planning and organisation, (written) communication
Written report	Planning and organisation, (written) communication
Structured questions	Problem-solving, planning and organisation
Annotated visual report	Initiative and enterprise, using technology
Oral report	Planning and organisation, (oral) communication
Test	Problem solving, planning and organisation, (written) communication, self management
Design brief	Information gathering and research skills, communication (written and oral)
Records of planning and production	Planning and organising activities, solving problems
Designing and developing a solution in response to a design brief including production work	Collecting, analysing information, working with others and in teams, communicating ideas and information, using mathematical ideas and techniques, using technology, initiative and enterprise, self management
Production work	Working with others and in teams, using technology, planning and organisation, communication (oral), self management, initiative and enterprise
Evaluation report	Analytical skills, decision-making skills, (written) communication
Oral report supported by visual presentation (promotion of production piece)	Collecting, analysing and organising information using technology, communicating ideas (visual) and information, initiative, enterprise, self management

In completing work for this study, students may also demonstrate other key competencies and employability skills, such as using mathematical ideas and techniques.

LEARNING ACTIVITIES

Examples of learning activities for each unit are provided in the following sections. Examples highlighted by a shaded box are explained in detail in accompanying boxes. The examples that make use of information and communications technology are identified by this icon ICT.

Unit 1: Design modification and production

AREA OF STUDY 1: Redesigning an existing product

Outcome 1

Describe the methods used by a designer to design a product, and apply similar processes to document the redesigning of an existing product.

Examples of learning activities

organise a designer to describe how a product is designed and developed


select an item such as a small storage unit (jewellery box, CD/DVD holder, fashion accessory, photo storage, item of clothing, etc) to redesign; use a range of media and techniques to communicate design ideas, proposals and options such as freehand drawing, computer aided design (CAD) and other applications for visualising design thinking


using the Internet, access the *Design Act 2003* and explain how it applies to the development and protection of products

collect newspaper articles on intellectual property issues and annotate these to show the implications for designers


research and acknowledge sources of inspiration such as previous designs; document types of intellectual property relevant to design and technology such as patents for new or improved products or processes; trade marks for letters, words, phrases, sounds, smells, shapes; logos; pictures, aspects of packaging or a combination of these; and pattern or ornamentation

analyse a product to determine its original purpose and write a design brief that outlines the modifications required to the design

develop a set of evaluation criteria that clearly relate to the specifications (considerations and constraints) in the design brief

source and cut out pictures based on a theme (e.g. storage, uniform) related to the product being redesigned and compile a mood board

compare products made from a combination of materials and discuss why those particular materials have been used

compare two similar products (for example a bag, skirt, dress, CD holders, lighting devices, screen) made out of different materials; describe how the choice of materials has influenced the design and function of the product


use books, videos, magazines and the Internet to search for information on the specific characteristics of materials, tools and processes relevant to production work; information is documented on word-processed ‘facts sheets’ or as a PowerPoint presentation


test materials for specific properties; word-process the materials testing report, making recommendations on the suitability of materials for specific applications; the report may contain spreadsheet tables and graphs

discuss the different types of drawings designers use and practise freehand and formal techniques and rendering

develop design opinions and justify the preferred option with reference to evaluation criteria developed from the design brief

.

construct models and/or mock-ups to trial ideas and options

trial construction techniques and comment on their suitability and application

develop a production plan listing processes, risk assessment related to the use of selected tools, equipment, machines and materials; and a timeline


devise a flowchart to show a sequenced list of procedures to implement the design; include notes on how risks will be managed


develop a list of materials (quantities, sizes and costs) using a spreadsheet application

Detailed example

RESEARCH INTO MATERIALS, TOOLS AND PROCESSES

In response to the design brief and design options students research the following:

- range of materials that could be used to make the redesigned product
- Materials Safety Data Sheets (MSDS)
- environmental issues relating to the materials that could be used to construct the product and the care of the product after construction
- tests to determine suitability of materials
- methods of joining of materials and tools, equipment and machines required for construction.

Document the findings of the research using one of the methods listed below:

- A spreadsheet which lists the materials, type of tests and results.
- A detailed word-processed report or 'facts sheets' with findings and justifications for the selection of materials, tools and processes.
- A PowerPoint presentation with speaker notes.

AREA OF STUDY 2: Producing and evaluating a modified product

Outcome 2

Use and evaluate materials, tools, equipment and processes to make the product redesigned in Outcome 1, and compare the finished product with the original design.

Examples of learning activities


use the Student Safety Guidelines – Technology CD-ROM (see Resources) as a reference to identify hazards associated with production works and note how these can be eliminated or reduced

demonstrate to the class the safe, responsible use, care and maintenance of a hand tool, equipment or portable power tool


word process a journal that documents the activities undertaken to implement the design; insert digital photographs into the journal

using the production journal as a reference, comment on the management of risks in the use of tools, equipment and machines used to undertake the production


use comparative data (observations, commentaries, questionnaires and expert opinions) to prepare a clear and concise evaluation report which makes reference to the production journal


word process the evaluation report; include judgments on the appropriateness of the redesigned product, suitability of tools, equipment, machines, materials and processes used; the production journal is referenced when recommending improvements that could be made


present to the class a data show using PowerPoint which reviews the suitability of the design solution, materials, components and processes

Detailed example

EVALUATING THE PRODUCT AND PROCESS

In order to evaluate the product it must be tested against the previously developed evaluation criteria.

Students:

- Evaluate the redesigned product using the evaluation criteria and write a response under the title: 'Evaluation of product with reference to the evaluation criteria'. Students discuss how each criterion was tested or checked and what conclusions they draw from the results.
- Identify any deficiency and explain how it was revealed and what the test results were.
- Discuss the suitability of the product to meet the intended need.
- Use surveys and questionnaires to analyse the effectiveness and suitability of the product.
- Judge the effectiveness and efficiency of production processes including use of tools and equipment.

Unit 2: Collaborative design

AREA OF STUDY 1: Designing as a team

Outcome 1

Individually and as a member of a team, identify a need and collaboratively develop design options and production planning in response to a design brief for a product range based on a common theme or a group product with component parts.

