

Science and
Technology K-6

Science & Technology K-6

Teachers' Kit

To assist teachers with the everyday classroom teaching of new syllabuses, the Board of Studies is producing for sale a teachers' kit to accompany the Science & Technology K-6 Syllabus. Use of this kit is entirely optional and the contents are suggestions only, however it is designed to assist teachers by providing high quality teaching resources and suggested lesson formats. The full K-6 Science & Technology Teachers' Kit comprises 39 separate booklets (see below), each targeted at one of the K-6 stages. Twenty-three of these booklets are now available; the remainder will be released soon.

STAGE 1 K-2

Available now

Getting About
Look Around You
Growing Up
Let's Communicate
What's Alive?
Kids Care
Back to Nature
A Place in Time
Sense of Direction

Available soon

Hot or Cold
Toyworld
Picture It
What's For Lunch?

STAGE 2 2-4

Available now

Out and About
Indoor, Outdoor
Mini-worlds
Keep in Touch
Cycles in Our World
Our Australia
Material World
A Look Inside

Available soon

Stuck on You
Making it Easy
Moving Pictures
Eating Out

STAGE 3 4-6

Available now

On the Move
The Best Place to Live
Out in Space
A Change for the Better
What's the Weather?
An Ancient Land
Environment Matters
Switched On

Available soon

Sailing, Sinking, Soaring
Light Up My Life
Visual Ventures
Food for the Tucker Box
Way Out Communication

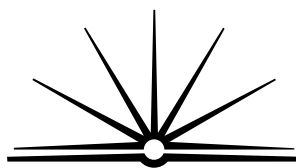


For further information on the kit contact:

The Sales Clerk, Publications Branch, Board of Studies, PO Box 460, North Sydney 2059.

Phone: (02) 9927 8178

Science and Technology K-6 Syllabus and Support Document



BOARD OF STUDIES
NEW SOUTH WALES

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Contents and overview

This syllabus is concerned with the teaching and learning of science and technology for the period of schooling from Kindergarten to Year 6. The document is arranged in two parts: the Syllabus and the Support Document.

The Syllabus

The syllabus describes the nature of science and technology teaching and learning and specifies the educational outcomes that should result from study in this Key Learning Area.

This section of the document is mandatory.

Introduction 1

- describes the Science and Technology Key Learning Area, science education and technology education in the context of this syllabus, the relationship between science and technology and the learning principles that underpin this syllabus.

Rationale 5

- provides an argument for science and technology in the primary curriculum. It also includes a justification for the approach to learning advocated in this syllabus.

Aim and objectives 7

- specifies the focus of learning in this Key Learning Area and includes objectives for knowledge and understanding, skills, values and attitudes.

Learning outcomes 9

- specifies key learning outcomes for the three stages of primary education. They are designed to indicate educational growth towards achieving the objectives of the syllabus.

Content 19

- **Content strands** describe the knowledge and understanding of the learning area within six content strands.
- **Learning processes** describe the nature of the processes that underpin all teaching and learning in this Key Learning Area, ie investigating, designing and making, and using technology.

Links with other Key Learning Areas 27

- describes the relationships of the Science and Technology Key Learning Area with other Key Learning Areas of the primary curriculum.

Assessment and evaluation 28

- provides advice on the means of gathering evidence of, and making judgements about, students' needs, strengths, abilities and achievements.
- provides advice on the means of collecting data and making judgements about the effectiveness of teaching programs, procedures and policies.

Support Document

The support document provides advice on the planning and programming of effective school courses.

Learning and teaching science and technology 35

- provides advice to be considered regarding the nature of the learner, principles of learning, and issues to be considered when programming learning experiences.

School planning 53

- provides guidance for teachers and schools on the organisation and implementation of a whole-school approach to teaching and learning science and technology.

Developing a teaching program 55

- provides suggestions and advice for teachers when developing class programs.

Units of work 57

- provides details of some sample units of work that can be used as a basis for programming science and technology and that illustrate how the learning outcomes can be addressed in each of the Stages 1 to 3.

Teaching strategies 141

- suggests a range of ideas that might be used in programming and teaching science and technology. The units of work refer to these teaching strategies but may be used also in the development of programs based on other approaches.

Suggested resources 228

- provides bibliographic information about book references suggested in the Support Document.

Parent Document

The Board of Studies will produce a parent document for the syllabus, aimed at strengthening the links between learning at home and learning in the classroom. This document will give parents information about

science and technology education and why it is being taught. It will provide guidance about how parents can assist their children develop understanding and skills in this Key Learning Area.

**Science and
Technology K-6
Syllabus**

The Board of Studies has developed
a general policy statement in relation
to the allocation of time across Key Learning
Areas which will be printed in
all primary syllabuses.

While the primary curriculum is divided into six Key Learning Areas, this is not to be interpreted as indicating that each Key Learning Area should have an equal time allocation. In line with NSW Government policy, the Board of Studies encourages schools to give greatest emphasis to English and Mathematics, and to adopt a responsible and reasonable approach which will provide each child with substantial access to each Key Learning Area in each Year.

Introduction

The primary curriculum

Science and Technology is one of the six Key Learning Areas of the primary curriculum. Each of the Key Learning Area syllabuses shares a similar format, is consistent with the other syllabuses in its use of terms and is based on a common set of learning principles.

Schools should adopt an approach which will provide each child with substantial access to the Science and Technology Key Learning Area continuously throughout each year of K-6. Schools should recognise that Science and Technology education has an essential place in the primary curriculum if students are to be adequately prepared for life in the 21st century. It is also necessary to recognise that the Key Learning Area of Science and Technology in K-6 leads to study in two of the eight Key Learning Areas in the secondary curriculum.

Science and Technology Key Learning Area

Science and Technology is the learning area in which all students learn about the natural and made environments by investigating, by designing and making and by using technology. Learning in Science and Technology will draw on and contribute to learning related to the other five Key Learning Areas.

The syllabus recognises the need for schools to address community values and to be responsive to local community concerns. It advocates that primary schools should actively promote close working relationships with parents and that they should strengthen their connections with the local community by seeking increased community involvement and participation.

Components of the Key Learning Area

The aim, objectives, learning experiences and learning outcomes of the Science and Technology syllabus are drawn from science education and technology education.

Science education

For the purpose of this syllabus, science is concerned with finding out about the world in a systematic way. Findings are accepted if they can be verified. Science is not just a body of knowledge but is also a process of investigation. Science seeks to be objective; nonetheless, as a human endeavour, it is affected by human values.

Scientific activity (testing and developing explanations) is generating knowledge at such a rate that even specialists can have difficulty in keeping abreast of developments in their area. Therefore part of science education must be to provide students with the processes and skills required to access this knowledge.

Science education assists students to understand themselves and the environment and provides opportunities for them to develop independent rational thought and responsible action. It emphasises first-hand experiences, investigating, designing, problem-solving and clarifying understandings.

Technology education

For the purpose of this syllabus, technology is concerned with the purposeful and creative use of resources in an effort to meet perceived needs or goals. It extends beyond the tools and technical inventions of a society and involves the application of human skills, knowledge, techniques and processes to expressive and practical problem-solving situations in all aspects of human life.

Technology education assists students to manage and influence technological change and to gain greater control over their lives in an increasingly technological world. It emphasises first-hand experiences, investigating, problem-solving, designing and making and evaluation of technological activity.

Technology education embraces computer and communication technology. This syllabus recognises the need to provide students with experiences which assist them to:

- understand computers by using them;
- understand the nature of communication technology and to become competent mass media users.

In so doing students will appreciate that these technologies influence almost every facet of all our lives and are some of the most significant causes of change for people in the latter half of the twentieth century.

The relationship between science and technology

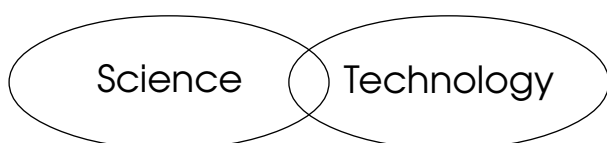
Implicit in the description of *technology* used in this syllabus is the manipulation of materials, energy and other resources. The manipulation of these resources requires scientific understandings, ie understandings of the natural world.

Science and technology are closely related, although the nature of this relationship can depend upon particular learning experiences.

The three examples which follow are provided to illustrate:

- the types of relationships that can exist between science and technology
- the scope of scientific and technological activity proposed in this Key Learning Area.

Example 1: Science and technology may not be closely related.



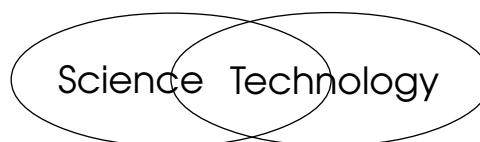
There can be scientific research for which no technological application is known or envisaged, eg searching for a new species of lizard.

There can be technological activity which does not require a particularly scientific understanding or skill, eg designing a logo which is aesthetically pleasing and functional.

In the Science and Technology Key Learning Area students can be involved in:

- *technological activities that are not intended to lead to particular scientific skills or understandings, eg the production of a class newsletter, the construction of character masks or the design of personal workspace*
- *scientific activities that are not intended to lead to particular technological skills or understandings, eg the exploration of types of animals found in freshwater streams or pools.*

Example 2: Science and technology may be somewhat related.



