



YEARS
11&12

DESIGN & PRODUCTION

TEACHING & LEARNING
SUPPLEMENT

Teaching and Learning Supplement

DESIGN AND PRODUCTION (DAP215116)

ADVICE TO TEACHERS

This document helps to describe the nature and sequence of teaching and learning necessary for students to demonstrate achievement of course outcomes.

It suggests appropriate learning activities to enable students to develop the knowledge and skills identified in the course outcome statements.

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.

COURSE SPECIFIC ADVICE

This Teaching and Learning Supplement for Design and Production level 2 must be read in conjunction with the Design and Production level 2 course document.

It contains advice to assist teachers delivering the course and can be modified as required. This Teaching and Learning Supplement is designed to support teachers new to or returning to teaching this course.

In *Design and Production*, learners focus on the use of the design process to respond to design briefs to produce solutions which aim to meet the needs of users. Learners develop an understanding of the product design choices, and develop the skills to appraise products as well as developing their own creative solutions.

The design process requires the identification of a real need from which the design brief stems. This may be the starting point, but given the cyclical nature of the design process it is not always the case. Regardless of the starting point, the need(s) provide the pivotal point for the design brief, from which further investigation takes place to identify and understand the impact the design factors can have on the solution, and the focal point for evaluation of the object. In the role of designer-maker, learners develop and apply their knowledge and understanding of factors which influence design. These factors sit alongside the over-arching understanding of design practice and the impact of aesthetic and functional considerations. Learners gain an understanding of the impact that environmental, economic, social and technological factors can have on the design and development of a product.

One of the most important issues for teachers to consider when planning a course is to ensure that the design process and the design factors are embedded into the practical activities within the course to engage students in learning. The knowledge and skilled use of resources is an integral component of product design and development. This includes an understanding of the range of materials, tools and equipment that can be used to create designs and objects, and the skills and knowledge to be able to use these safely, effectively and with purpose to develop solutions.

Learners build the skills of project implementation, enabling them to manage resources and risks effectively to develop their design solutions. Learners appraise and assess ideas and products against criteria developed to justify their design decisions and further refine their ideas and objects.



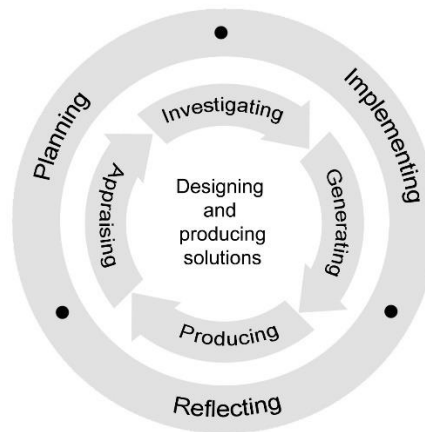
COURSE CONTENT

	Unit Title	Indicative Times
Area 1	Designing and producing solutions	Integrated Delivery
Area 2	Design factors	
Area 3	Implementing projects	

Area 1 Design and producing solutions

The design process is cyclical in nature, with the possibility of many points from which to start. Exploring the nature of each phase of the process is essential, with the use of design briefs with a range of starting points, which lead in to learners developing their own design briefs. For example, a design brief may involve appraising an existing object to develop a brief for an improved design.

The Design Process



The design process incorporates an iterative approach, which involves incrementally developing and refining a design based on feedback and appraisal. The inner and outer circles of the diagram are intended to occur concurrently.

Learners continuously plan and reflect to work towards producing a design which best meets the needs of the clients of design situation. Reflection is undertaken throughout the investigating, generating and producing phases. Evaluation occurs in the appraisal phase and is an 'endpoint' judgement of how well the designed object meets the identified criterion.

Whilst many different and alternative models of the design process exist, they all aim to represent how designers or designer-makers start with a need, problem or opportunity that materialises into a product as a result of a series of cognitive and physical activities. The design process outlines the stages learners will work through that replicates processes that many designers use to change their initial design concepts into a product. In industry, this process varies according to the company, the product and the experience of the designers. In this course, the design process provides a structure for learners to work through to realise their own design ideas.

Key concept:

The design brief

The design brief is a statement which clarifies the project task and defines the need or opportunity to be resolved. It usually identifies the users, success criteria, constraints, considerations, available resources and a timeframe. It focuses on the desired results related to the design of a product.