Examples of learning activities

select three products and analyse the needs/requirements they meet and possible modifications to improve the products


make an annotated visual display to show how new technologies developed in research and development (R & D) led to spin offs for new products, e.g. microwave ovens, fax machines and mobile phones were made possible by radar developments; alternatively identify a product that has undergone significant change and research developments that have led to change, e.g. smart fabrics used in sports wear

teams produce and deliver an oral presentation outlining the need for the design of lamps/lighting devices, specifications and evaluation criteria of their solution to the design problem, design ideas and options; each team member presents their contribution to the team response


prepare a data show presentation explaining how Safety Legislation and/or Australian Standards has led to improvements in the design of products; for example, flameproof children's nightwear, childproof caps on medicines, children's toys

use examples of existing design briefs to identify and discuss specifications (considerations and constraints) and priorities

individually and in teams write a design brief using an existing brief as a guide


word process evaluation criteria which reflect the specifications (considerations and constraints) of the design brief being undertaken in class


use suitable means of communicating design ideas, including sketches, drawings (computer-aided), mood boards and annotations, and justify choices

Individually and in teams:

- identify the properties of materials required for a collaborative product or range of products to be produced and determine their availability and costs
- gather information on relative costs of materials and produce a costing table for a product; consider minimisation of waste
- investigate the availability of materials, standard sizes and types and comment on implications on the product design
- consider a range of products and discuss the compatibility of materials (including adhesives, fastenings, notions, finishing materials)
- investigate and research a material used to make a commercial product; consider how the characteristics of the material, its processing and effects of its use influence the design process
- report on a visit to an industry where materials used and/or products made are similar to those being used and made by students; investigate social, economic, ethical and environmental issues related to the use and processing of the materials

- collect similar types of products made of different materials, e.g. bags, cushions and utensils, containers; discuss which materials are more appealing, fashionable and acceptable
- develop a production plan for making the product, including a list of materials and processes, tools, equipment and the reasons for selection; include risk assessment
- discuss and list reasons for selecting particular materials

Detailed example

DESIGNING A RANGE OF LAMPS/LIGHTING DEVICES AS A TEAM

Each design team is provided with the following design brief:

A local lighting company wants to create a range of lamps/lighting devices that reflect the Australian landscape and colour scheme. The target audience is the overseas tourist market. **Your design team** is encouraged to incorporate a range of materials (timber, plastics, textiles, paper, and metal). Design proposals should be original, creative and stylish. A variety of sizes and shapes are encouraged; however, they must have a common theme, shape form or colour that ties them together as a range.

The team will need to research the following. **Tasks must be shared** amongst the group:

- Identify the needs of the overseas tourist market. Investigate current trends in lamp designs.
- Visit tourism shops in person and on the web to determine current offerings and make judgments about the ability of these products to meet this niche market.
- Research the Australian landscape. Identify colours, shapes, forms and textures. Use sources such as photographs, web images and paintings as inspiration.
- **The team** refines the design brief further to reflect their research findings.
- **Each team member** contributes at least one specification (consideration or constraint) on the design to meet the needs of the client.
- **Each team member** contributes at least one evaluation criterion as a question, justifies why this criterion is included and describes a test or check to determine if the criterion has been met.
- **Each team member** produces sketches/ drawings and two design options to contribute towards the final selection of design options.
- **Each team member** produces a scaled model or mock-up of the preferred options in the range.
- **The team** prepares an oral presentation, supported by their design development work. Each team member explains their contribution.

AREA OF STUDY 2: Producing and evaluating a collaboratively designed product

Outcome 2

Justify, manage and use appropriate production processes to make a product and evaluate, individually and as a member of a team, the processes and materials used, and the suitability of a product or components of a group project against the design brief.

Examples of learning activities

individually write a clear and concise description explaining his/her progression through the production; give reasons for any changes or modifications and the effect of the changes

test the completed product, evaluating it against the predetermined criteria and make an oral presentation to the class (accompanied by notes) reporting on the success of the product in satisfying the specifications (considerations and constraints)

demonstrate the correct, safe and accurate use of tools, equipment and machines to carry out processes to make the product adhere to risk management methods

ICT individually and collaboratively present a multimedia presentation that provides comments on the suitability of the product for the intended purpose, suitability of materials and construction methods, aesthetic appeal, and the relationship of individual products to the product range

individually present an evaluation report based on the evaluation criteria developed prior to the commencement of the production work

write a report which analyses the team's performance; make reference to the role and contribution of each member of the team

Detailed example

TESTING AND REPORTING ON THE COMPLETED PRODUCT

- Each team member writes a thorough report on how useful the production plan was.
- Team members refer to their journal of weekly progress and mention any modifications that took place along the way.
- Team members make a judgment about how effective the production plan was, e.g. 'I think that the production plan was very realistic because' or 'The production plan was not very realistic…' or 'due to illness I was not able to meet all of the predictions of my plan. To overcome this I …'
- Team members and individuals evaluate their work habits, organisational skills, efficient use of time, use of equipment (accuracy, efficiency, equipment care and safety), and any problems that occurred (caused by them or external factors). Students use journal records of progress and compare this with their production plan.
- Team members comment on how cohesive the product range was or how the components of the collaborative project related or complemented each other. Detailed reasons for their findings are discussed.

Notes to assist with this activity:

- Effectiveness refers to reviewing tasks and considering if they were well planned. (For example, were the right materials for the product selected following appropriate research and testing?)
- Efficiency refers to the means used to accomplish each stage of production or to reach goals. To evaluate efficiency involves looking in detail at each stage. (For example, were tools, equipment and machines used accurately and carefully for each stage? Why was time lost during particular stages? Were materials handled safely and without waste?)
- The team report could be either written or presented in multimedia format with each team member contributing to the components of the report.

Unit 3: Design, technological innovation and manufacture

AREA OF STUDY 1: The designer, client and end-user in product development

Outcome 1

Explain and demonstrate the role of a designer by writing a design brief, developing evaluation criteria, and identifying and explaining areas for research and methods that would be used to develop design ideas.