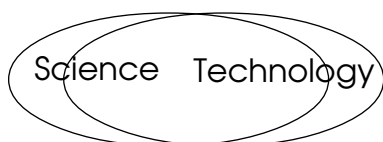
A significant amount of scientific research finds application in a range of technology, eg scientific research related to farming is resulting in changes in animal breeding and farming techniques.

Equally, a significant amount of technological activity draws on the special quality that scientific knowledge has, compared with other forms of knowledge. For instance, while constructing a TV program is a technology in itself, it also uses contributing technologies (such as video and sound recording techniques) and scientific knowledge (such as electronics and coloured lighting).

In the Science and Technology Key Learning Area students can be involved in:

- *technological activities that will also result in the development of scientific skills and understandings, eg the design of stage props that use electricity and lighting*
- *scientific activities that will also result in the development of technological skills and understandings, eg the use of a computer database to record and organise information as part of an investigation.*

Example 3: Science and technology may be virtually indistinguishable.



Science and technology can be indistinguishable when the quest for scientific understanding meets human needs or goals, or when technological activity generates scientific understanding or uses scientific methods.

A considerable proportion of recent research and development is part of industrial and military activity. Such activity can blur distinctions between 'pure' scientific research and particular technologies, eg developing drugs by genetic engineering, developing new plastics.

In the Science and Technology Key Learning Area students can be involved in:

- *activities that will result in the development of both scientific and technological skills and understandings, eg the investigation of the social habits of bees by designing an apparatus that can be used to study their behaviour.*

Science and technology learning experiences

Science and technology learning experiences should be based on the learning principles that underpin this syllabus and are common to other Key Learning Area syllabuses. These common learning principles are that:

- students learn when they are recognised and valued as individuals and social beings
- effective learning should involve the student in interacting, connecting, investigating, communicating, designing and making, doing, reflecting
- learning is enhanced by learning activities which are purposeful, appropriate, challenging, cooperative and rewarding
- learning is enhanced by learning environments which are secure, caring, supportive, structured and interesting.

Science and technology should recognise the nature of the learner and the needs of the diverse learner group. As well as common characteristics students have a number of characteristics that make them different. These differences and special needs are a result of:

- ethnicity
- language
- gender
- socio-economic background
- culture, including religious practices and beliefs
- geographic isolation
- learning difficulties
- special talents
- specific disabilities, eg intellectual, emotional, physical and behavioural.

Science and technology education is based on students experiencing and using the processes of science and technology. That is, the interrelated processes of investigating, designing and making, and using technology are central to science and technology and are experiences that particularly characterise learning in this Key Learning Area.

Within this Key Learning Area students will engage in these processes and as a result will develop their knowledge of a range of scientific and technological concepts. These concepts are embodied in each of the content strands of the syllabus. The content strands are:

- **Built Environments**, in which students learn about the structures and spaces that people construct, modify and adapt
- **Information and Communication**, in which students learn about communication technology and the ways people make, store, organise and transfer images and information
- **Living Things**, in which students learn about people, other animals and plants

- **Physical Phenomena**, in which students learn about phenomena related to energy, space and time
- **Products and Services**, in which students learn about goods and commodities, and the systems used to produce and distribute them
- **The Earth and its Surroundings**, in which students learn about the Earth and its environment, and how people use the resources it provides.

Learning about science and technology will occur in relation to each of the above strands.

Science and technology are integral parts of the modern world. Dramatic and rapid change in these areas is a basic fact of life for all students. For personal, social, environmental and economic reasons, young people must be well equipped to be active participants in our scientific and technological society.

This syllabus will provide learning experiences in the areas of science and technology which will assist in meeting the needs and interests of both students and the wider community.

Meeting the needs and interests of students

Science and technology learning experiences assist students to:

- manage their everyday activities
- utilise opportunities for the development of creativity, flexibility and innovativeness
- understand their world and the things that influence it
- develop their understanding of scientific concepts
- evaluate and use the products of technology
- find, make judgements about and use information effectively
- understand that scientific and technological careers are equally appropriate for women and men
- make informed judgements in relation to issues concerning the natural and made environments
- accept a measure of responsibility for improving the quality of the environment
- more effectively resolve moral dilemmas associated with scientific and technological issues.

Meeting the needs and interests of the wider community

These learning experiences also help to prepare students for making a positive contribution to the future social, environmental and economic welfare not only of Australia, but of the wider world. As informed and educated people they will be required to:

- participate in shaping our future
- respond appropriately to local, national and global, social, economic, environmental and ethical issues
- assess critically the developments in the area of science and technology
- contribute to the continued development of science and technology
- make appropriate career choices.

Learning about science and technology

The syllabus specifies that students will engage in learning experiences which involve both scientific and technological content and processes.

This approach is necessary if students are to be equipped to respond to the growth of scientific and technological knowledge, together with the rapidly changing nature of the world. The curriculum content and teaching methodologies proposed in the syllabus encourage students to be active and flexible learners.

More particularly such an approach will:

- recognise the individual differences of students and accordingly provide them with learning experiences which further develop their scientific and technological understandings and skills

- guarantee that all students will experience a representative sampling of the various content areas which constitute this Key Learning Area
- provide students with a means of better understanding the world through the process of investigation
- allow students to explore how human needs can be met through the designing and making process
- equip students with the skills necessary for selecting and using a wide range of tools, equipment and materials when investigating, designing and making
- ensure students have the skills to access information which is most appropriate for their purpose
- enable students to pose problems and reach appropriate solutions by employing a range of strategies
- capitalise on the fact that students learn best when they are actively engaged in the learning process. The provision of cooperative, hands-on, problem solving activities will assist students to develop strategies for dealing with new and unexpected circumstances and issues.

This approach will also encourage students to express their understandings imaginatively and creatively while acquiring a broad range of practical skills.

Aim and objectives

Aim of the syllabus

The aim of this syllabus is to develop in students competence, confidence and responsibility in their interactions with science and technology leading to:

- an enriched view of themselves, society, the environment and the future and
- an enthusiasm for further learning of science and technology.

Objectives

Knowledge and understanding

Students will develop their knowledge and understanding of:

- Built Environments
- Information and Communication
- Living Things
- Physical Phenomena
- Products and Services
- Earth and its Surroundings
- the process of investigation that people use in order to develop reliable understandings of the natural and made environments
- the process of designing and making that people use in order to satisfy their wants and needs
- the technologies people select and use; how these technologies affect other people, the environment and the future.

Skills

Students will be able to:

- investigate natural phenomena and made environments
- design and make products, systems and environments to meet specific needs
- assess, select and use a range of technologies.

Values and attitudes

Students will engage in learning experiences which will enable them to develop positive and informed values and attitudes:

- towards themselves
- towards others
- towards science and technology.

Learning outcomes

Statements of learning outcomes

Outcomes are the specific, observable indications of learning to be expected of students at the end of a particular stage of a course.

Statements of outcomes clarify the student performance to be assessed, are concrete ways of establishing whether or not an objective has been achieved and can be used to communicate instructional intent to students, parents, employers and the community.

The learning outcomes as described in this section have been developed from the syllabus objectives and are presented in categories corresponding to three overlapping stages of primary schooling:

- Stage 1 (K-2)
- Stage 2 (2-4)
- Stage 3 (4-6).

While the syllabus requires that these outcomes be addressed it should be noted that not all learning outcomes will be achieved by all students at the same time. For example, many students between the years of Kindergarten and Year 2 will achieve and demonstrate Stage 1 learning outcomes. However, some students will be able to demonstrate these outcomes when they begin school, while others may not exhibit these behaviours until later in the primary years.

Statements of learning outcomes have been organised in the following groupings.

Knowledge and understanding of:

- *Built Environments*
- *Information and Communication*
- *Living Things*
- *Physical Phenomena*
- *Products and Services*
- *Earth and its Surroundings*
- *Investigating*
- *Designing and making*
- *Using technology.*

Skills in:

- *Investigating*
- *Designing and making*
- *Using technology.*

Values and attitudes:

- *Towards themselves*
- *Towards others*
- *Towards science and technology.*

Use of the learning outcomes

The learning outcomes can have a number of purposes. They can be used:

- to ensure scope, balance and sequence when **programming** learning experiences
- as a basis for the **assessment** of student development toward the general objectives of the syllabus
- to identify areas of learning that require particular emphasis when programming.

Comprehensive school programs of science and technology will address each of the specified outcomes for each of the Stages 1, 2 and 3.

Objective**Outcomes**

**Knowledge and understanding:
Content strands****Stage One**

Students will develop their knowledge and understanding of:

Students will know and understand that:

Built Environments

- people organise spaces by assembling and arranging components to meet particular needs.
- people alter their environment in response to natural conditions.

Information and Communications

- there are different ways of communicating with others.
- information can be stored for later use.

Living Things

- all living things are different.
- living things grow, reproduce, move, need air, take in nutrients and eliminate wastes.
- the senses are used to receive messages from all around.

Physical Phenomena

- pushes and pulls can make things move and stop.
- living things and machines need energy to do things.
- some things feel hotter and some things feel colder than our bodies.

Products and Services

- products can be created to fulfil specific purposes.
- products can be made, processed or grown.

Earth and its Surroundings

- time can be measured through change and regular events.
- the weather can have a powerful effect on people.
- some living things change according to the seasons.