The design brief should not describe a final solution but should allow room for exploration, creativity and innovation.

In some cases a brief will be accompanied by a scenario which will provide a context for the design brief including information about the needs and wants of a client and/or an end user.

Examples of learning activities

Learners:

consider reasons why people design and identify an existing object which may have been designed for each reason

conduct a needs investigation by:

- surveying a group of people regarding their needs associated with a particular object, for example something to carry their school book in or
- constructing an in-depth profile of an individual to identify their needs for an object with a specific purpose such as an outfit to wear to an upcoming party or a shelving system for their sound system.

use a needs investigation as a starting point to write a design brief.

using an existing product, identify and explain how to apply the four stages of the design process to the redesign of the product.

Key Concepts

Investigating

Critical and Creative Thinking

The development of approaches to critical and creative thinking, underpin all aspects of this course. It is essential for learners to learn to organise and communicate their design ideas and possibilities through drawing and annotation.

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 one angle or problem to another).



Examples of learning activities

Learners:

research and compare different creative and critical design thinking methods; identify and use one of these methods to assist in the development of creative design ideas to select the preferred option; consider brainstorming, mind mapping as a starting point or models for generating new ideas such as 'SCAMPER' (Substitute, Combine, Adapt, Modify/magnify/minimise, Put to another use, Eliminate, Remove/reverse) or a 'POOCH' (Problem, Options, Outcome, Choice) framework to support their exploration.

use a mobile application to generate, organise and document the thought process e.g. mind map, fishbone diagram.

discuss the different types of drawing presentation techniques in the generation stage of the design process; use these different types of drawings for a redesigned product; to assist, watch a video related to the generation stage of the design process.

explore what makes good design by analysing examples from their local environment.

reverse brainstorm - identify a problem, identify ways of causing it, then from backwards work on ways of preventing it through the use of a designed object.

brainstorm possibilities to meet a need, such as a place to store magazines.

identify needs which could be met through the creation of a designed object.

appraise an existing design as a starting point for a design brief.

identify five objects that exist to fulfil a particular need, such as the need to carry a debit card and licence. Construct an appraisal grid to appraise the properties and effectiveness of each item for the intended purpose. Consider the changes that could be made to improve the lowest ranking design so that it scores more highly than the highest ranking design.

Key Concepts

Generating

Design communication and development

The generation stage of the design process requires a range of drawings styles to communicate designs. The characteristics and purpose of the drawings varies with the communication need.

Learners will annotate drawings to provide explanatory notes and comments that link back to the design brief, considerations and constraints.



The main types of drawings and design development techniques as well as their roles are outlined below.

Visualisations are quick, freehand drawings of ideas that may be whole or parts of an envisaged product. They are usually in pencil using lines and very basic rendering. Visualisations are informed by research and the learner's own ideas to communicate possibilities. They are used to 'work through' potential ideas to take forward into design options.

Design options (sometimes called presentation drawings) are generally drawings that show what the whole of the product will look like and include annotations. Design options often include lines, colour, rendering in pencil, markers, and watercolour/wash. Computer-aided design software (CAD) may be used to produce design options. They provide a good indication to the designer and others of what a potential product could look like. Annotations provide details such as construction methods and link back to the design brief, considerations and constraints and design factors.

Working drawings and/or patterns are more refined drawings developed from a design option or combination of options. These drawings include technical language and conventions, use of symbols and measurements. Technical instruments and CAD are often used to produce working drawings. These accurately show what the product looks like, how it will be constructed and are used to work out product specifications (materials, parts and sizes needed to make the product). They could be used along with a scale model to show specific details before a prototype or product is made.

Prototyping

Prototypes for designs are developed to test ideas and support design development. Creating prototypes enables a design concept to be tested, iteratively revised and refined. Less costly material are usually used including cardboard, paper, plywood, calico, plastic or acrylic. The use of new technologies enable prototyping and fabrication with 3D printers and pens, computer numeric controlled (CNC) routers and laser cutters.

Some design briefs may require the production of a well-developed prototype(s) rather than a fully resolved product.