Examples of learning activities

examine the content of a range of design briefs and highlight key words

use a storyboard to document how a commonly used item is likely to have been developed through the design process, and the role of the designer

in the role of a designer, identify a need or work with a client to document in a design brief a design problem, including specifications (considerations and constraints)

collect and document appropriate information about the client and/or end-users and existing solutions to similar design problems using a range of sources, including books, magazines and the Internet to assist in providing ideas to address the design brief

visit a designer's workplace or invite a designer to the school to talk about the work of a designer and how they respond to the needs of their clients; discuss the role of designers during and following the visit

select a product such as a vacuum cleaner and discuss the input the designer would have had into the product

establish relevant evaluation criteria that could be used to evaluate the design and completed product including an explanation of the relevance of each criterion and expected methods of how each criterion would be tested or checked

produce a concept map to show information a designer would need to collect about a design situation or context

Detailed example

DESIGN OF A PRODUCT: VACUUM CLEANER

Select a product such as a vacuum cleaner. Discuss the development of the product. Explain the reasons behind the development of this product and its acceptance in the marketplace.

Consider and discuss:

- the needs of the consumers
- the cost of the product
- the efficiency of the product
- the size of the product
- the shape of the product
- the durability of the vacuum.

Discuss the input of the designer into this product, including:

- sketches, drawings, mock ups, prototypes of design options
- analysing the design constraints
- designing for specific needs
- researching the availability of materials
- exploring manufacturing processes required and available to produce the product.

List other questions and issues raised throughout the general discussion as points in order of perceived priority. Write a design brief for the designers of the vacuum cleaner, referring to previous discussion.

Dyson has a downloadable education pack containing information and exercises on how Dyson engineer their machines. A school kit is also available.

An educational video on Design and Technology for your school can be obtained from Dyson. Visit the website at www.dyson.com.au

Alternatively, other suitable resources for this activity are listed in the Resources.

AREA OF STUDY 2: Product development in industry

Outcome 2

Explain the factors that influence the design, development and manufacture of products within industrial/commercial settings.

Examples of learning activities

investigate and write a report on a manufacturing industry and its design and production activities

visit a business/industry venue that uses modern production techniques and interview an employee to determine research and development activities undertaken, influences of research and development on design, production and distribution, including new technology, production cycles and management

show and discuss a video/DVD that demonstrates the design and production of a product/s (see Resources); select a product and draw a flow diagram of the design and production stages

discuss reasons why manufacturing industries may or may not use Quality Management Systems

using software such as Inspiration produce a diagram to show types and stages of a product cycle in an industry which includes reference to social, environmental and ecological factors (Life Cycle Analysis), economic, technological and time factors

compare single item production with mass production using a table or graphic organiser

make a visual display which explains how design adds value to products

Detailed example

VIEW A VIDEO AND DISCUSS THE DESIGN PROCESS

View the video 'Designing Dream Machines'.

Using a prepared worksheet students:

- list and analyse factors that the designers consider in the development of the products
- identify the methods of research the designers use
- identify the materials and techniques that the designers use in the development of the prototypes.

As a class, select a hypothetical product and make a flow diagram of the design and production process through to the prototype stage, identifying:

- factors that would influence the designer
- the types of research that is appropriate (for example, ergonomics, user appeal, market demand, and existing products)
- design techniques to be used
- types of materials to be used in the production of a prototype
- tools, equipment and machinery to be used for the prototype
- materials to be used for the production model
- manufacturing techniques to be used for the production
- basic costs to be considered in setting up for mass production
- specific aspects of the production that would require Quality Management or compliance with Australian Standards
- methods for marketing and distribution of the product.

AREA OF STUDY 3: Designing for others

Outcome 3

Present a folio that documents the procedure and decision-making process used while working as a designer to meet the needs of a client or end-user, and commence production of the designed product.

Examples of learning activities

interview a client and write a client profile; alternatively, survey a potential user group and write a product user group profile

develop a design brief that addresses the needs of a client or end-user/s; establish evaluation criteria and justify their relevance to the information in the design brief

using specifications from the design brief, develop evaluation criteria and weigh these in relation to their importance (determined from client or end-user group)


use a range of communication methods such as concept mapping, sketching, mood boards, brainstorming, computer-aided design (CAD), modelling and prototypes to convey the design ideas and options to the client or end-user

record client feedback on design ideas and options using a table and score each option against the weighting allocated to criterion

write a report to justify the selection of the preferred design option; use client feedback and specifications to present valid reasons for the choice


use an electronic Gantt chart to list production tasks and time required to complete each task


use a spreadsheet or project management software to prepare a detailed production work plan that includes a sequence of operations, timeline, tools, processes, risk assessment and modifications as possible column headings


using a spreadsheet (such as Excel) calculate the materials, quantities and cost of production

demonstrate safe, responsible and efficient production activities to specified standards of quality

select tools used in the production and compare them against tools that may be used to carry out the same process; give advantages and disadvantages of each; use a suitable communication method that will enable this comparison to be presented to the class or an assessment panel


record progress of design and production activities in a word-processed journal and using a digital camera

provide and document progressive updates to the client on production progress

discuss with the client modifications and changes, and document these, providing reasons

Detailed example

MATERIALS LIST FOR A PRODUCT

Using a spreadsheet such as Excel calculate the individual components and costs of the product to be produced. Note that each component should be listed individually and the total lengths of multiple components used to calculate the cost of the product. Use formulas on the example below as a guide to calculate quantities and costs.

	1	2	3	4	5	6	7	8
A	No. of pieces	Component	Length of each component (mm)	Sum total of lengths (metre/ mm)	Width (mm)	Thickness (mm)	Cost per metre	Total cost
B	3	top	0.600	1.800	140	19	$3.20	$5.76
C	2	sides	0.400	0.800	140	19	$3.20	$2.56
D	4	legs	0.480	1.920	42	42	$4.30	$8.26
E	4	rails	0.350	1.400	70	19	$1.20	$1.68
F								
G				Total of all components				$18.26

Formula = sum (B1*B3)

Formula = sum (B4*B7)

Formula = sum (B8:E8)

Material: Radiata Pine

Unit 4: Product development, evaluation and promotion

AREA OF STUDY 1: Product analysis and comparison

Outcome 1

Analyse similar product types through a comparison of innovative features, function, aesthetic and visual appeal, and any economic, social and environmental benefits and costs.