Stage Two

Students will know and understand that:

- people create specialised environments to meet specific needs.
- structures are built from natural and processed materials and components.
- environments are sometimes modified to fulfil new and different requirements.
- computers are machines that store and process information.
- people use different technologies to organise and communicate information in different ways.
- production technologies have changed over time.
- plants and animals live in environments that supply their needs.
- change occurs throughout the lifetime of living things.
- living things depend on other living things to survive.
- simple machines can make moving loads easier.
- magnets attract some materials but not others.
- sounds are produced by vibrating objects and can travel through materials.
- materials and resources are used to produce goods and commodities.
- manufacturing processes convert raw materials into useful products.
- materials are joined, formed, shaped and finished.
- most natural resources are limited and so need to be used wisely.
- there are benefits and problems associated with human changes to the physical environment.
- most materials come from the Earth and its surroundings.

Stage Three

Students will know and understand that:

- people try to control the conditions in the environments they build.
- people live in communities and build environments to service their common needs.
- both aesthetic and functional factors need to be considered when people make changes to their environments.
- information can be represented in a number of different forms, including graphics, sounds and texts.
- technologies continually offer new ways of creating and sending messages.
- living things show variation within a species.
- the activities of people can change the balance of nature.
- groups of living things have changed over long periods of time.
- there are various forms of energy.
- a complete circuit is needed for an electrical device to work.
- the sun is the source of most of the energy on the Earth.
- light can pass through some materials and not others, and when it does not shadows form.
- there are environmental consequences of production and consumption.
- systems are designed to provide particular services.
- systems are used to deliver and distribute goods.
- there are many physical phenomena which change the environment.
- there are various parts to the physical environment, eg stars, planets, earth, air and water.
- environments on Earth have been affected by technology.

**Knowledge and understanding:
Learning processes**

Students will develop their knowledge and understanding of the process of investigation that people use to develop reliable insights into the natural and made environments.

Students will develop their knowledge and understanding of the process of designing and making that people use in order to satisfy their wants and needs.

Students will develop their knowledge and understanding of the technologies people select and use; how these technologies affect other people, the environment and the future.

Stage One

Students will:

- state the purpose of an investigation.
- give examples of the ways the different senses can be used in observing.
- recognise that discoveries can be made through play, exploring and experimenting.
- demonstrate that tools and equipment can be used to aid observation.

Students will:

- name possible needs and wants of people.
- give examples of how people plan to make in order to provide for their own and others' needs.
- recognise that people plan and make changes in many aspects of their daily lives.

Students will:

- recognise that technological activity affects people and their environments.
- show that equipment should be used with care and safety.
- give examples from their immediate environment that show how resources can be conserved.

Outcomes

Stage Two

Students will:

- demonstrate that investigation can take many forms.
- recognise that the results of investigations can lead to more questions.
- show that designing and making can lead to the need for investigations.
- give examples of predictions that are sometimes supported, sometimes disproved.

Students will:

- recognise that designs are constrained by time, skills, tools and materials.
- identify the forms and components used in the production of a design.
- relate planning and evaluating to each stage of designing and making.
- relate the particular properties of materials to end uses.

Students will:

- explain that technology can be used to help people learn.
- justify the selection of processes, tools, equipment, materials, products and software to meet the requirements of the task.
- understand that the use of tools, equipment, software etc. requires the development of specific skills.
- show that technology can enable people to gain access to, organise and use information.

Outcomes

Stage Three

Students will:

- recognise that investigations may be conclusive/inconclusive.
- describe the social, environmental or economic implications of the investigation of new materials and processes.
- identify investigations which involve discoveries leading to unexpected outcomes.
- show some relationship between the process of investigation and the process of designing and making.
- describe the process of investigation which can involve exploring and discovering phenomena and events, proposing explanations, initiating investigations, predicting outcomes, testing, modifying and applying understanding.

Students will:

- describe the factors that influence design.
- justify the decisions made in designing and making.
- justify the combination of materials and techniques in relation to the properties required for specific end uses.
- explain the need for safe, ergonomically sound work environments.
- identify that new technologies increase the options for designing and making.
- describe the process of designing and making which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments, and evaluating outcomes.

Students will:

- explain that the future must be considered when making choices of particular technologies.
- evaluate technological activity in terms of social and environmental costs and benefits.
- explain that particular technologies are significant causes of change in the way people live.
- describe ways in which resources can be conserved.

Objectives

Outcomes

Skills

Stage One

Students will be able to investigate natural and made environments.

Students will:

- observe, using all the senses.
- explore how things work and engage in guided play.
- undertake an investigation as a result of individual curiosity or as a means of solving problems.
- interpret data and explain their observations.

Students will be able to design and make products, systems and environments to meet specific needs.

Students will:

- name possible needs and wants of people.
- make practical changes that could modify existing products or processes.
- present ideas as to what they might plan as a design proposal.
- combine a variety of materials and images to make simple models, drawings and structures.
- describe to others the strengths and limitations of a design.

Students will be able to select and use a range of technologies.

Students will:

- choose classroom materials and tools appropriate to the activity.
- identify and use with safety the correct tools for specific purposes.
- recognise their own use of technology in the school and home environment.
- maintain and care for equipment in their immediate surroundings and organise their immediate environment.

Outcomes

Stage Two

Students will:

- make accurate observations and describe these observations, or record them as diagrams, tables of data and graphs.
- state the issue or area to be investigated.
- propose explanations using simple observations.
- make a prediction based on data collected by themselves or others.
- devise ways of checking or testing predictions.

Students will:

- describe needs and wants of people in relation to design activities.
- use graphics, models and written data to record the exploration of different ideas for design proposals and to assist making.
- suggest modifications to design proposals to improve the original design.
- organise systems for small scale mass production.
- evaluate materials and processes used.

Students will:

- recognise the appropriate use of tools, equipment, hardware and software.
- use basic construction tools, materials and computerised data bases to refine observations.
- report on the social and environmental costs and benefits of familiar technology.
- show how the technologies in the classroom affect coexistence and cooperative learning.

Outcomes

Stage Three

Students will:

- make detailed observations using appropriate technologies.
- discuss the factors that might affect an investigation.
- devise fair tests.
- identify data which support a particular prediction.
- devise a test that will support or disprove a prediction.
- modify and apply their understanding in the light of their investigation.

Students will:

- use investigation techniques to identify opportunities for design activities.
- develop a design proposal by selecting and refining ideas and justifying choices.
- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task.
- produce a model, prototype, product or procedure to meet a specific design brief.
- test, or propose ways of testing, the extent to which a product satisfies the design intentions.

Students will:

- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function and in order to gather information.
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas.
- use resources with consideration for the environment and adopt procedures which minimise waste.
- identify and report unsafe conditions.
- record the economic, moral, social and environmental consequences of advances in technology.

Values and Attitudes**Stage One**

Students will engage in learning experiences which will enable them to develop positive and informed values and attitudes.

Values and attitudes towards themselves.

Students will:

- demonstrate confidence in themselves.
- have a positive view of themselves.
- persevere with activities to their completion.

Values and attitudes towards others.

Students will:

- be honest in their dealings with others.
- respect the rights and property of others.
- work cooperatively in groups.
- show fair treatment for all.

Values and attitudes towards science and technology.

Students will:

- show informed commitment to improving the quality of their immediate environment.
- be curious about the natural and made environment.
- gain satisfaction from their efforts to investigate, to design and make, and to use technology.

Stage Two

Students will:

- demonstrate confidence in themselves and willingness to make decisions.
- have a positive view of themselves and their capabilities.
- show responsiveness to ideas.
- persevere with activities to their completion.

Students will:

- be honest and open in their dealings with others.
- respect the rights and property of others.
- work cooperatively in groups.
- show a commitment to fair treatment for all.

Students will:

- show informed commitment to improving the quality of the local environment.
- be curious about and appreciate the natural and made environment.
- gain satisfaction in their efforts to investigate, to design and make, and to use technology.
- appreciate the scientific and technological contributions made by Australians.

Stage Three

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions.
- have a positive view of themselves and their capabilities.
- exhibit self-direction in their own learning.
- show flexibility and responsiveness to ideas and evidence.
- initiate and persevere with activities to their completion.

Students will:

- be honest and open in their dealings with others.
- respect the rights and property of others.
- work cooperatively in groups.
- show a commitment to fair treatment for all.
- respect different viewpoints and ways of living.

Students will:

- show informed commitment to improving the quality of society and the environment.
- be curious about and appreciate the natural and made environment.
- develop rational and creative thinking.
- gain satisfaction in their efforts to investigate, to design and make, and to use technology.
- appreciate education as a continuing process.
- appreciate the scientific and technological contribution made by Australians and members of other societies and cultures.

Content strands

The Science and Technology Syllabus has six content strands:

- Built Environments
- Information and Communications
- Living Things
- Physical Phenomena
- Products and Services
- The Earth and its Surroundings.

Learning outcomes are specified in relation to each strand. These represent the outcomes that should be achieved during each stage. The content strands provide:

- **contexts** for learning about science and technology
- a means by which teachers can ensure **scope** and provide **balance** in the selection and organisation of learning experiences for students
- a means by which students can develop their own understanding about the relationship between science and technology.

Built Environments

People create, construct, modify and adapt structures and spaces for a wide range of purposes. The environments they build are an important part of our communities and cultures.