Examples of learning activities

Learners:

develop their visualisation sketching abilities through quick response activities e.g. card packs where each card gives an item learners must draw within a given time limit or books such as 'Draw me a House'.

capture their design development process using a digital camera then show their journey using a digital presentation tool such as *Prezi*.

create a class design response to a problem by working in small groups to sketch a design solution, which is then circulated in turn to other groups in the class. Each group makes two improvements to the design before passing it onto the next group.



take an existing object and appraise it in detail, considering the design decisions that were made in the creation of that product. Consider aspects such as function and affordability, use of materials, technical decisions, aesthetic choices, packaging, marketing, suitability of materials or impact on environment.

classify at least two materials from within the same category; for example, conventional cotton and organic cotton; baltic pine and radiata pine; copper and brass.

develop, complete and present a materials test for a specific property such as strength, elasticity, or durability; photograph the testing procedures and make recommendations on the suitability of the materials for specific uses/applications.

trial construction/joining techniques and comment on their suitability and application/use for a specific product.

create a moodboard to trial various materials, colours, patterns, surfaces and textures

Producing

Examples of learning activities

Learners:

complete a safety induction using explicit teaching techniques which is undertaken in the practical workspace including all environmental, chemical, equipment, energy and work practice hazards.

complete safety activities and online simulation tests.

complete a Job Safety Analysis (JSA) prior to using any high risk equipment or activity (e.g. use of fixed machinery in wood and metal workshops).

work in small groups to identify risks and hazards in the workshop (or practical workspace) and justify their classification.

source Safety Data Sheets (SDS) for materials being used for practical projects and discuss with teacher any precautions and safety measures required to eliminate safety hazards.

outline health and safety issues that might have impacted on the design and production of a familiar product.

choose at least two different pieces of equipment to be used during the production of the project and complete a written risk assessment that identifies the risk/hazard, assesses the level of risk and eliminates or controls the risk.



demonstrate to the class the safe and responsible use of a hand tool, piece of equipment or a portable power tool for a particular purpose using photographs and written comments in a logbook demonstrate the use of processes for selected materials.

source materials, components, notions and finishes for the project.

create a scale model to use to reflect on the aesthetics and function of the object.

appraise methods of cutting, joining and shaping materials prior and during production process to ensure that functional requirements of the brief are met.

use a range of sources including the internet to obtain instructions on technical processes when completing the design project.

trial processes which have not been completed previously to develop skills prior to completing on the design project.

Appraising

Examples of learning activities

Learners:

- identify and list success criteria based on the design brief which address the constraints, consideration and design factors, during the investigating and generating phase of the design process.
- reflect on the identified success criteria as they work through the design process to monitor their progress and to seek feedback from clients or end users.
- use the previously established success criteria to appraise the product as a solution to the design brief including whether the product meets the requirements outlined in the design brief and the degree to which design factors were considered.
- complete a written appraisal of the product that has been re-designed that includes responses to the earlier developed success criteria generated from the design brief, constraints and considerations; compare the design to the original showing the three points of difference; suggest how improvements could be made, including references to sustainability.
- write an appraisal that includes a review of the efficient and effective use of materials, tools, equipment and machines and techniques in design, planning and production activities; make reference to the accuracy and clarity of production plans and working drawings; suitability of production processes, effective planning and use of time and resources (a journal or logbook could be referenced) and suggestions for further improvement.



Area 3 Design factors

Factors influencing the design of products and designed solutions are identified and addressed in response to the design brief.

Key Concepts

The design factors of function, environmental, economic, aesthetic, social, technology and design practice are detailed in the course document.

To help students understand the design factors and related parameters, each factor can be framed into a question and illustrated with examples. For example, function could be developed into the following questions:

- What is the purpose or function of the product to be designed?
- What is the reason for its development?
- Who needs it?
- Where and when will it be used?

Learners will need to refer to these factors, the related considerations and constraints and the questions when they write design briefs, discuss and annotate designs and appraise products.

Design decisions require weighing up of a range of design factors to make judgements based on the brief. Learners need to develop an understanding of the interaction between the various design factors.