Examples of learning activities

compare two similar products (such as sunglasses), judging suitability for function/purpose, appeal to user and quality

analyse the arrangement of controls on a range of personal audio devices and list the key factors to consider when designing such human interfaces

using photographs of products from famous designers and design groups, produce designs for a table lamp in a similar style, for example The Bauhaus (Narcek Breuer), De Stijl (Gerritt Rietveld), and Memphis (Ettore Sottsass)

investigate the design features of a home appliance such as an iron or toaster; consider the opinions of users of the appliance; consider positive and negative features and how the product could be improved

find examples of a variety of products that you consider to be of good quality; identify the factors that give these products quality

using a data show analyse two similar products in terms of their social and environmental impact; report on ethical factors relating to the sourcing and processing of materials as well as social and human impact of the manufacturing of the product

Detailed example

DESIGN FEATURES OF A HOME APPLIANCE

Select an everyday home appliance such as an electric kettle, a toaster, a hair dryer, a juicer or a can opener.

Study and use the appliance and make notes about how it feels as you use it.

Ask several people to use the selected product and watch them carefully. Talk to them about how it feels as they use it. Record their comments, making sketches or taking photographs as necessary.

Consider the product from both the designer and user's point of view.

Analyse the product, asking questions like:

- What are the good features?
- What are the weaknesses?
- What improvements could be made?
- What materials are used?
- Are the materials environmentally friendly?

Present your finding using annotated sketches, photographs, and annotations on a poster or multimedia presentation.

AREA OF STUDY 2: Product manufacture

Outcome 2

Competently and safely apply a range of production skills and processes to implement the production plan, make the product designed in Unit 3, Outcome 3, and manage time and resources efficiently.

Examples of learning activities

demonstrate safe production skills to implement the plan to make the product as specified

analyse each process for potential risks and produce a plan for the safe handling of tools, machinery, equipment, materials and chemicals involved in the making of the product; record actual time taken and changes to processes

word process a record of production and use digital photos to document the production processes involved in making the product, making reference to expectations of quality

competently use appropriate processes such as marking out, cutting, constructing and applying finishing techniques; the techniques must include a range of complex processes

use 'no-go' jigs to check material and construction sizes as part of quality checking procedures

justify the use of selected tools, equipment and processes; give details of the processes; assess their appropriateness for the task and how well they have been carried out

Detailed example

DOCUMENTING PRODUCTION PLANNING AND RISK ASSESSMENT

Below is an example of a Production plan layout. Prepare a similar plan using a table in Microsoft Word. Print it on A3 paper. This planning tool is to document the sequence of production processes and to anticipate risks. The 'Actual time and modifications' column should not take the place of the production journal. The production journal should document the activities in depth and be used as a reference for the evaluation report.

Process	Materials, substances, chemicals	Tools, equipment and machinery	Risk assessment and safety considerations	Predicted time (minutes)	Actual time and explanation of modifications

AREA OF STUDY 3: Product evaluation and promotion

Outcome 3

Evaluate the outcomes of the design and production activities, and promote the product's design features to the client and/or end-user.

Examples of learning activities

discuss the completed product with the client and test it using methods (previously devised and agreed) to determine the degree it satisfies the design specifications (considerations and constraints)

word process a report analysing the effectiveness and efficiency of planning and production activities

write a report which outlines the extent to which the product meets the requirements of the design brief (making reference to each of the specifications)

observe and research using text and web-based resources the marketing methods used for products similar to those being produced by students and plan a strategy to promote the product making reference to the five Ps of marketing

collect a series of advertising brochures and determine methods used to promote featured products; consider the socioeconomic profile of the consumer that is being targetted by these brochures

Detailed example

PLANNING A STRATEGY TO PROMOTE YOUR PRODUCT

Your client or end-user has decided that your product has a wide appeal and is offering to help you to promote your product to a wider audience.

Make notes about the marketing mix of the five Ps: People, Product, Price, Place and Promotion.

You are required to make a number of decisions regarding your promotional strategy:

- what the product might be called
- the factors that will determine the price of your product
- the method of promoting your product (stores, catalogues, Internet, direct mail, product fairs)
- the location of the outlets that your product will be promoted in.

Document decisions and explain reasons to support them.

SCHOOL-ASSESSED COURSEWORK

In Units 3 and 4 teachers must select appropriate tasks from the assessment table provided for each unit. Advice on the assessment tasks and performance descriptors to assist teachers in designing and marking assessment tasks will be published by the Victorian Curriculum and Assessment Authority in an assessment handbook. The following is an example of a teacher's assessment program using a selection of the tasks from the Units 3 and 4 assessment tables.

Outcomes	Marks allocated	Assessment tasks
Unit 3 **Outcome 1** Explain and demonstrate the role of a designer by writing a design brief, developing evaluation criteria, and identifying and explaining areas for research and methods that would be used to develop design ideas.	25	An annotated design brief developed from a scenario which includes specifications (considerations and constraints) and a diagrammatic outline of how the designer could explore and develop design ideas and options in response to the brief. Development of evaluation criteria with explanation of their relevance and how the product would be tested or checked against each criterion. Scenario 1: Client requires shelving unit for small apartment. **or** Scenario 2: User group (future students) will require a uniform to be worn at a school to be opened early next year.
Outcome 2 Explain the factors that influence the design, development and manufacture of products within industrial/commercial settings.	25	A short written report defining the role of market research and development in a local manufacturing industry; the importance of quality Management and application of Australian Standards; the roles of people in the product cycle; and how the company uses new technology and the effect of social, environmental, economic technological, the importance of Life Cycle Analysis. The report will contain judgments on value adding in the designing of products and compare different forms of production.
Total marks for Unit 3	**50**	
Unit 4 **Outcome 1** Analyse similar product types through a comparison of innovative features, function, aesthetic and visual appeal, and any economic, social and environmental benefits and costs.	25	A multimedia report that analyses and compares products for function, aesthetics, finish, quality, cost and appeal. Includes an analysis of the impact of the products on society and the environment.
Total marks for Unit 4	**25**	

SCHOOL-ASSESSED TASK

In Units 3 and 4 teachers must provide students with the opportunities to complete the school-assessed task. The following is an example of a teacher's assessment program based on the tasks from the Units 3 and 4 assessment tables.