The Built Environment strand is concerned with:

- buildings and the spaces within and surrounding these buildings, eg homes, schools, community facilities and factories, parks and gardens
- natural environments that have been modified to suit particular needs, eg land cleared for farming and altered waterways

- transport systems, eg railways, roads, shipping ports and airports
- the people and organisations that change environments
- the effects of change on made and natural environments
- services provided to communities, eg electricity, water, etc
- aesthetic and functional qualities of built environments
- systems used to control conditions in built environments
- methods used to construct buildings and environments
- the variety of characteristics of refined and processed materials and how these affect their uses.

Information and Communications

Information and communications are fundamental to most human activity. They can be used to collect, store and organise data and so assist in solving problems.

The Information and Communications strand is concerned with:

- the nature of communications
- methods of communicating between individuals, groups and communities, eg personal conversation, telephones, satellite link-ups
- systems of information storage and transfer, eg databases, computer systems, videotape libraries, microfiche
- the people and organisations who produce, use, consume or are affected by information and communications technologies
- structures and products that exist to access, promote and distribute information, eg

magazines, television, films, computer networking, telecommunications

- changes to information and communication technology over time.

Living Things

Living things interact with each other and affect their environments in complex ways. Understanding of people, other animals and plants are fundamental to a wide range of human activity.

The Living Things strand is concerned with:

- the similarities and differences between living things
- the way that living things interact with one another
- the processes that occur within living things
- the way living things adapt to their environments
- the human body as a complex system that needs to be understood and cared for
- the ways people use and manipulate other living things to address their own needs and wants
- how living things change over a lifetime
- how groups of living things change over long periods of time
- how natural environments are affected by technological activities
- the beneficial and detrimental effects of technology on living things
- how environments provide for the needs of living things.

Physical Phenomena

Energy can exist in various forms and can be used to meet specific needs. A considerable proportion of human activity depends on understanding of physical phenomena related to energy, space and time.

The Physical Phenomena strand is concerned with:

- relationships between time, space and movement

- how physical phenomena are used by people to address particular needs
- forces and their effects
- sources of energy
- light and some of its characteristics
- sound and some of its characteristics
- heat and some of its characteristics
- electricity and some of its characteristics
- magnetism and some of its characteristics
- availability of energy resources and the uses people make of the various forms of energy, eg solar and wind
- electrical circuits and their uses
- the systems that exist and the environmental cost of supplying different forms of energy.

Products and Services

People make, distribute, use and consume an enormous quantity and variety of goods and commodities. A considerable proportion of human activity is aimed at providing these products and services.

The Products and Services strand is concerned with:

- the processes people use to produce goods, commodities and services
- products people make, process or grow
- the organisations people develop to produce goods or products
- means of delivery and distribution
- systems designed to provide particular services, eg transport, health, education
- the effect of various products and services on people and organisations
- the management of materials and resources including waste disposal and recycling
- the means by which products are marketed
- the materials and resources used to produce goods and commodities
- the way in which the characteristics of naturally occurring materials affect their use

- how production technologies have changed over time
- how materials are shaped, joined, formed and finished
- the environmental consequences of production and consumption.

Earth and its Surroundings

The Earth is part of a changing system. It is also itself a changing system. In order to preserve life on Earth, there is a growing need to develop understanding of the Earth's characteristics and how people interact with their environments.

The Earth and its Surroundings strand is concerned with:

- the solar system, planets, Earth, moon and stars
- aspects of the physical environment, eg the Earth's crust, its oceans and atmosphere
- natural changes that occur, such as soil erosion, volcanic eruption, climatic changes and movement of water
- the passing of time and the natural events that make people aware of this passing, eg daily cycles, lunar cycles and seasons
- the variety and characteristics of naturally occurring materials
- the methods people use to obtain and process materials
- the methods people use to manage natural resources
- limitations to resources available on Earth
- renewable resources.

Learning processes

Science and technology education requires that students learn about and engage in:

- the process of investigating
- the process of designing and making
- the use of technology.

Investigating

All people engage in the activity of investigating. It is an activity that capitalises on and develops curiosity. It is a core process whereby students develop understandings about natural and made environments.

In the process of investigating the students should develop the following skills.

Exploring and discovering phenomena and events

Exploring and discovering are closely related, are interactive and foster curiosity.

All phenomena and events can be explored. Students can explore in many ways — through the processes of observation, manipulation, discussion, research and directed play.

Exploring is a key element of investigation. It can involve playing and tinkering, thinking, vocalising, pooling information, discussing, internalising, experimenting, designing, manipulating, making.

Exploration may lead to discovery. It involves finding or realising something that was previously unknown to the learner. In an educational setting, discoveries will be a direct result of the students' exploration. These discoveries will often act as a stimulus to further investigation and discovery.

Investigating can be initiated as a result of:

- a sense of curiosity
- a desire to understand, or
- a need for understandings that can be used as a basis for further action.

An integral part of this process is the need to clarify an area of investigation by:

- stating the phenomena or events to be explored

- recognising limitations that may be placed on the investigative process.

Proposing explanations

Students will be required to propose explanations for discoveries they have made. A proposed explanation or inference involves providing a tentative explanation for an observation or set of observations.

In scientific terms a proposed explanation is not an assumption, a supposition or a theory. These proposed explanations should be able to be tested and should state what is to be observed during testing if the proposed explanation is to be supported.

Predicting outcomes

Students will make predictions as part of a search for understanding. Predicting involves making suggestions that something will happen. Predictions are based on selected information and can be an end in themselves.

To predict accurately, careful observations should be made about the relationships between observed events.

Testing and modifying understanding

Challenging and testing predictions is carried out to clarify, or identify, likely outcomes. The results of this process will:

- establish support for a prediction or proposed explanation, or
- disprove a prediction or proposed explanation.

Testing can be carried out in a variety of ways. It is important that students be encouraged to consider and select appropriate means of carrying out tests.

As a result of testing, understandings can be changed or modified. In some cases this process will lead to further exploration and discovery.

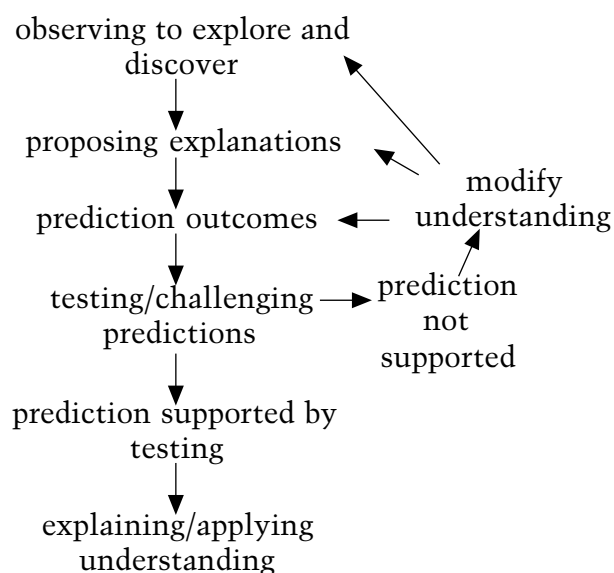
Explaining and applying understanding

Explaining understanding is the interpretation of observations to establish relationships and patterns between them.

Explanations may take the form of written reports or talks and can be supported by a variety of media.

In applying understandings that have been developed as a result of investigation, the student will develop appropriate problem solving strategies. These strategies can be used to solve increasingly more complex/sophisticated problems. Applying understandings encourages lateral thinking and incidental learning.

The flow chart below shows a possible sequence of the investigating process.



It is important to ensure that students are provided with opportunities at each stage of the investigative process to reflect upon their actions, their learning and how such learning relates to other situations.

Designing and making

Designing is an activity in which all people engage. It is a core process through which students try to identify needs and propose practical means by which these needs can be addressed.

Designing and making will involve students in the following activities.

Identifying needs and wants and defining a design task

Design activity can result from:

- an examination of social or environmental issues
- an exploration of needs in the student's learning or living environment
- the analysis of existing products of technology.

An integral part of this process is the statement of a design task. This statement may include:

- objectives of the task
- limitations that apply to the designing and making activity
- criteria to be used for evaluation.

As a result of this activity students should value the tasks they undertake.

Generating and selecting ideas to best meet the design task objectives

This may involve:

- lateral and imaginative thinking
- representing ideas by modelling and drawing
- developing an understanding of space and form
- investigating and selecting appropriate materials, processes and equipment.

It will require:

- predicting possible outcomes for people affected by the proposal
- proposing and evaluating possible solutions
- assessing environmental costs
- testing alternatives
- making decisions.

Using resources to assemble or construct products, systems or environments

This will require:

- detailing a proposal by making further drawings or models
- planning a logical order for implementing the design
- planning a timeline for the task
- organising the tools, equipment, materials, workspaces, human and other resources
- manipulating materials, tools, machines and other resources.

Design activities in the classroom may result in a model, a one-off media product or a procedure for carrying out some task. In some cases it may extend to small-scale mass production.

Evaluating the outcome including processes, products and their social and environmental effects

Students will evaluate their work throughout the designing and making activity and make changes as necessary. This will involve:

- reviewing the adequacy of each stage of their work
- judging the outcome according to the objectives they have established
- predicting the effects on the environment, on users of the product and on other people.

Students may well report to the class on their design and invite the class to help evaluate it. The evaluation should canvass people's feelings about the outcome and possible consequences.

The flow chart below shows a possible sequence of the design process.