Examples of learning activities

Learners:

Function

- suggest a range of potential modifications that could improve an existing product by refer to the design factors in annotations on a digital or printed image of the product to show.
- source designs which meet a functional need (e.g. sports clothing, safety gear, skateboard, trolley, gardening tool) and identify ways in which a design will benefit its users in terms of function, including ergonomic and safety features.
- using presentation software, present to the class information that explains the different approaches designers have taken with two or three selected products that have a similar function, e.g. chair, hat or child's toy.
- identify and list the general considerations when designing an object.
- list possible criteria that a designer should adhere to ensure the success of a product, e.g. DVD packaging and describe how the criteria will be used to appraise the success of the product.

Environment

- create a sustainability Venn diagram to consider factors when designing a storage box.
- use the internet, books or magazines to identify two designers who claim to work sustainably and discuss how they address sustainability.



- using the Life Cycle Analysis (LCA) model, research the sustainability of two disposable products that have the same primary function; link the LCA to environmental, social and economic systems; provide suggestions and a justification for a sustainable alternative product.
- compare a natural to a synthetic/manufactured material (within the same category) using Life Cycle Thinking; for example, radiata pine and chipboard/particle board; woollen material and nylon; steel and aluminium.

Economic

- plan for production by calculating materials costs and formulating a gantt chart to estimate the time required, making adjustments to design if brief cannot be met.
- identify ways of reducing materials costs for a design by exploring recycled materials, less expensive materials or altering the design to accommodate the budget.
- design products which use industrial waste (e.g. old seatbelt webbing, sails, broken pallets, plastic bottles) to transform them into new functional objects.
- compare the economic and environmental factors of materials choices within their project and justify their selection.

Aesthetic

- develop a sample and/or mood boards to convey the style or feel of a design concept for a specific purpose.
- use a digital camera to take images of colour and texture, then use appropriate presentation software to create a mood board.
- create a pattern using a particular element of design as the focus e.g. line and then apply the pattern to two different designed objects.
- sketch an object which gives an impression of having a particular texture, when in reality it is quite different.
- design two contrasting looks using colour and shape on a photocopy of a sketch of a plain cabinet, bookshelf or bag.

Social

- identify designs which improve an individual's or communities well-being such as universal design (also called 'inclusive design'), fair trade or ethical production methods and suggest how elements of this design practice could be applied to their own design decisions.
- use historical or cultural precedents as a source of inspiration for designs, e.g. Art Deco inspired design brief.
- find an innovation that has been developed in response to social issues, such as the anti-terrorism garbage bin or sound proof windows and discuss how the needs of the community met by this innovation.
- create a futures wheel (graphic organiser) to look in to the future and consider the consequences of a product design on individuals, society and the environment.



Technological

- identify the impact of digital technologies in enhancing the practice of design at each stage of the design process, e.g. CADD, 3D printing and other digital fabrication techniques as well as digital imaging and printing processes.
- complete a PMI analysis of a range of social media and internet enabled tools which support designers in sharing, developing markets and publicising their work.
- identify two designs where technology has had an impact
- discuss whether technology has a positive or negative impact on classic design.
- modify a design from a previous era to improve it by incorporating appropriate technology.

Overarching questions

Consider the following questions when developing a design:

- What are the functions of the product ?
- Will the design be safe ?
- What 'ergonomic' factors need to be taken into account ?
- What materials are available ? What materials will be the most suitable?
- What will be the overall size ?
- How long will the product take to make ? What is the best shape/form for the solution ?
- What colour scheme will be most appropriate ?
- What special features need to be built into the design ?
- What designs already exist ? Could they be improved ?
- Where research material be found to help design the product ?
- Who is going to use my product ?
- Is the proposed solution likely to solve the design problem ?
- What equipment and tools will I need to make the product ?

Design practice

Key Concepts

The focus is on knowledge of design practice and pathways in relevant materials area to understand how designers approach the design process and design factors within their work and the numerous study and career pathways within the design field.

Examples of learning activities

- conduct an investigation into the work of a local designer to collect and present information relating to the designer's inspirations, use of elements and principles of design, materials and techniques and environmental considerations. An extension activity could compare and contrast this with a designer from a broader area or who focuses on different techniques with similar materials.
- investigate the concept of 'slow design'.