Outcomes	Marks allocated	Assessment tasks
Unit 3 **Outcome 3** Present a folio that documents the procedure and decision-making processes used while working as a designer to meet the needs of a client or end-user, and commence production of the designed product.	Subject to external review	A design folio that includes a profile of the client and/or end-user, research, drawings, sketches, notations, diagrams and models/mock-ups and incorporates the use of conventions, and traditional and computer-assisted methods. Includes justification of design ideas based on specifications (considerations and constraints) outlined in the design brief. Include evaluation criteria, client feedback, production work plan, a materials list containing quantities, costs and materials.
Unit 4 **Outcome 2** Competently and safely apply a range of production skills and processes to implement the production plan, make the product designed in Unit 3, Outcome 3, and manage time and resources efficiently.	Subject to external review	Production work accompanied by a journal of production processes, documentation of modifications and justification of these changes (text and images should be included). A functional product that conforms to set standards of quality, performance, ease of use and safety.
Outcome 3 Evaluate the outcomes of the design and production activities, and promote the product's design features to the client and/or end-user.	Subject to external review	An evaluation report using client feedback that evaluates the product in relation to evaluation criteria and the efficiency of the design and production activities, and discusses improvements that were or could be made. **And** A poster to promote the main design features of the product to the client and care requirements. Reference is made to the five Ps in the development of the poster.

SUITABLE RESOURCES

Courses must be developed within the framework of the study design: the areas of study, outcome statements, and key knowledge and skills.

Some of the print resources listed in this section may be out of print. They have been included because they may still be available from libraries, bookshops and private collections.

At the time of publication the URLs (website addresses) cited were checked for accuracy and appropriateness of content. However, due to the transient nature of material placed on the web, their continuing accuracy cannot be verified. Teachers are strongly advised to prepare their own indexes of sites that are suitable and applicable to the courses they teach, and to check these addresses prior to allowing student access.

BOOKS

Technology

Chapman, C 2002, *Resistant Materials – Real World Technology*, Harper Collins Publishers Ltd, London, UK.

Livett, J & O'Leary J, 2006, *Design and Technology VCE Units 1–4*, 2nd edn, Thomson Learning Australia, Melbourne. (Forthcoming.)

McDonald, M & Morris, P 2000, *The Marketing Plan in Colour*, Butterworth-Heinemann, Oxford University Press, UK.

Slynko, B 2005, *Introducing Technology*, Thomson Nelson, Australia.

Stevens, R & Ramsay, B 1997, *Technology 1*, Cambridge University Press, UK.

Stevens, R & Ramsay, B 1998, *Technology 1*, Cambridge University Press, UK.

Warner, N & Riley, M et al. 1995, *Studies in Design and Technology*, Jacaranda Press.

Woodson, W 1992, *Human Factors Design Handbook*, 2nd edn, McGraw Hill.

Product and fashion design

Bairstow, J, Barber, R & Kenny, M 1999, *Design Modelling: Visualising Ideas in 2D & 3D*, Hodder & Stoughton, London, UK.

Byars, M & Barre-Despond, A 1999, *100 Designs/100 Years*, Rotovision SA, Switzerland.

Crafti, S 2002, *Request Response Reaction: Designers of Australia & New Zealand*, Images Publishing Group Pty Ltd, Australia.

Cranz, G 2000, *The Chair: Rethinking Culture, Body and Design*, W.W. Norton & Co. Inc, New York, US.

Dul, J & Weerdmeester, B 2001, *Ergonomics for Beginners*, Taylor & Francis Inc., London, UK.

Fair, D & Kenny, M 1987, *Design Graphics: Drawing & Presenting your Design Ideas*, Hodder & Stoughton, London, UK.

Fiell, C & Fiell, P 2003, *Designing the 21st Century*, Taschen, Germany.

Hagen, K 2005, *Fashion Illustration for Designers*, Pearson Education Inc., New Jersey.

Hauffe, T 1998, *Design: A Concise History*, Laurence King Publishing, London.

IDSA (International Designers Society of America) 2003, *Design Secrets: Products: 50 Real-life Products Uncovered*, Rockport Publications Inc.

IDSA (International Designers Society of America) 2004, *Design Secrets: Products 2: 50 Real-life Products Uncovered*, Rockport Publications Inc.

Lewis, H & Gertsakis, J 2001, *Design + Environment: Global Guide to Designing Greener Goods*, Green Leaf Publishing, Sheffield, UK.

McDermott, C 2000, *20th Century Design – Mini*, The Overlook Press, New York, US.

Sparke, P 1998, *A century of Design*, Mitchel Beazley, Reed Consumer Books, Great Britain.

Stungo, N 2000, *Charles & Ray Eames*, Carlton Books, London, UK.

Wassreman, M, 2004, *Re:Think Re:Design Re:Construct*, How Design Books, Ohio, US.

Metal

Byars, M 2003, *Design in Steel*, Laurence King Publishing London, UK.

Frisch, S & Frisch, D 1998, *Metal: Design & Fabrication*, Whitney Library of Design.

Hansson, B 2004, *The Fine Art of the Tin Can*, Lark Books, New York, US.

Jeffus, L 2002, *Welding Principles & Applications*, Delmar Publishing, New York, US.

Kondinin Group 2002, *The Welding Book: A Practical Guide for the Workshop*, Kondinin Group, Australia.

Le Van, M 2005, *Fabulous Jewellery from Found Objects*, Lark Books, New York, US.

Lefteri, C 2004, *Metals: Materials for Inspirational Design*, Rotovision SA, Switzerland.

