

YEARS 7-8

# TECHNOLOGY AND DESIGN

BJ Jacobs



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Science Press

This book is dedicated to students who love to 'fly' and teachers who want to facilitate the learning opportunities to do so.

© Science Press 2009  
First published 2009

Science Press  
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# To the teacher

## Rationale

The needs that inspire the design activities of students, the facilities available at each school and the expertise and training of each teacher will determine the reference material and skill-based texts required for use in all Technology courses. These could be different for each student and each design activity. Numerous texts are available which detail procedures with various materials, many written by experts in their fields; this text does not attempt to duplicate those.

After pressure from various sources to put my ideas on paper, I made a number of failed attempts to duplicate the type of texts mentioned above. Eventually, though, this book for introductory Technology subjects developed along completely different lines.

It meets a range of other needs for students and teachers – for example, given a problem, job, design project or opportunity for design, where do I start, how do I proceed and what do I do next? It is intended to initiate logical thinking and to put practical boundaries on design options. It attempts to promote lateral and creative thinking in both teachers and students while demonstrating that the only real limit to success is imagination.

This book relates the process of design to the design projects provided. Computer experiences are involved in varying amounts in each project but teachers are free to select projects that give their students the required computer experience over the whole course. Materials and technologies can also vary depending on the facilities and resources available.

## An individualised approach

This text is arranged in such a way that teachers can give as much or as little direction to students as they wish. Each student, working from their own copy of the text, can develop their own design projects, referring to the various parts of the book as they need them. The entire class can work from the same design brief or individuals or groups can work from different briefs, depending on the teacher's approach and the needs and abilities of the students.




## How to use this book

This book is divided into five main parts.

**Part 1 – Introducing technology and design** introduces the concepts of technology and design by asking – What is technology? What is design?

**Part 2 – The design process** introduces the idea of a process of design and includes activities that show students how to design. A simple design project carries through Part 2 and can be used as an initial short-term project at the beginning of Year 7, when students are formalising the design process they used in primary school. Marking criteria are added as a checklist in the Assessment section of the process.

**Part 3 – Design projects** outlines design projects in a variety of focus areas. They appear in alphabetical order of title. One themed collection is found at the end of Part 3 – Frog Hollow projects.


Each project in Part 3 follows the same steps described in Part 2. The  symbol in each heading within a project directs students to **TURN BACK TO** Part 2 and complete the activities found under this same heading. The availability of further reference or extension material is indicated by the  or  symbol. This directs students to **GO TO** that heading in Part 4 or the sample worksheets in Part 5.



The Frog Hollow projects are described more briefly but students will still need to work through the design process introduced in Part 2. These projects all relate to 'Frog Hollow', an imaginary place described at the beginning of the Frog Hollow projects. Students may even like to substitute their own real place. The Frog Hollow series develops the issues of appropriate technology and environmental sustainability in a real-life situation.

Many of the projects can have a significant component of work that requires computer use to develop expertise and understanding in the use of information and communication technologies (ICT).

The design situations in some of the projects are very broad. Teachers and/or students may like to narrow them down by imposing limitations to meet a specific need or the facilities available. Some of the stand-alone projects could also use the guidelines of Frog Hollow to put them into a realistic setting.

**Part 4 – Technology for design** contains rules of thumb for designers and reference material that may be difficult to find elsewhere. There are also extension activities to motivate investigation or broaden student understanding of each issue. Whenever the  symbol is found throughout the book, it is directing students to a heading in Part 4. The headings in Part 4 are in alphabetical order.

**Part 5 – Design folio worksheets** contains a simplified guide through the design process outlined in Part 2. It includes worksheets that can be used by students as they work through any design project. These pages can form the backbone of a student folio.

## Managing activities

Throughout the book there are various suggestions for research and extension activities for students. These are of three types – postits, webquests and workstations. These activities add depth to design projects and technology content by examining issues, values, historical and cultural dimensions. Although these activities are found linked to particular projects the ideas can also be used in other projects. Some activities are occasionally repeated in different projects because they are relevant.