- visit a local design centre or makers' outlet to investigate the range of designers working locally.
- summarise the key elements of the design practice of designers who use a material that learners are working with using case studies on the internet.
- investigate the availability of local co-operatives where design space may be available to use or hire.
- choose a designed item, such as a cutlery tray and find four examples that can be purchased from a range of designers, from an individual, hand produced item to a mass produced item found in a department store. Prepare a poster which compares the likely design and production processes of each item.
- investigate websites of designers to identify their marketing strategies and examine web-based platforms for designers (e.g. *Etsy*), crowd funding (e.g. *Pozzible*) and social media (e.g. *Twitter*, *Instagram* and *blogs*) to support early career designers.

Area 3 Implementing projects

Key Concepts

Project management

Learners use project management tools and strategies to plan and implement practical projects. Learners apply a systems approach to structuring a plan for the implementation of a project. This approach can be used to develop a plan which results in the production of a prototype as the end result, or it may go on to an end point of the full production of a designed object.

Examples of learning activities

Learners

- develop a sequence plan for production showing the stages for production, tools, equipment and machines to be used and safety procedures to be followed; include quality measures and checks and a modifications section.
- choose at least two different pieces of equipment to be used during the production of the project and complete a written risk assessment that identifies the risks and hazards, assesses the level of risk and eliminates or controls the risk.
- complete a materials list that includes the costing for all materials, notions and fixtures and fittings to be used for a design project.
- develop a Gantt chart for a proposed project or use an electronic calendar to schedule dates which includes reminders to stop and reflect on the progress of a project and refine plans as needed.
- complete a journal/logbook that documents the activities undertaken to manage the production processes and progress made while making the prototype/product; photographs and written information, that could include annotations, should be used to show management of risks in the use of tools, equipment and machines as well as the different stages of production (this activity links with the production phase of the design process also)



SUPPORTING STUDENT RESPONSES AND ELABORATIONS

The work requirements outlined in the course document should form the minimum assessment tasks for each of the units. Teachers will need to acknowledge these requirements when designing their scope and sequence however, additional assessment (particularly of a formative nature) may be included to support and enhance the learning program. The learning activities, described in the preceding section, may support, facilitate and enrich learners' understandings in preparation for completion of the following work requirements.

Major Project:

Regardless of specialisation, all learners must complete a minimum of one major project. Learners must document their major project by creating a design folio which gives evidence of their response to the design brief including investigation of the impact of design factors, documentation of their design development and production phases, incorporating appraisal and ongoing refinement and details of the final solution.

Minor Projects:

Learners need to complete the specified number of minor projects to complete this course. Learners may complete one of their minor projects or work on a mini project as a member of a group to scaffold the learning and documentation for the major project.

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Guthrie, K, 2012 *Visual communication and design Workbook : VCE units 1-4 (2nd Edn)*, Nelson, Cengage Learning, South Melbourne, Australia

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DIGITAL RESOURCES

- Critical thinking graphic organisers
 - Digital*
<https://www.mindmeister.com/>
<http://www.simpleapps.eu/simplemind/desktop>
 - Templates*
[http://www.itcouldnthappentome.com.au/strategy-tool/supported by Teacher Resource](http://www.itcouldnthappentome.com.au/strategy-tool/supported%20by%20Teacher%20Resource)
<http://www.itcouldnthappentome.com.au/assets/Uploads/8.Strategy%20tool/Strategy-tool.pdf>
 - <http://www.enchantedlearning.com/graphicorganizers/>
 - Ergonomics and functional needs
 - <http://designingwithpeople.rca.ac.uk/>
 - <http://www.ergonomics4schools.com/faqlist.htm>
 - <http://designandlife.com/main.html>
 - Environment and sustainability
 - <http://storyofstuff.org/>
 - <http://www.theseconlifeofthings.com/>
 - <http://www.designother90.org/about/>
 - Aesthetics - moods boards
 - http://www.onlinedesignteacher.com/interior_design/presentation_boards.html#.VdUt-425iP8
 - <http://essenziale-hd.com/?s=mood+board>
 - Social
 - Future wheel
<http://www.emergentfutures.com/wpdl/Emergent%20Futures%20Consequence%20Wheel%20Tool%20Download.pdf>
 - Historical Furniture styles
<http://www.techitoutuk.com/knowledge/designhistory/historyws.html>
 - Technological
 - <http://www.thecoolist.com/the-tech-of-fashion-10-ways-technology-drives-tomorrows-fashion/>
 - Design
 - <http://www.designsponge.com/>
 - <http://design-milk.com/>
 - <http://www.thecoolhunter.com.au/design/>
 - <http://www.designthinkingforeducators.com/>
 - <http://dia.org.au/index.cfm?id=186> Design Institute of Australia
 - <http://www.technologylearner.com/>
 - Project Management
 - http://hsc.csu.edu.au/ipt/project_work/3286/project_management.htm
- General
- <http://www.bbc.co.uk/schools/gcsebiteize/design/>



AUDIOVISUAL RESOURCES

There are a wide variety of programs on sites such as YouTube.