Mc Creight, T 1998, *Jewellery – Fundamentals of Metalsmithing*, A & C Black Publishers.

McCreight, T 1999, *Bodes and Lockets*, *Metalsmithing Techniques*, Hant Book Press, US.

McCreight, T 2005, *The Complete Metal Smith, an Illustrated Handbook*, revised edition, Davis Publications.

McGrath, J 2004, *Encyclopaedia of Jewellery Making Techniques*, The Bookshop Pty Ltd, Singapore.

Meilach, D 1999, *Decorative and Sculptural Ironwork, Tools, Techniques and Inspiration*, 2nd edn, Schiffer Publishing Ltd, USA.

Stevens, R 1994, *Metal and Technology*, Cambridge University Press, Australia.

Untracht, O 1982, *Jewellery Concepts and Technology*, Doubleday.

Wicks, S 1992, *Jewellery Making Manual*, A Little Brown Book and Company, UK.

Ceramics

Del Vecchio, M 2001, *PostModern Ceramics*, Thames & Hudson Publishing Ltd, London, UK,

Clark, G 2001, *The Artful Teapot*, Thames & Hudson Publishing Ltd, London, UK.

Costentino, P 1990, *The Encyclopaedia of Pottery Techniques*, Simon Schuster, Australia.

Lefteri, C 2003, *Ceramics: Materials for Inspirational Design*, Rotovision SA, Switzerland.

Lefteri, C 2003, *Glass: Materials for Inspirational Design*, Rotovision SA, Switzerland.

Walker Ceramics 2004, *The Pottery and Ceramics Handbook,* 6th edn, Croydon, Victoria (www.walkerceramics.com.au).

Wood

Bryars, M 1998, *50 Product Innovations in Design and Materials*, Prodesign Series, Rotovision SA, Switzerland.

Campbell, P 1997, *Timber for Building*, RMIT Press, Melbourne, Australia.

Desch, H & Dinwoodie, J, 1996 *Timber Structure, Properties, Conversion and Use*, 7th edn, Macmillan Press, London.

Gray, A & Hall, A 1999, *Forest-Friendly Building Timbers*, Earth Garden Pty Ltd, Australia.

Haines, T & Smith, T 1998, *The Complete Book of Woodworking and Carpentry*, Lansdowne, NSW, Australia.

Huey, G 2004, *Building Fine Furniture*, Popular Woodworking Books, Ohio, US.

Jackson, A & Day, D 1996, *Collins Complete Wood Worker's Guide*, Harper Collins Publishers Ltd, London, UK.

Jackson, A & Day, D 2002, *Good Wood Series: Guide to Routers, Joints, Finishes & Basic Woodworking*, Harper Collins Publishers Ltd, London, UK.

Lefteri, C 2005, *Wood: Materials for Inspirational Design*, Rotovision SA, Switzerland.

Lydgate, T 2004, *400 Wood Boxes*, Lark Books, New York, US.

Pierce, K 2001, *The Custom Furniture Source Book*, Taunton, US.

Popular Woodworking, 2002, *Build Your Own Contemporary Furniture*, Popular Woodworking Books, Ohio, US.

Porter, T 2004, *Wood Identification and Use*, Guild of Master Craftman Pty Ltd, East Sussex, UK.

Stack, J 2002, *Design Your Own Furniture*, Popular Woodworking Books, Ohio, US.

Stacpoole, J 1996, *What Timber Will I Use? The Essential Timber Guide for DIY Renovators, Woodworkers and Students*, 2nd edn, John Maxwell & Associates, Victoria.

Weiss, A 1999, *Workshop Materials*, Nexus Special Interests Ltd, Kent, UK.

Plastic

Australian Government Publishing Service 1994, *Plastics Recycling: Economic Issues and Implications*, Canberra, Australia.

Lefteri, C 2001, *Plastics: Materials for Inspirational Design*, Rotovision SA, Switzerland.

Lefteri, C 2006, *Plastics 2: Materials for Inspirational Design*, Rotovision SA, Switzerland. (Forthcoming.)

Richardson, T & Lokensgard, E 1997, *Industrial Plastics: Theory and Application*, Delmar.

Strong, A 1996, *Plastics – Materials and Processing*, Prentice Hall, New Jersey, US.

Textiles and fashion

Barnett, A 1997, *Examining Textiles Technology*, Heinemann, Oxford, UK.

Baulch, K & Opperman, K 1994, *Textiles and Technology, Australian Technology Studies Series*, (Stevens, R ed.), Cambridge University Press, Melbourne.

Beaney, J & Littlejohn, J 2005, *Stitch Magic: Ideas & Interpretation*, B T Batsford, London, UK.

Betzina, S 2004, *More Fabric Savvy*, Tauton Books, US.

Braddock, S & O'Mahony, M 1998, *Techno Textiles: Revolutionary Fabrics for Fashion and Design*, Thames & Hudson, UK.

Deckert, B 2001, *Sewing 911*, Tauton Books, US.

Fritz, A & Cant, J 1989, *Consumer Textiles*, Oxford University Press, Australia.

Galea, G, A 1991, *Study Guide to Textiles and Design*, Longman Cheshire, Melbourne, Australia.

Readers Digest 2002, *New Complete Guide to Sewing: Step-by-step Techniques for Making Clothes and Home Accessories*, The Readers Digest Association Inc.

Schaeffer, C 2003, *Sew any Fabric*, Krause Publications, US.

Steele, V & Borrelli, L 1999, *Bags: A Lexicon of Style*, Beatrice Vincenzini.

Wolff,C 1996, *The Art of Manipulating Fabric*, Krause Publications, US.

AUDIOVISUAL

Design

A Design Project – A Case-study of Four Innovative Caravan Designs (VHS) 1993, Classroom Video, Australia.

CAD-CAM in Industry and Schools (VHS/DVD/Clickview) 2004, Video Education Australasia, Australia.

CAD-CAM in the Classroom (VHS/DVD/Clikview) 2003, Video Education Australasia, Australia.

Designing a Chair; Sitting Pretty (VHS) 2002, Australasia.