### Post-its

Post-its are activities that:

- ***prompt technology literacy, e.g. a research task that requires a written, oral or graphic outcome***
- ***extend students – deeper, more broadly, laterally – beyond the immediate project but within the focus area***
- ***provide homework options or group work possibilities within the focus area.***
- ***provide related activities to complete 'while the paint dries'.***

Post-it activities can use paper or web-based sources of information or even interviews and visits.

## Webquests



**Webquests require students to search the World Wide Web for information and develop it into an outcome that usually requires analysis and synthesis. Searching tips and activities are outlined in Part 4.**

Webquests are excellent for finding up-to-date information about innovations and emerging or specialised technologies. They can also be used for case studies of designers, products or focus areas.

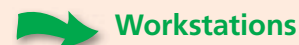
A summary list of the Webquests included in this book is provided in the table on pages xiv and xv. These webquests are not fully developed in this book but by searching for the topic of the webquest (and include the word webquest) in double inverted commas a search will often lead to a fully developed webquest for your students to complete (e.g. try searching for 'our indigenous garden webquest'). Sometimes a search for the topic without the word 'webquest' will work best. You can then outline what you would expect your students to find and do or suggest some sites for them to visit.



## Workstations

Workstations can be set up in the classroom to display items in a particular theme or to manage resources for research and/or tools to be shared. A more complete description is given in Part 4.

Try the system now – turn to Part 4: Workstations.



## Summary of projects

The table on pages xvi and xvii lists the design projects found in Part 3 and outlines the product, system or environment being designed, the major theme, the recommended group size, and possible major materials or technologies that could be used for each.

Textile-based or similar materials could include fabric, fibres, leather and soft plastics. Graphics materials can be computer- or hand-generated graphics. Mixed materials could be as diverse as paper, card, gardening materials, Lego, Meccano or found objects.

## Technology-related content

When learning about technology students complete projects with quality solutions and a design folio in a variety of areas including:

- built environment
- products
- information and communication.

By completing these projects students will learn design-related content integrated with specific content related to at least six technologies.

The following lists group the design projects from Part 3 under the technology-related content that could be specifically taught with them. Many projects could include more than one important technology or could be modified to involve another technology. Some projects could be used in a variety of areas.

## Animal production

Small-scale agricultural garden  
Frog Hollow - New shed

## Control

Balancing act  
Wheels and levers  
Wind power  
Frog Hollow - Solar lighting  
Frog Hollow - Watering system

## Electronics

Balancing act  
Tour guide  
Wheels and levers  
Wind power  
Frog Hollow - Solar lighting  
Frog Hollow - Watering system

## Food

Bush banquet  
Fast food  
Managing compostable waste  
Marketable agricultural product  
Sausage sizzle  
Small-scale agricultural garden  
Wrap it up  
Frog Hollow - Open-fire cooking

## Graphics

Bedroom alteration  
Children's book  
Designer labels  
Emergency!  
Getting it all together  
Greeting cards  
Landscape design  
Library leaflet  
Local area board game  
Marketable agricultural product

Paper engineering  
Parcel in the post  
Puppets  
Safety first  
To market, to market!  
Tour guide  
Wrap it up

## Information

Children's book  
Designer labels  
Emergency!  
Getting it all together  
Landscape design  
Library leaflet  
Local area board game  
Safety first  
To market, to market!  
Tour guide

## Media

Children's book  
Local area board game  
Safety first  
Tour guide

## Metals

Access  
Balancing act  
Bedroom alteration  
Body decorations  
Carriers and holders  
Miniatures  
Wheels and levers  
Wind power  
Frog Hollow - Letterbox  
Frog Hollow - Loaded up  
Frog Hollow - New shed  
Frog Hollow - Rock mover

## Mixed technologies

Access  
Balancing act  
Bedroom alteration  
Body decorations  
Carriers and holders  
Getting it all together  
Local area board game  
Marketable agricultural product  
Puppets  
Wheels and levers  
Frog Hollow – Creek crossing  
Frog Hollow – Dunny design  
Frog Hollow – New shed  
Frog Hollow – Rock mover