DVD Video Education Australasia (VEA), Australia

Design

- Creative Thinking Skills (DVD) 2010,
- Design: A Team Approach (DVD) 2010, Video Education Australasia (VEA), Australia.
- Design Works (DVD) 2003, Avenue Education, Australia.
- Developing a Design Brief (DVD) 2009, Classroom Video, Australia.
- Elements & Principles of Design (DVD) 2004, Video Education Australasia (VEA), Australia.
- Evaluating a Product (DVD) 2008, Classroom Video, Australia.
- Inclusive Design: How Industry Designs for the User (DVD) 2010, Video Education Australasia (VEA), UK.
- Inspiration for Design (DVD) 2005, Video Education Australasia, Australia
- Redesigning a Product (DVD) 2010, Video Education Australasia (VEA), Australia.
- Intelligent Design and Technology (DVD) 2008, Classroom Video, UK.

Design for the Environment and Sustainability

- Choosing Sustainable Materials: Product Design and Sustainability Series (DVD) 2009, Video Education Australasia (VEA), UK
- Design for Sustainability (DVD) 2008, Video Education Australasia (VEA), Australia.
- Designing with Recycled Materials: Product Design and Sustainability Series (DVD) 2009, Video Education Australasia (VEA), UK.
- Life Cycle Assessment (DVD) 2003, Video Education Australasia (VEA), Australia.
- Product Design and Sustainability Series (DVD) 2009, Classroom Video, UK.
- Sustainable Packaging (DVD) 2010, Video Education Australasia (VEA), UK.

Ergonomics

- Ergonomics and Design Matching Products and Tasks with People (DVD) 2002, Classroom Video, Australia.
- Ergonomics in the Real World (DVD) 2009, Classroom Video, Australia.
- Innovation and Emerging Technologies (DVD) 2009, Classroom Video, Australia.

Product Design

- Designing, Manufacturing, Evaluating a Product (DVD) 2007, Classroom Video, Australia.
- Promoting Your Designs (DVD) 2010, Video Education Australasia (VEA), Australia
- Furniture Design and Wood
- Designing a Chair; Sitting Pretty (DVD) 2002, Australasia.
- 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 (DVD) 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 (DVD) 2001, Classroom Video, Australia.



Fashion Design and Textiles

- A Textile World (DVD) 2003, Video Education Australasia, Australia.
- Eco Fashion. Is Green the New Black? (DVD) 2009, Classroom Video, Australia.
- Fashion: How Green are your Jeans? Series (DVD) 1996, Video Education Australasia, Australia.
- Hunter Gatherer – A Case Study in Apparel Design & Manufacture (DVD) 2002, Video Education Australasia, Australia.
- Part 2 – A Textile World, All About Textile Series (DVD) 2003, Video Education Australasia, Australia.

Other Videos

General design

- Genius of Design: The Compelling Five part Series on Designs that Shaped Our Lives (DVD) 2010, BBC 2, UK.

Fashion

- The Closet Tales of Australian Fashion (DVD) 2007, SBS, Australia.
- Yarn Construction and Specialist Yarns: Talking Textiles (DVD, YouTube) 2010, Boulton-Hawker Films Ltd, UK.
- Blood, sweat and T-shirts: episodes 3 & 4, 2008, BBC.
- Coco Before Chanel (DVD) 2009, Warner Bros, France.

Metals and plastics

- Essentials of Design and Technology Skills, Drilling, Lathes and Soldering (DVD) 2004, Video Education Australasia, Australia.
- Forming and Shaping Metals; Heating, Cold Forming & Milling (DVD) 2002, Classroom Video, Australia.



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