It is important to ensure that students are provided with opportunities at each stage of the designing and making process to reflect upon their actions, their learning and how such learning relates to other situations.

Using technology

A significant proportion of human activity involves the use of technologies. As a result of science and technology education students will learn to use a wide variety of tools, hardware, materials, equipment and software appropriately and safely.

In this Key Learning Area, technology will be used:

- as a tool in the learning process. Appropriate technology can extend student capabilities and this enables them to engage more fully in understanding concepts and processes
- as a resource to enable students to develop cooperative skills, risk-taking and a sense of control over technology
- within a context for investigation to allow artificial or restricted worlds to be constructed and explored
- to provide a stimulus for further investigation
- to act as a stimulus for students to design, to modify technologies and to explore alternative uses of particular technologies.

In most instances activities will involve learning about the use of technology, not for its own sake, but as a probable means to an end. During investigating and designing/making activities opportunities arise where the use of technology enhances the learning process. The use of technologies is becoming an increasingly important part of investigation. Designing and making will often involve the use of technology as an integral part of the process. Using technology can also give stimulus for further investigation or act as stimulus to design and make something.

Specific technological knowledge and skills are becoming redundant in increasingly shorter periods of time and there is little value in teaching such knowledge and skills in isolation.

In carrying out investigating or designing/making tasks with the aid of technology, students will need to do the following things.

Understand the nature of the task

This requires setting the task which needs to be accomplished by using technology, in the light of the designing and making or investigating activity.

Select the appropriate technology

This means assessing the needs of the task:

- by understanding the potential and limitations of the technology
- by exploring the alternatives, ie tools and their applications
- by effective decision-making.

Such decision-making should recognise that choices can be made and that some options may be more appropriate than others.

Develop the necessary skills to use the technology

Students will need to develop:

- basic operational skills such as operating equipment, tools and machinery for a clearly defined purpose, eg being able to cut, join and shape materials; use simple computer software packages; create images
- the ability to organise information in a variety of forms and communicate with/to others
- organisational and managerial skills which will involve careful planning of the task, being able to follow correct procedures, developing an appropriate sequence in both time and events, being able to acquire resources, eg where to go, who to make inquiries to, what to purchase or get etc

- skills in caring for tools and equipment as well as for the safety, health and well being of themselves, others and the environment. Aspects that could be considered in this area are:

- work habits that reflect the need to care for and maintain tools, equipment, machines and materials
- recognising the need to conserve and preserve resources
- development of work practices related to the conservation, reusing and recycling of materials and other resources
- an appreciation of the potential damage that particular technologies can cause to oneself and others.

Evaluate the possible benefits of technology in relation to the personal, social and economic effects of its use

This will require:

- assessment of the immediate benefits and costs of particular technologies
- assessment of longer-term benefits, and costs, to society and the environment.

It is important to ensure that students are provided with opportunities at each stage of the process of using technology, to reflect upon their actions, their learning and how such learning relates to other situations.

Links with other Key Learning Areas

Science and technology education involves learning that is unique to each of these component areas. It also will require that students draw upon, develop and apply learning that is associated with other Key Learning Areas. For instance, when students 'investigate', 'design and make', and 'use technology' they will be required to use:

- mathematical skills and understandings
- communication skills and understandings
- understandings of people, societies, environments etc
- practical and creative skills.

Activities in this syllabus will provide opportunities for integration with the following Key Learning Areas.

Mathematics

Mathematical skills are essential for solving scientific and technological problems. Such problems frequently involve concepts of space, number and measurement. The learning activities suggested in the Science and Technology syllabus will provide students with many opportunities to apply mathematical concepts.

Human Society and its Environment

Scientific and technological activity is carried out by people in response to their needs, ie the need to understand, the need to create, the need to solve practical problems. There is an increasing demand that such activity takes into account effects on society and the environment. Learning in Science and Technology seeks to develop in students an appreciation of the relationships between science, technology, society and the environment.

Personal Development, Health and Physical Education

In Science and Technology, students will develop understandings of people, the human body and the technologies used to promote and maintain health. The learning activities will enable students to appreciate the potential effects of scientific and technological activity on themselves and on others, particularly in respect to safety.

English

Scientific and technological activities are essentially social activities and therefore demand use of language. Students will use language to pose questions, clarify ideas and communicate understandings.

Learning activities in the Science and Technology area will reflect the need to understand and use a wide range of scientific and technological language.

Creative and Practical Arts

Scientific and technological activity is both creative and practical in nature. Such activity draws upon qualities and understandings fostered in the arts. In particular, scientific and technological problem-solving is enhanced by lateral thinking, sensitivity to the characteristics of materials and environments, and skills in the control and manipulation of materials and other resources. Learning activities in the Creative and Practical Arts area can be complementary and closely related to those suggested in this syllabus.

In the Science and Technology Key Learning Area, students will be required to make decisions in which they must reconcile such objective considerations as quality, function and cost with more subjective considerations, such as ethics and appearance. In so doing, students will apply all types of learning, and will practise making the types of decisions required of all people in all stages of life.

Assessment and evaluation

Assessment and evaluation are carried out in order to determine the effectiveness of teaching and learning. For the purpose of this syllabus:

- assessment is the process of gathering evidence of and making judgements about students' needs, strengths, abilities and achievements.
- evaluation is the process of gathering data and making judgements about the effectiveness of teaching programs, policies and procedures.

Student assessment

Assessment of student progress is an integral part of teaching and learning, forming the basis for all further action by both teacher and student. Assessment involves the process of observing student learning before, during and after programmed activities, making judgements and deciding on a course of subsequent action. It may be informal, as part of daily teaching strategies, or formalised through activities that indicate student achievement and progress. Both informal and formal assessment need to be systematic and planned.

Continuous appraisal of progress towards the objectives of the program should underpin all activity in the Science and Technology Key Learning Area. Usually it involves the measurement of the degree of student achievement of the syllabus objectives in terms of the outcomes for the stage of the course being assessed. This will involve consideration of students' competence before activities are undertaken, and at all stages of the investigating and designing and making processes.

A range of strategies should be employed to ensure information is gathered regarding:

- ideas being formed and knowledge being gained
- the skills being developed
- the attitudes, values and feelings demonstrated.

Strategies should be appropriate to the range of objectives and be supportive of the learning process.

Practical activities give students the opportunity to apply understandings, knowledge and skills and to allow them to show resourcefulness, interest, ingenuity, originality, creativity, appreciation and perseverance.

Whatever assessment strategies are used, it is important that teachers ensure that tasks are accessible to all students. The language used needs to be suitable for all students including those from non-English speaking backgrounds, and activities should not disadvantage students from Aboriginal backgrounds.

In assessing students from language backgrounds other than 'standard' English, teachers should be aware that these students may be hampered in revealing the full extent of their abilities because of their limited capacity in English.

Assessment strategies

Observation

While students are working in groups or individually, the teacher has the opportunity to observe and note aspects of student learning. Things to look for include:

- choices students make in regard to those with whom they work, the equipment they use and the activities they prefer
- attitude to work, eg perseverance, willingness to address difficulties, organisation, cooperation, independence
- interaction with other students
- gross and fine motor skills
- the degree of care shown in the use of equipment
- the approaches students take to solving problems.

Listening

It is important that teachers listen to what students say and give them time to respond. What students say to the teacher or to other students provides many clues to their understandings and attitudes. Things to listen for include:

- the tone of voice
- the accuracy of language used
- student explanations which often provide immediate feedback on understanding
- requests for help.

Teachers should consider how best to elicit responses from students. Teachers' questions might address:

- problem posing: 'What would happen if... ?'
- fact finding: 'What is it?'
- reason seeking: 'Why does this happen?'
- routine: 'Where do I put this?'
- reassurance seeking: 'Is this right? Is this how you do it?'
- perception seeking: 'What does "energy" mean to you?'

Structured interviews

Structured interviews can provide the teacher with specific information on how the student thinks in certain situations. The student's responses will often reveal strengths, weaknesses, misunderstandings, level of understanding, interest, attitude and abilities. The following are suggestions for improving the quality of structured interviews.

- Talk to students in their classroom so that they are able to respond in a known environment.
- Let the student do the talking. Do not interrupt.
- Try not to use leading questions.
- Ask for explanations rather than facts.
- Listen carefully to responses.
- Give time for answers. Avoid rephrasing the question.
- Encourage verbalisation of thoughts.

Student-teacher discussions

These differ from the structured interviews in that the student's talk is not limited or directed by the teacher's questions and may be initiated by the student.

- Let the student provide the direction for the discussion.
- Do not feel obliged to fill in gaps in the flow of conversation.
- Listen carefully.

Student explanation and demonstration

Provide opportunities for students to give an explanation or demonstration of a particular facet of science and technology to the teacher alone, to another student, to a group of students or the whole class. Teachers should take note of:

- how the student organises the material
- the language used, including both vocabulary and structure
- the depth and breadth of the treatment
- clarity
- the student's confidence.

Samples of student work

This is a technique for assessment commonly used by teachers. Samples should be collected at regular intervals and dated, forming a cumulative file on the student. A careful study of the student's work provides information on:

- the level of understanding
- logical thought processes
- any difficulties experienced
- the need for remediation
- the need for consolidation and/or extension work
- the amount of work completed
- the quality of what the student has done.