Designing a Product (VHS) 1994, Video Education Australasia, UK.

Designing Dream Machines (VHS) 1996, Video Education Australasia, UK.

Designing to Please (VHS) 1995, Video Education Australasia, Australia.

Elements & Principles of Design (DVD) 2004, Video Education Australasia, Australia.

Ergonomics and Design Matching Products and Tasks with People (VHS) 2002, Classroom Video, Australia.

Inspirational Design Case studies of award winning designs (VHS) 2000, Classroom Video, Australia.

Inspiration for Design (VHS/DVD) 2005, Video Education Australasia, Australia.

Life Cycle Assessment (VHS) 2003, Video Education Australasia, Australia.

Right from the Start – The Axis Kettle and the Dishlex Dishwasher (VHS) 1996, Video Education Australasia, Australia.

Student Design Project Two Case Studies (VHS/DVD/Clickview) 2002, Video Education Australasia, Australia.

Vacuum Cleaner Design & Marketing (VHS) 2000, Classroom Video, Australia.

Walking On Water: Applying Design and Technology to Surfing (VHS) 1995, Video Education Australasia, United Kingdom.

Washing Machine – Design & Manufacture Case study: Simpson – development and manufacture (VHS) 1999, Classroom Video, Australia.

Wood

Design and Technology at Work, Making Guitars (VHS & DVD) 1992, Video Education, Australasia, Australia.

Engineered Wood Products: Chipboard, MDF, ply, fibreboard, manufacture and uses (VHS & DVD) 2000, Classroom Video, Australia.

Furniture Design – Part 2, Designers from Australia, Canada, UK (VHS) 1999, Classroom Video, Australia.

Timber: Production and Processing Series (VHS), 2004, Video Education Australasia, Australia.

Wood Properties and Uses: Simple Tests in The Workshop To Find The Best Wood (VHS & DVD) 2001, Classroom Video, Australia.

Technology

Design Works (VHS) 2003, Avenue Education, Australia.

Designing a Workshop Project Planning, Designing, and Costing in the Workshop (VHS) 2002, Classroom Video, Canada.

Essentials of Design and Technology Skills, Drilling, Lathes and Soldering (VHS) 2004, Video Education Australasia, Australia.

Mountains, Materials &Technology Produced (VHS) 1994, Video Education Australasia, United Kingdom.

Testing Consumer Products: Properties, Prototype, Production, Products, Procedure (VHS) 1999, Classroom Video, Australia.

Textiles

A Textile World (DVD) 2003, Video Education Australasia, Australia.

Clothing Design and Manufacture: How Clothes are Designed, Manufactured and Sold (VHS) 1998, Classroom Video, Australia.

Creating Retail Fashion in Australia, Behind the Seams Series (VHS) 1992, Video Education Australasia, Australia.

Designing & Manufacturing Clothing in Australia from the Behind the Seams Series (DVD) 1992, Video Education Australasia, Australia.

Fashion How Green are your Jeans? Series (DVD) 1996, Video Education Australasia, Australia.

Hunter Gatherer – A Case Study in Apparel Design & Manufacture (VHS & DVD) 2002, Video Education Australasia, Australia.

Mambo – Wearing the Image (VHS & DVD) 1995, Video Education Australasia, Australia.

New Textiles and their Application, Beyond 2000 Series (VHS) 1994, Video Education Australasia, Australia.

Part 2 – A Textile World, All About Textile Series (DVD) 2003, Video Education Australasia, Australia.

Stringybark on Screen: A Case Study of Design and Technology at Australia's Leading T-Shirt Maker (VHS) 1998, Video Education Australasia, Australia.

Wayne's World – Designer Sales Textile Technology Series (VHS) 1993, Video Education Australasia, United Kingdom.

Metals and plastics

Forming and Shaping Metals; Heating, Cold Forming & Milling (VHS & DVD) 2002, Classroom Video, Australia.

Forming of Plastics series (VHS) 1999, Video Education Australasia, Australia.

Metals – The Simplest Materials Science in Focus Series (VHS) 1990, Video Education Australasia, United Kingdom.

Non-Ferrous Metals: Properties, processes and uses (VHS & DVD) 2001, Classroom Video, Australia.

Plastics: Properties, Uses & Disposal (VHS) 1990, Video Education Australasia, United Kingdom.

The Making of Aluminium (Advanced Version) (VHS) 1993, Video Education Australasia, Australia.

Welding: Metallic Materials Part A (VHS) 2001, Video Education Australasia, Australia.

Welding: Metallic Materials Part B (VHS) 2001, Video Education Australasia, Australia.

Safety

Safety in the Workshop; Your tools are out to get you (VHS & DVD) 1998, Classroom Video, Australia.

Safety in Technology Workshops, working with Wood, Metal and Plastics (VHS/DVD/Clickview) 2001, Video Education Australasia, Australia.

Student Safety Guidelines – Technology (CD-ROM)
This resource was distributed originally to secondary schools in 2003 as part of the Science in Schools Initiative. Additional copies are available through School Innovation in Teaching Program – Science, Mathematics and Technology. Contact the Department of Education & Training, Victoria.

JOURNALS AND PERIODICALS

Design (general)

Curve
Beesting Publishing Pty Ltd
Mt Eliza Vic Australia
www.curve.com

DATA news
DATA
Warwickshire CV35 9JB, UK

I.D. (International Design Magazine)
F & W Publications Inc.
OH, US

Object
Australian Centre for Craft and Design
NSW, Australia

Prodesign
AGM Publishing Ltd
Auckland, NZ

SDO (Scene Design Quarterly)
Indesign Publishing Pty Ltd
NSW, Australia

The Design and Technology Association
16 Wellesbourne House
Walton Road
Wellesbourne

Ceramics

Australian Ceramics and Pottery
Express Publications Pty Ltd
Silverwater, NSW

The Journal of Australian Ceramics – Pottery in Australia
www.australianceramics.com