## Models

Access  
Balancing act  
Bedroom alteration  
Frog Hollow – Creek crossing  
Miniatures  
Puppets  
Wheels and levers  
Wind power  
Frog Hollow – Letterbox  
Frog Hollow – Loaded up  
Frog Hollow – New shed  
Frog Hollow – Rock mover  
Frog Hollow – Solar lighting

## Plant production

Landscape design  
Marketable agricultural product  
Small-scale agricultural garden  
Frog Hollow – Loaded up  
Frog Hollow – Self-sufficiency  
Frog Hollow – Watering system

## Polymers

Balancing act  
Bedroom alteration  
Carriers and holders  
Getting it all together  
Local area board game  
Miniatures  
Parcel in the post  
Puppets  
Wheels and levers  
Wrap it up  
Frog Hollow – Letterbox  
Frog Hollow – Watering system

## Textiles

Balancing act  
Bedroom alteration  
Body decorations  
Carriers and holders  
Designer labels  
Getting it all together  
Parcel in the post  
Puppets  
Sunwise

## Timber

Access  
Balancing act  
Bedroom alteration  
Carriers and holders  
Local area board game  
Managing compostable waste  
Miniatures  
Puppets  
Wheels and levers  
Wind power  
Wrap it up  
Frog Hollow – Creek crossing  
Frog Hollow – Letterbox  
Frog Hollow – Loaded up  
Frog Hollow – New shed  
Frog Hollow – Rock mover

## Table of technologies

Project	Technologies													
	Animal production	Control	Electronics	Food	Graphics	Information	Media	Metals	Mixed	Models	Plant production	Polymers	Textiles	Timber
Access														
Balancing act														
Bedroom alteration														
Carriers and holders														
Frog Hollow – Creek crossing														
Frog Hollow – Letterbox														
Frog Hollow – Loaded up														
Frog Hollow – New shed														
Frog Hollow – Rock mover														
Local area board game														
Managing compostable waste														
Miniatures														
Puppets														
Wheels and levers														
Wind power														
Wrap it up														
Body decorations														
Bush banquet														
Designer labels														
Emergency!														
Fast food														
Frog Hollow – Dunny design														
Frog Hollow – Open-fire cooking														
Frog Hollow – Self-sufficiency														
Frog Hollow – Solar lighting														
Frog Hollow – Watering system														
Getting it all together														
Greeting cards														
iProject – children's book														
iProject – library leaflet														
Landscape design														
Marketable agricultural product														
Paper engineering														
Parcel in the post														
Safety first														
Sausage sizzle														
Small-scale agricultural garden														
Sunwise														
To market, to market!														
Tour guide														



## Table of webquests

Topic	Objectives	Reference	Page
Design process.	List of alternative and extra words for the design process steps in this book.	Part 2	11
Circus balancing acts.	Make posters for the classroom or an inspirations scrapbook.	Balancing act	28
Smart fabrics, smart textiles.	Make a flyer advertising a garment or accessory that uses 'smart fabrics' or 'smart textiles'. Or write a report to describe some properties and uses of 'smart fabrics' or 'smart textiles'.	Body decorations	33
Food for bushwalkers, Scouts, Guides or camping.	Make a computer-generated recipe card for the recipe you would like to make.	Bush banquet	35
Techniques used for decorating your chosen material.	Create a table to compare three different techniques for ease of use, cost, aesthetics.	Carriers and holders	37
Issues of copyright and plagiarism when publishing your story.	Write a list of the issues you find and rules you need to follow. Discuss how you could avoid the pitfalls.	Children's book	39
Images of clothing logos and labels.	Save these images and change them slightly to create an original version.	Designer labels	40
The role of engineers in emergency situations after natural disasters.	Create a collage of words and pictures that show the work these engineers are involved in after natural disasters.	Emergency!	43
Storage methods for foods – drying, freezing, refrigeration, bottling, vacuum packaging.	Describe five basic rules for each method to avoid food deterioration.	Fast food	44
The '10 000 steps a day walk'.	Write down the benefits and drawbacks of taking part in this program. Count your steps each day with a pedometer. Present a bar graph showing your daily step count for one month.	Getting it all together	47
Email and online greeting cards.	Present a table with 'for' and 'against' columns for a class debate about sending online greeting cards. Debate this issue in class.	Greeting cards	49
Team work skills, group work skills.	Use one or two of the skills you find as you work together in your group projects.	Landscape design, Sausage sizzle	50, 71
Landfill solutions.	Write a letter to your local council or member of parliament to outline one environmentally sustainable option to be introduced into your area.	Managing compostable waste, Wrap it up	57, 87
ABC shows about gardening and agriculture.	List the issues and themes that are relevant to your design product.	Marketable agricultural product, Small-scale agricultural garden	59, 73
Nanomachines, nanotechnology.	Sketch a nanomachine and on the same page, at the same scale, sketch a pinhead.	Miniatures	61
Paper engineering.	Classroom display of paper engineered products made by your class.	Paper engineering	62
Manufacture for recycling, product life cycle.	How would you promote the use of such products?	Parcel in the post	65
Safety education.	Complete an online safety course.	Safety first	69
Our indigenous garden.	Design a garden using only native Australian plants.	Small-scale agricultural garden	73
Innovations in designing for solar protection.	Make a list or a collage of the sorts of products that now come in sunsafe materials.	Sunwise	77
Starting a small business.	List of the things you will need to remember.	To market, to market!	78
Innovations to improve the lifestyle of aurally or visually-impaired people.	What issues will you need to consider when designing your tour guide?	Tour guide	81