Pen and paper tests

These tests are a means of assessing how well older students have acquired certain understandings, knowledge and skills. It is relatively easy to construct tests to assess recall of facts and basic skills. It is more difficult, however, to construct test items that assess:

- the understanding of a concept, eg concept map
- problem-solving abilities.

If these tests are used in the early school years, they should be supplemented by other assessment strategies.

Recording student assessment information

The primary function of assessment is to use this information to improve the quality of both the teaching and learning. This information must therefore be fed back to all those involved: the student, the teacher and the parents. This can be achieved in a number of ways, whether it be formal or informal. The assessment, whatever methods are to be used, needs to include:

- what the student has done and to what extent goals have been achieved
- what follow-up is required to achieve these ends, and
- suggestions for future directions.

The emphasis here will depend on the audience for this information. Strategies should therefore be developed in the school's evaluation policy to facilitate this communication to all those involved.

Reporting to parents is most important because it enables them to understand and participate in their child's learning. The emphasis is on reporting individual progress stating what has been achieved and what direction further progress will take.

Teachers should keep an ongoing record of each student's performance and application in Science and Technology. Assessment procedures should be designed to assist teachers with this task.

Ideally the system of recording information should be manageable, should give a clear indication of the student's development in understandings, knowledge and skills, and should be available to teachers in the following year.

The recording of assessment information is carried out at two levels:

The class level

- Test results and checklists
- Student records of their own work
- Anecdotal information.

The school level

- To provide a basis for reporting on the student's progress
- To provide an indication of where each student/class is in the school's Science and Technology program so that there is an efficient transition from year to year
- To provide some indication of the suitability of the school's Science and Technology program.

Here the nature of the records kept will depend on, and be linked to, the school's Science and Technology assessment and evaluation policies.

Program evaluation

Evaluation should be ongoing.

Students and parents as well as teachers, executive teachers and principals should be involved in this process. Evaluation focuses on the teaching and learning of objectives and processes. It is used to modify the teaching program and procedures.

The evaluation process involves:

- determining the purpose of the evaluation
- deciding on the focus of the evaluation
- deciding on the information to be collected and the methods of collection
- interpreting the information
- using the interpretation to plan for further action
- taking the action planned.

Evaluation processes enable the teacher to make informed decisions leading to more effective teaching. The results of evaluation will assist the teacher in:

- considering the appropriateness of the program
- deciding whether the learning outcomes have been met by the teaching program
- setting student assignments and projects
- grouping the students
- selecting and using resources
- assigning additional work for individual students
- providing opportunities for students to work cooperatively
- pacing the teaching
- providing opportunities for creativity
- recognising other areas where decisions need to be made about teaching and learning
- reporting on student progress
- involving the community.

Sample evaluation questions

Some examples of questions that teachers may address when evaluating teaching programs in science and technology are as follows:

- Does the activity consolidate previous work?
- Is the content appropriate?
- What learning outcomes have been met?
- How effective is the teaching approach?
- Are opportunities provided for students to discuss their science and technology?
- Is the classroom environment conducive to cooperation and supportive behaviour?
- What elements in the classroom are barriers to student learning?
- How is student understanding to be determined?
- Are cultural and individual differences recognised and catered for?
- Are the materials available free of cultural or gender bias?
- Are girls and boys equally involved in all activities?
- Is grouping effective for a particular activity?
- Are the resources appropriate?
- Are the materials and equipment accessible and utilised?
- Can school and community personnel be involved in classroom activities?

**Science and
Technology K-6
Support Document**

Learning and teaching in science and technology

When determining learning experiences there is a need to consider the principles of learning, the nature of the learner, and learning experiences as they apply to this key learning area.

Learning principles

The learning principles that underpin this syllabus are common to other K-6 Key Learning Areas Syllabuses. These common learning principles are listed below with their implications for learning in this Science and Technology Key Learning Area.

Students learn when they are recognised and valued as . . .

individuals

Students learn when their individuality is recognised and valued. Individuals learn in different ways and at different rates according to their maturity, prior understanding and membership of particular groups. Teachers can cater for the favoured learning styles of all students by employing a wide range of teaching and learning strategies. In addition teachers may take into account the earlier experiences of students engaging in this learning area. Earlier experiences of many students may not have included using the language, tools and equipment associated with science and technology.

social beings

Students learn when their membership of various social groups is recognised and valued. These groups may be based on gender, ethnicity and cultural background.

Teachers can encourage students to be aware of the diverse range of contributions made to science and technology by members of all socio-cultural groups. Learning in this context will not only increase individual students'

self-esteem but will also promote an appreciation of other cultures and their achievements.

Effective learning involves . . .

interacting

Students learn by interacting with the social and physical environment. The family, the community, other teachers and the students themselves should be regarded as resources in science and technology. Students can be provided with opportunities to interact in a variety of ways with people and the environment. Opportunities for interaction can occur when schools include guest speakers, parent helpers, visitors or excursions in their programs. Teachers should also provide opportunities for students to interact with learning materials and equipment.

connecting

Students learn by connecting current learning experiences to their existing understandings and prior experiences. This is true in the area of Science and Technology where they relate scientific and technological concepts to their own experiences and needs. When students describe, explain or report what they are doing and thinking, they clarify and develop their own thoughts and communicate these to the teacher and their peers.

When students are exposed to concepts that are too difficult for their level of cognitive development they may make connections that are incorrect. Teaching which provides students with a wide range of developmentally appropriate learning experiences will lead them to refine their scientific and technological understandings.

investigating

Students learn by investigating ideas, and issues. When investigating, students interpret their observations in the

light of their experience and their current capacities. They clarify the tasks to be undertaken, organise and use the data, and gather information from a range of sources in order to find solutions. Students can be encouraged to think independently and be provided with opportunities to negotiate their learning with the teacher and other students.

communicating

Students learn by using language and other forms of communication to construct and explore meanings. They need to use a variety of writing forms and methods of accessing information. Students need also to use specific scientific and technological terminology and understand its meaning. Teachers should build on students' existing competence in the technical language of science and technology. It may be necessary, in some cases, to use a student's first language as this will support ongoing conceptual development. Science and technology education provides a rich source of both conceptual and language development for students. It is essential that science and technology lessons be used to further develop students' language acquisition.

designing and making

Students learn by designing and making in a variety of ways. Designing is a core process of science and technology education through which students try to identify needs and propose practical means by which these needs can be addressed.

doing

Students learn by active participation and first hand experiences. Learning in science and technology is promoted when students are actively engaged in investigating and designing and making.

reflecting

Students learn by reflecting upon what they have been learning and how they have been learning. Through reflection students are able to modify their future attempts at investigating, designing and making and using technology. Reflection should occur throughout the learning processes. By reflecting, students identify the processes they have used and apply this knowledge to new situations.

Learning is enhanced by learning activities which are...

purposeful

Learning is enhanced when students understand the purpose of learning activities. Designing and making and investigating need to address the issues and problems of the wider world if students are to experience meaningful learning.

appropriate

Learning is enhanced when learning activities are appropriate to students' personal, social and cultural qualities and needs. Learning experiences should be appropriate to each student's level of development and previous experiences and understanding. Students may be provided with opportunities to relate their scientific and technological learning experiences to their personal interests.

The planning stage is particularly important. Learning activities may require adaptation in different classrooms as some areas of inquiry may be regarded as inappropriate to students' beliefs or value systems.

Activities should include resources from a range of cultures. They also need to be gender inclusive and, as far as possible, cater for the wide range of student ability.

challenging

Learning is enhanced when students' current perceptions are challenged by learning activities that involve meaningful problems. Learning activities should be designed to provide students with personal challenges and enjoyable experiences. In order for students to maintain high self-esteem the challenges presented by scientific and technological activities need to be achievable goals. Therefore, students must be encouraged to strive for personal achievement rather than compete with their peers.

cooperative

Learning is enhanced when learning activities require cooperation and collaboration as well as individual endeavour. Students can cooperate in investigative and designing and making activities. This allows students to

develop confidence and competence in using subject-specific language and in the manipulation of tools and materials.

rewarding

Learning is enhanced when students achieve success in investigating activities, designing and making activities and their choice and use of technologies. Students learn most effectively when the positive features of their work are recognised or rewarded. Students who do not value themselves or their work because of prior failure may need non-competitive activities to help restore their self-esteem. Many students require a high level of reassurance in their learning environment if they are to continue to develop as successful learners.

Learning is enhanced by learning environments which are...

secure

Learning is enhanced when the learning environment facilitates students' initiatives and learning attempts. A secure environment will allow students to express their opinions and not feel embarrassed about making mistakes. Activities should be encouraged which allow students to take risks and explore ideas, materials and equipment.

caring

Learning is enhanced by caring learning environments in which students feel valued by both their teachers and peers. A caring environment takes into account the emotional and physical needs of students. Teachers need to create a positive classroom environment where all students understand and accept the value of sharing equipment and materials.

supportive

Learning is enhanced when the learning environment supports the nature of the learning activities. A learning environment should provide suitable working areas for students and a variety of materials and equipment with which they can interact.

structured

Learning is enhanced when the learning environment is designed to promote the processes of investigating, designing and making and to facilitate students' use of appropriate technology. In this Key Learning Area students will need many opportunities to learn through interaction with materials and equipment as well as with their teacher and peers.

interesting

Learning is enhanced by interesting and attractive learning environments. Stimulating environments promote students' curiosity and desire to understand the world around them. Teachers can create a learning environment which fosters talents and extends the interests and skills of all students.