Fashion and textiles

Elle
Hachette Filapacchi Media, USA

Fashion Trend Australia
Ellikon Press
NSW, Australia

Harpers & Queen
National Magazine Co.
London, UK

Textile Fibre Forum
The Australian Forum for Textile Arts Ltd, Queensland

Vogue Australia,
FPC Magazines, NSW, Australia

Metal/jewellery

Art Jewelry
Kalmbach Publishing Co., WI
www.artjewrymag.com

Wood

Australian Wood Review
Interwood Holdings Pty Ltd
Qld, Australia

Fine Woodworking
Tauton Press Inc.
Newtown, CT, USA

Furniture Making
Guild of Master Craftsmen Publications Ltd, UK

WEBSITES

General

www.ryan56.freeserve.co.uk/links1.htm
World Association of Technology teachers – has lots of links to other sites that could be useful

www.technologystudent.com/
Technologystudent

www.intel.com/education/design/curriculum.htm
Intel® Innovation in Education – Design and Discovery Curriculum

www.technology.org.uk/
UK National Grid for Learning, Technology Insight: Working with industry to enhance Design and Technology

www.teachers.ash.org.au/glennbrown/technology_links.htm
Links to other Design and Technology related pages

www.dyson.com/
Dyson website – links to Australian site

www.designandtech.com/
A Jones, Fallibroome School, Macclesfield, Design and Technology

www.designaddict.com/
Patrick and Alix Everaert, Belgium, Design Addict

www.core77.com/bullitts/default.asp
Core 77 Industrial Design supersite

http://hsc.csu.edu.au/design_technology/index.htm
Charles Sturt University and NSW Department of Education – NSW HSC Online – Design and Technology

www.baddesigns.com/
Michael J Darnell – Bad Designs

www.davidsemporium.co.uk/_SEVEN44.html
www.schoolroomsearch.co.uk
Davidsemporium (contains information on Design and Technology resistant materials and textiles)

www.spartacus.schoolnet.co.uk/REVdt.htm
Spartacus Educational Design and Technology

www.design-council.org.uk/design/
Design Council, UK

www.csiro.au
CSIRO Australia

www.virtualsalt.com/crebook1.htm
VirtualSalt Introduction to Creative Thinking
Robert Harris

Designers
Australian designers at work
www.phm.gov.au/designersatwork/index.html

Materials
www.materialexplorer.com
Material explorer

Fashion/textiles

www.fashioninformation.com/
Fashion Information Ltd

www.design-technology.info/textilessubsite/page4.htm
Textiles Technology on the web

Glass

www.cmog.org
Corning Museum of Glass

www.spectrumglass.com/
Spectrum Glass

www.axessglass.com/
Axess Glass (Box Hill, Victoria)

Wood

http://oak.arch.utas.edu.au/tbia/default.asp
Timber Building in Australia, Tasmanian Timber on the Internet

www.vwa.org.au/
Victorian Woodworkers Association

www.naturallyaust.com.au/index.html
Naturally Australian

Australian Standards
www.standards.org.au/
Standards Australia

www.standards.com.au/catalogue/script/search.asp
SAI Global Distributors of Australian Standards

Intellectual Property
www.ipaustralia.gov.au/
Intellectual Property Australia

www.ipria.org/
Intellectual Property Research Institute of Australia

Ergonomics/anthropometrics
www.ergonomics.com.au
Ergonomics in Australia

www.ergoweb.com/resources/casestudies
Ergoweb – Case studies in Ergonomics

Design for the environment

www.cwwt.unsw.edu.au/
The University of New South Wales Centre for Water and Waste Technology (contains information on Life Cycle Assessment)

www.greenhouse.gov.au/
Australian Government, Department of the Environment and Heritage, Australian Greenhouse Office

www.aela.org.au/gec/Textiles.html
The Australian Environmental Labelling Association Inc

www.cfd.rmit.edu.au
RMIT Centre for Design

Safety

www.noel-arnold.com.au/
Noel Arnold and Associates website

www.workcover.vic.gov.au/
WorkSafe Victoria website

www.eduweb.vic.gov.au/hrweb/ohs/accp/plantm.htm
Victorian Department of Education & Training, Human Resources – checklists and guidance through DE&T's OHS and Safety School website

www.sofweb.vic.edu.au/facility/docResearch/keyDocs.htm#1
Building Quality Standards Handbook 2003 covering OHS design issues in technology

www.eduweb.vic.gov.au/hrweb/ohs/other/train.htm
Victorian Department of Education & Training, Human Resources – Information about safety training providers

www.comcare.gov.au/publications/factsheets/fact-sheet-17c.html
Australian Government Comcare – Material Safety Data Sheet information for hazardous substances

www.nohsc.gov.au/SmallBusiness/BusinessEntryPoint/specific/wood/#cwdi
Australian Government, Department of Employment and Workplace Relations, Office of the Australian Safety and Compensation Council, National Occupational Health and Safety Commission – Wood and wood products

ORGANISATIONS

http://nationaldesigncentre.com/index.html
National Design Centre (Melbourne)

http://web.data.org.uk/data/index.php
The Design and Technology Association (DATA) – UK subject association

OHS school audits and helpline support:
Noel Arnold & Associates
www.noel-arnold.com.au/
ph (03) 9890 8811

TEFA (Technology Education Federation of Australia)
www.pa.ash.org.au/tefa/deca.html

Standards Australia
19–25 Raglan Street
South Melbourne Vic 3205
Tel: 1300 65 46 46.
Fax: 1300 65 49 49
Website: www.standards.com.au/catalogue/script/search.asp

Technology Education Association of Victoria (TEAV)
150 Palmerston Street
Carlton Vic 3053
Email: teav@mpx.com.au
Tel: (03) 9349 1538
Fax: (03) 9349 5391
Website: www.teav.vic.edu.au/

Victorian Home Economics and Textiles Association (VHETTA)
3 Windsor Avenue
Mount Waverley Vic 3149
Tel: (03) 9888 2240
Fax: (03) 9888 2241
Website: www.vhetta.com.au/

Design Institute of Australia
www.dia.org.au

International Technology Education Association (ITEA)
1914 Association Drive
Suite 201
Reston, VA 20191
www.iteaconnect.org