Topic	Objectives	Reference	Page
Engineering careers.	What subjects will you need to do at school to become an engineer? How do the science and maths subjects you are doing now relate to engineering and engineering-related fields of work?	Wheels and levers	83
Principles of aerodynamics, flight.	Draw labelled diagrams to explain how planes fly.	Wind power	84
Fords, culverts, small-scale bridges.	Create a collage of images of creek crossings to share with the class.	Frog Hollow – Creek crossing	93
Toilet designs for remote areas, developing countries.	What are the benefits of recycling biodegradable wastes?	Frog Hollow – Dunny design	94
Safety hazards of carrying heavy loads.	Are there safety standards for fruit pickers?	Frog Hollow – Loaded up	99
Energy-efficient building design.	Write a list of things to consider so your shed design keeps the chooks cool in summer and warm in winter.	Frog Hollow – New shed	101
Preparing food over open fires.	Make a list of hints, tips, guidelines and suggestions.	Frog Hollow – Open-fire cooking	103
Bush cooks.	Bush cooking and cooking bush foods are different things! What is the difference?	Frog Hollow – Open-fire cooking	103
Solar and wind energy as an alternative to mains power on farms.	List the benefits and drawbacks of using mains power for farm energy needs.	Frog Hollow – Solar lighting	107
Alternative methods for moving water.	Document ways to avoid the use of non-renewable fossil fuels in your watering system design.	Frog Hollow – Watering system	109
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## Table of projects

Project	Design brief <i>Design and make a/an:</i>	Theme	Group size		Area of study			Technologies														
			Individual	Small group	Class group	Built environments	Products	Information and communication	Animal production	Control	Electronics	Food	Graphics	Information	Media	Metals	Mixed	Models	Plant production	Polymers	Textiles	Timber
Access	Structure to allow easier access.	Building design for the disabled.																				
Balancing act	Toy that uses balance.	Working with gravity.																				
Bedroom alteration	Alteration for your bedroom.	Indoor environments.																				
Body decorations	Item of clothing, jewellery, hat, shoes.	Clothes and accessories.																				
Bush banquet	Banquet picnic lunch.	Catering outdoors.																				
Carriers and holders	Device to carry or hold something.	Carrying and holding things.																				
Children's book	Personalised children's storybook.	Databasing and mail merge.																				
Designer labels	Logo and label.	Clothing labels.																				
Emergency!	Plan for evacuation.	Handling emergencies.																				
Fast food	Healthy fast-food product.	Healthy food habits.																				
Getting it all together	Health program and prompter.	Being fit and healthy.																				
Greeting cards	Set of cards for mass production.	Manufacturing processes.																				
Landscape design	Landscape plan.	Outdoor environments.																				
Library website	Leaflet about the school library.	Effective word processing.																				
Local area board game	Board game.	Local area.																				
Managing compostable waste	System for managing compost.	Environmental issues.																				
Marketable agricultural product	Value-added product and advertising.	Value-added products.																				
Miniatures	Method to display miniatures.	Working to scale.																				
Paper engineering	Decorative but useful object.	Making paper do work.																				
Parcel in the post	Protective package.	Appropriate packaging structures.																				