The nature of the learner

What do primary students have in common as learners of science and technology?

Students learning in the area of science and technology share common characteristics. These include:

- curiosity and the desire to understand and interact with the world around them
- some understanding of the world around them influenced by their socio-cultural backgrounds and their cognitive development
- some experience in investigating, designing and making and using technology
- some views about how living and non-living things behave or operate.

It is most important for teachers to be aware of this last characteristic because sometimes, when children's views of the world interact with teachers' scientific explanations, they can develop non-scientific interpretations of natural and constructed phenomena. These interpretations have been called children's science. Many students will resist the explanations of adult science in favour of child explanations. Teaching which provides

students with many practical demonstrations and experiences can help teachers to lead students towards more conventional scientific and technological understandings.

The diversity of the learner group

As well as their common characteristics students have a number of characteristics which make them different. Each student's own personal life experiences make him or her unique. As well each student will belong to particular social groupings. These groups are based on:

- ethnicity
- language
- gender
- socio-economic background
- culture, including religious practices and beliefs
- geographic isolation
- learning difficulties
- special talents
- specific disabilities, eg intellectual, emotional, physical and behavioural.

All students will belong to more than one of these groups, which further contribute to their individuality. All students will bring to the learning situation a set of understandings, skills, values and attitudes about science and technology which arise out of their:

- physical
- sensory
- emotional
- social
- aesthetic
- cognitive

level of development.

It is important that teachers also recognise the social and cultural experiences which students bring to the classroom.

Meeting the learning needs of diverse student groups

In order to meet the needs and experiences of all students as individuals and members of particular social groups, teachers may:

- recognise that students learn in different ways and at different rates
- ensure that their teaching content, materials and methods are diverse and relevant, eg that they draw upon technologies from a range of cultures, provide a variety of individual and cooperative learning situations and are appropriate to the level of development of the student
- make and choose resources for classroom use which:
 - (a) avoid sexist, racist or stereotyped materials
 - (b) provide for a range of language competencies
 - (c) consider students with special talents, visual or hearing impairments, physical disabilities and learning difficulties
- ensure that their teaching/learning strategies provide equality for learners and are appropriate to their requirements as individuals and group members. Students with learning difficulties, for example, may need more guidance and support when attempting activities, girls may need more time and exposure to unfamiliar tools and equipment
- develop assessment materials and procedures which recognise the range of needs, interests and experiences of students and are appropriate to each student's level of development
- utilise wherever possible the expertise of such people as specialist teachers, classroom therapists, parents and community members who can support classroom activities and school programs in this learning area.

Girls and boys

The learner group

Girls and boys do not make up two homogenous groups, each with equal experiences, outlooks, models and life chances.

In general the early childhood experiences of many girls and some boys have not included using the language, tools and equipment associated with this learning area.

Given that social factors external to the school environment impact on the gender expectations and aspirations students have for themselves and each other, teachers must build upon all students' needs, interests and experiences. They need to ensure a student is not disadvantaged in his/her science and technology learning as a result of decisions made on the basis of gender.

Meeting the needs of girls and boys in science and technology

Girls in general have not achieved equally in the areas of science and technology with boys. Such a situation has reduced the life choices available to many girls and has led to the loss of a valuable resource at a time when scientific and technological expertise is crucial.

To ensure the needs and interests of both girls and boys are met, teachers need to consider carefully the teaching practices they employ, the learning environments they create and the kinds of resources they use.

Teaching practices

Teachers may:

- demonstrate that investigating, designing and making and using technology are important activities for both girls and boys
- ensure that the needs, interests and experiences of all students are catered for when choosing curriculum content, by using gender inclusive material wherever possible, eg skates, radios, kites
- provide a clear purpose and a social context for all science and technology learning and

illustrate particular concepts by providing examples which are gender inclusive

- encourage students to identify specific ways in which all adults use science and technology, both at work and in the home
- take into account the disparity that exists between the starting points of students engaging in this learning area. Opportunities for 'tinkering', catching-up experiences and activities which develop spatial relationships, particularly for girls, should be provided
- employ a wide range of teaching strategies to cater for the favoured learning styles of all students. These should include small group, collaborative and collective learning experiences and hands-on problem-solving activities
- ensure that group work skills are taught and provide opportunities for boys and girls to experience a variety of roles, eg recorder, questioner, organiser, time-keeper. Roles should not be gender determined and should be rotated so that all students have opportunities to gain these skills
- generally provide a gender balance when establishing groups, though there may be occasions where single sex groupings will prove beneficial. In the area of computer access frequent single sex groupings will prove valuable
- ensure all students' reading and writing capacities are developed across a range of text forms. Their experiences must include familiarity with both factual and expressive writing
- employ a variety of assessment procedures to ensure all students have the opportunity to demonstrate their skills and understandings, eg oral, written, graphic and demonstration.

Learning environment

Teachers may:

- consider the physical organisation of the classroom to ensure all students have equal access to and practical experience of all types of equipment and resources, eg computers, audio-visual equipment and

materials used for designing, making and investigating

- ensure that the physical space of the classroom is not consistently over-utilised by either boys or girls
- ensure that all students are given responsibility for organising, setting up and clearing away the materials and equipment necessary for investigating, and designing and making, activities.

Learning resources

Teachers may:

- where possible select materials, including computer software and videos, which are free from gender bias
- provide a balance of materials catering to the needs and interests of both girls and boys
- utilise the human resources of the community by inviting people involved in scientific and technological pursuits into the classroom to share their knowledge and experiences and to act as role models. Where possible teachers should arrange visits to see workers in their place of work. Women working in these areas should be highlighted so that all students realise that science and technology careers are open to both girls and boys.

Aboriginal students

The learner group

For Aboriginal people, being Aboriginal is not so much having dark skin or obviously 'Aboriginal' features, but having an affinity with the land and with each other. In the context of this syllabus, references to Aboriginal people will include Torres Strait Islanders.

An Aboriginal or Torres Strait Islander is a person who identifies as such and is accepted as such by the community with which he or she is associated. Teachers need to be aware of the diversity of Aboriginal communities in New South Wales.

This diversity is due to variations in geographic location, language and customs, socio-economic conditions and historical experience.

Aboriginal identity and self-esteem

Because of the cultural diversity of Aboriginal Australia, no indigenous word for people can apply to the whole of Australia. Aboriginal people in New South Wales use terms such as Koori, Guri and Murri to express pride in their cultural identity. Local Aboriginal groups should be consulted to determine acceptable local usage.

Self-esteem is essential to successful learning and the pride in identity of Aboriginal students therefore needs to be recognised, maintained and encouraged. Devaluing any aspect of Aboriginal culture will put the Aboriginal student in the untenable position of being forced to choose between home and school values.

Recognising Aboriginal students' cultural attributes and needs

Teaching Aboriginal students successfully involves a high degree of cross-cultural understanding. Some specific issues for teachers to consider are:

- Aboriginal people's experience of schools and schooling in NSW have often been negative and in conflict with the values and attitudes of their culture
- the Aboriginal family is usually extended and community based. Consequently, most Aboriginal children come to school with different views on sharing, personal property, individualism, competition and group relationships
- for complex socio-cultural reasons Aboriginal children have a high incidence of hearing impairment caused by middle ear infections, the effects of which may be intermittent. Teachers should always be aware of this possibility
- one key home experience is that many Aboriginal students come to school speaking Aboriginal English. Where

students use Aboriginal English teachers must respect and encourage the maintenance of this home language if Aboriginal students are to succeed in their education. As not all parents of Aboriginal students will want their children to use Aboriginal English, it is essential that consultation on this issue takes place

- non-verbal communication, body language in particular, is extremely important and widely used in Aboriginal communities. Teachers should refer to the 'Aboriginal English' section of the English K-6 Syllabus
- the incorporation of Aboriginal perspectives in all teaching programs is essential to promote the self-esteem and prevent the possible alienation of Aboriginal students, and to educate all students about the culture and heritage of Aboriginal Australia
- efforts should be made to establish both in the classroom and in the broader school community a socio-cultural environment which promotes Aboriginality
- due to the cultural and socio-economic diversity of Aboriginal communities, it should not be assumed that any one teaching/learning style or method will always be successful with all Aboriginal students
- that an intrinsic part of Aboriginal culture are spirit communications and the power of sacred places. It is important that teachers be aware of and respect this vital cultural difference.

School / community consultation

Few non-Aboriginal teachers will have had the training or experience to develop much understanding of Aboriginal communities. It is therefore vital for all teachers to be aware of the importance of appropriate, effective and ongoing consultation, particularly at the local level.

A range of personnel, support structures and resources is available to assist teachers in both improving the educational outcomes of Aboriginal students and educating all other Australian students about Aboriginal heritage and culture.

Local, Regional and State levels of the Aboriginal Education Consultative Group provide support for Aboriginal education. Teachers might also consult with other specialist service providers such as consultants and community liaison personnel who will not only be able to provide valuable guidance in contacting caregivers but will facilitate communication between the school and its Aboriginal communities enabling teachers to:

- learn from consultants, family and community members working with students about the particular skills, interests and talents of students and plan learning experiences to build on these strengths to promote student self-esteem
- understand the nature and the range of interpersonal and interfamily relationships of the Aboriginal school communities
- establish in the classroom and the broader school community a socio-cultural environment which promotes Aboriginality and an appreciation of Aboriginal culture and heritage. This can involve inviting Aboriginal people from a variety of situations for motivational and awareness raising talks to both staff and students about Aboriginal science and technology including local environmental issues
- invite and promote the participation of Aboriginal members of the community in the classroom to assist Aboriginal students to use their home language, to talk through their understandings of the new words and ideas encountered in their science and technology activities
- recognise bias and generalisations in teaching resources and the mass media.