			Group size			Area of study		Technologies														
Project	Design brief <i>Design and make a/an:</i>	Theme	Individual	Small group	Class group	Built environments	Products	Information and communication	Animal production	Control	Electronics	Food	Graphics	Information	Media	Metals	Mixed	Models	Plant production	Polymers	Textiles	Timber
Puppets	Puppet for a children's story.	Entertainment of children.																				
Safety first	Advertising campaign.	Advertising strategies.																				
Sausage sizzle	Food production line.	Food manufacture and marketing.																				
Small-scale agricultural garden	Agricultural garden.	Plant production.																				
Sunwise	UV protection garment or item.	Skin cancer concerns.																				
To market, to market!	Business structure and market space.	Marketing processes.																				
Tour guide	Audio tape and booklet commentary.	Communication technologies.																				
Wheels and levers	Device that uses wheels and levers.	Using mechanisms.																				
Wind power	Wind-powered device.	Using wind power.																				
Wrap it up	Food package.	Food safety and marketing.																				
Frog Hollow – Creek crossing	Method for crossing creek.	Building structures.																				
Frog Hollow – Dunny design	Total waste management system.	Environmental sustainability.																				
Frog Hollow – Letterbox	Letter and deliveries box.	Building structures.																				
Frog Hollow – Loaded up	Garment or accessory for loads.	Fruit picking equipment.																				
Frog Hollow – New shed	Shed for tools and chooks.	Building structures.																				
Frog Hollow – Open-fire cooking	Healthy winter meal.	Cooking over an open fire.																				
Frog Hollow – Rock mover	Device for use with a donkey.	Building structures.																				
Frog Hollow – Self-sufficiency	System for selling a product.	Self-sufficiency.																				
Frog Hollow – Solar lighting	Solar-powered lighting system.	Energy issues.																				
Frog Hollow – Watering system	Watering system for orchard.	Environmental issues.																				

# To the student

## How to use this book

### PART 1: Introducing technology and design

In Part 1 you will start thinking about what technology and design are all about and where you could find opportunities for design projects (design situations).

### PART 2: The design process

How to design is explained in detail in Part 2.


Your first design project is to design some bookmarks.

The sample pages in Part 2 show you one way to complete each step as you design and redesign your bookmarks. Blank worksheets are provided in Part 5 to use as the backbone of your design folio.



### PART 3: Design projects

Once you have worked through Part 2, you can start working on a design project from Part 3.

Each step of the process in Part 2 still needs to be followed. The steps are summarised in Part 5 – Design folio worksheets – to help you document your design work. Use Part 5 with each project you do. You can modify each step to suit the project you are working on.

In each project in Part 3, when you find the symbol  you should **turn back to Part 2** to remind yourself of the design process. Then go back to the activities for your current project.

This is when you might start using the bookmarks you designed.

When you find the symbol  or  before a topic heading, it means: **go to** that topic in Part 4 or the sample worksheet in Part 5. More bookmarks may be needed.

Webquests and post-its will start you thinking about issues and technologies related to each project.

### Part 4: Technology for design


The headings in Part 4 are in alphabetical order. Discuss with your teacher which activities you will need to complete for your project.

### Part 5: Design folio worksheets

The sample pages in Part 2 are given as worksheets in Part 5. There is also a summary of each step in the design process in this part. For each design project you do, you can modify these or use them as they are.

Remember:

 **Turn back to Part 2** (process headings)

 **Turn to Part 4** (technology headings)

 **Turn to Part 5** (sample worksheets)



## PART I

# Introducing technology and design

### What is technology?

Technology is more than just computers.

Technology enables us to design, make, evaluate and use products, systems and environments to 'improve' lifestyle. In fact the products, systems and environments we design are also technologies.

### TECHNOLOGY

Technology is 'The skills, knowledge, hardware and procedures for providing useful goods and services'. Source: UNESCO Thesaurus at [www.ulcc.ac.uk/unesco/terms](http://www.ulcc.ac.uk/unesco/terms)

Technology can be real or digital. It also includes 'know how', materials, tools and techniques.

***What is technology? Find three definitions of 'technology'. Create your own answer to this question. Present your answer as a collage of words and pictures. Discuss each picture before you add it to your collage. Why do you think it is technology? Does it fit the description of technology given above? Add this collage to your folio with the heading 'Technology is ...'***



### What is design?

Design is about creating something to meet a need. This usually means that designers have to plan what they are going to do, consider the needs of their client, and work within the constraints of time, money and safety. They also need to consider the social, cultural, ethical and environmental issues that their designs might have.

Sometimes design is the invention of something new but sometimes it involves changing something that already exists to be different or better.

## Meeting needs

Designing is about meeting needs. These needs might include:

- something you need
- something your brother or mother needs
- the needs of a group of people (such as people who use wheelchairs)
- the needs of a community (better traffic flow or a pedestrian mall)
- needs found in a commercial or industrial setting (an inviting shopfront display or a more efficient assembly line)
- a global need (an advertising campaign to cut down on the overuse of fossil fuels at the family level)
- the needs of pets
- the needs of native animals in bushland near you or in remote areas
- the needs of an ecosystem supporting a variety of living things.

Needs and opportunities for design are all around us, we just have to look for them. Once you have found the need, you will be able to work out what to design (the design brief) and why you are designing it (the design situation).

***What is design? Find three definitions of 'design'. Create your own answer to this question. Present your answer as a collage of words and pictures. Add this to your folio with the heading 'Design is ...'***

## Focus areas for design

Technology and design are interrelated. Designers design technologies by using technology.

The three broad areas in which you will be finding and using technology are:

- built environments
- products
- information and communication.

Considerations common to all areas of design include:

- aesthetics
- function
- materials and production processes
- ergonomics and human form
- safety
- scale
- safety
- sociocultural, environmental and ethical issues.

As well as these, each focus area has its own features.

### Built environments

The built environment is about the space and place we occupy and use. We need to modify surroundings for different purposes, communities and cultures. Spaces you use are your home, school and local shopping area. Can you think of others you use?



Designers in this focus area specialise in careers in architecture, environmental planners and engineering, interior design, landscape design and civil engineering.

The work they become involved in includes:

- structural design
- plans
- drawings
- models
- set design
- facilities
- exhibitions
- public access areas
- habitats
- aquaria
- land management
- water management
- environmental management
- plant and animal production.

What would you like to design if you were working in this focus area?

 **Built environments**

## Products

The products focus area includes the objects, systems and artefacts we use. This area also focuses on the production, distribution, use and removal of materials we use for these products. Some products are individually crafted but others are mass-produced.

Designers in this focus area have careers in fields like:

- accessories and jewellery design
- agricultural products
- fashion design
- food technology
- industrial design
- product engineering – mechanical, mechatronics, telecommunications.

The types of products you could design include:

- body adornment and personal expression products
- animal and plant products
- systems for producing animal and plant produce
- clothing
- fashion shows and displays
- food products, menus, food preparation and packaging systems
- food presentation
- diets for special needs.

Can you think of others?

 **Products**



## Information and communication

This focus area is about data and information. Communication involves 'sending' a message, 'receiving' a message and the things that need to happen to make this process work. To do this designers in this area use text, images, audio, video and more. They must understand how information and ideas are accessed, processed and transferred. They use a range of media including written, oral, graphic, and electronic media. The most important thing for designers in this focus area is to understand the needs of their audience.

Designers in the information and communication focus area specialise through careers that include:

- communication media
- information systems
- promotional materials
- software design
- digital media
- engineering – telecommunications, computer systems, software.

Some information and communication designs you might be involved in include:

- radio and video
- signage
- event design
- multimedia
- databases
- information kiosks
- websites
- packaging
- presentations
- brochures
- advertisements
- branding
- digital games
- data management and analysis
- entertainment
- education
- software programs.



Now let us try designing!