Aboriginal science and technology

Science and technology in Aboriginal culture are based on detailed and intimate knowledge and experience of the Australian environment.

In the past such knowledge and experience were largely unknown to Europeans, and as a result the impact of European settlement on the Australian environment has been significant and in many ways destructive. In recent years, however, Aboriginal knowledge and experience have begun to be understood

and valued. Environmental attitudes of many other Australians now have more in common with Aboriginal people's respect for the land. It is the responsibility of all educators to emphasise and encourage this process.

The learning environment

Teachers need to consider the following strategies to create a supportive yet challenging science and technology learning environment for Aboriginal students.

- Provide an active learning environment which fosters the curiosity of Aboriginal students and encourages early success through short activities.
- Support the Aboriginal student's need to achieve whilst respecting Aboriginal non-competitive attitudes towards achievement.
- Plan to develop Aboriginal students' understanding of classroom routine and the language of science and technology.
- Assist Aboriginal students to understand the nature and requirements of the task by teacher/peer demonstration and provide students with opportunities to gain skills in small group work.
- Plan cooperative peer group work activities to assist Aboriginal students to investigate, design and make and use technology.
- Create a positive classroom environment where all students understand and accept the value of sharing equipment and tools.
- Ensure that Aboriginal students participate in a variety of group settings. Group settings based on students' friends, relatives, and shared interests are more likely to promote participation in their own learning than streamed ability group settings.
- Encourage Aboriginal students to use computers as a tool for learning to create and explore ideas. The computer allows students to take risks in making changes to texts and graphics without feeling anxious about making mistakes.

Teaching practices

- When incorporating Aboriginal perspectives in units of work teachers should ensure that such perspectives are accurate and do not stereotype Aboriginal people. The best materials will be those which have a local perspective.
- Aboriginal students need to gain competence in using standard English to succeed in education. Teachers should build on students' competence in Aboriginal English to progress towards competence in Standard English, and in the technical language of science and technology. For further guidance on Aboriginal English, teachers should refer to the relevant section of the English K-6 Syllabus —Nature of the Learner.
- Many Aboriginal people regard direct questioning as personally intrusive and threatening. Aboriginal students may not ask direct questions of the teacher, and may need time to formulate responses to questions.
- Available evidence strongly indicates that traditional Aboriginal education employed imitation and demonstration as methods of teaching skills. However, at the same time Aboriginal people also developed problem-solving skills to adapt materials in their environment to meet their needs. These examples make it clear that no one teaching style or method will be infallible for use with Aboriginal learners.
- Group work, the use of concrete examples and collaborative learning, as well as traditional methods, should form part of teachers' classroom practice. Other valuable teaching/learning strategies are those which provide alternatives to the spoken/written word. Students should be provided with the opportunity to present their ideas visually and through dramatic expression.

These approaches provide for the preferred learning styles of most Aboriginal students. They also represent sound teaching practice and consequently will be beneficial for all students.

- Assessment procedures should ensure all students have the opportunity to demonstrate their skills and under-

standings, eg oral, written, graphic demonstration. Such assessment can be done individually or in groups.

- In teaching Aboriginal students it must be remembered that devaluing any aspect of Aboriginal culture may alienate not only Aboriginal students but also their communities.

Students of diverse cultural/ language backgrounds

Learner group

Students with home language backgrounds other than English, or those from different cultural backgrounds, bring to school a diversity of attitude and understandings which impact on their learning of science and technology.

Such students may be:

- learners of English as a second language (ESL)
- learners from non-English speaking background (NESB)
- learners who speak English as a first or dominant language but come from a home culture originally overseas, eg English speaking Indian student from Fiji.

These three broad groups include students who:

- are recent arrivals in Australia who are not familiar with the English language
- are in the early stages of learning English
- can use English to participate in most classroom activities
- can use English in ways comparable to native speakers of English but require additional support to increase their repertoire of competencies in new and extended contexts
- can use English competently but whose socio-cultural experience varies from that of the school.

Students belonging to these groups have very different learning needs. Even within each group teachers will observe a great range of interest, talent and skill amongst students in using language, and in their capacity to design, make and investigate.

Whatever the level of language development of a student they still have to learn science and technology. It is therefore essential that science and technology lessons be used to further develop students' language acquisition.

Relevance of cultural and language background to teaching and learning science and technology

Some specific issues which impact on the science and technology learning of students from diverse cultural and language backgrounds are that:

- their cultural backgrounds may traditionally exclude them from certain activities, especially camps and excursions. The school should communicate with parents to explain the educational value of such activities
- some areas of inquiry may be regarded as inappropriate, according to students' beliefs or value systems, whatever their background. Teachers need to identify and deal with these matters sensitively and with discretion. This applies to students of English and non-English speaking backgrounds alike.

Recognising and meeting the needs of individual students from diverse cultural/language backgrounds

Important factors which contribute to the special needs of students from culturally diverse backgrounds are:

- differences in the use of home and school language
- anxiety caused by separation from caregivers and the community
- students' expectations of school derived from perceptions of their previous education or that of their parents
- teachers' expectations of students to conform to unfamiliar school language and routine.

To meet the learning requirements of students from culturally diverse backgrounds teachers should give particular consideration to consultation with parents and the local community, their teaching practice, the learning environments they create and the learning resources they use.

School / community consultation

An ongoing consultative process between the school and its local communities is essential if parents are to understand and participate in their children's education.

Schools should utilise the services of community interpreters and translators to inform parents of their children's science and technology experiences. Translating notes and newsletters into the relevant community languages and providing interpreters at interviews, parent-teacher evenings, demonstrations etc will go some way towards averting potential conflict resulting from different cultural expectations.

Teaching practices

The extent of support students will need to develop proficiency in science and technology will be different for individual students and will vary over time.

Teachers should provide opportunities for students to:

- recognise and exploit the fact that science and technology education provides a rich source of both conceptual and English language development for students from diverse first language backgrounds
- engage in interactive, 'hands-on', problem solving activities. Such experiences will allow students to develop their investigating, designing and making skills and understandings
- develop science and technology understandings through a range of language activities
- use their first language which will support their ongoing conceptual development
- gain gradual confidence in using a new language. For a limited time students should

be permitted to express their understandings in non-verbal forms, and to exercise the right to be silent

- engage a variety of collaborative group work opportunities which will allow them to develop confidence and competence in using subject-specific language and in the manipulation of tools and materials
- express their opinions and not feel embarrassed about making mistakes. There may be a desire for some students to blend in with the mainstream culture
- work within assessment procedures which recognise students may have acquired science and technology concepts but not the English language skills to express their understandings
- have access to publishing software in their home languages which will enable them to record their science and technology understandings at their appropriate cognitive level.

Learning environment

Teachers may:

- provide a supportive and less stressful environment for newly arrived students by using multilingual signs and posters in the classroom
- establish groupings within the classroom which support yet challenge students, eg a balance of fluent/not so fluent students, pairing students of similar/dissimilar backgrounds
- establish predictable routines which are clearly understood.

Learning resources

Teachers may:

- use visual and graphic materials to support the development of language and science and technology concepts, eg concrete materials which students can use and manipulate, construction 'toys', photographs, pictures, computer software, diagrams and graphs to assist students to focus on the topic under discussion

- choose material resources from a range of cultures and where possible select resources from students' home cultures
- invite and encourage the participation of the local community members in classroom activities so their knowledge and skills can be shared by all students. Students from non-English speaking backgrounds will gain a sense of worth and acceptance from such input
- choose materials which are not culturally biased and which meet the needs of students' cognitive development as well as their language acquisition
- wherever possible avail themselves of the services and expertise of ESL teachers, ethnic aides, and consultants
- use software, including word processors, in languages other than English.

Students with disabilities and learning difficulties

The learner group

In most classes there are students who at some time experience learning difficulties which may relate to the ways in which students learn or be a result of social and cultural factors. These learning difficulties usually vary in cause, type, intensity and duration.

Students may have learning difficulties for a number of reasons. They can find learning difficult and develop at a rate that is slower than that of their peers. There are students whose inappropriate behaviour presents a barrier to learning whilst others may come from backgrounds where, for a variety of reasons, education is not or cannot be given a high priority. Some students can have difficulty in processing certain types of information, such as understanding, speaking, writing, reading, language, or any combination of these.

Students with learning difficulties are the responsibility of the classroom teacher. This teacher often works with a support teacher who is specially trained to assist such students. Learning difficulties can arise at any time and their identification and remediation should be ongoing. There may be students with

intellectual, physical, sensory and emotional disabilities in a class. Such students may have:

- a language disability
- a mild or moderate intellectual disability
- hearing impairment
- visual impairment
- a behaviour disorder
- significant physical or mobility difficulties.

It is important to treat each child as an individual; every child with special needs is different. Classroom teachers need to be flexible in developing appropriate strategies for meaningful participation of students with special needs in all aspects of the educational program. Teachers should consult with parents, the community, specialist service providers — for example counsellors and speech pathologists — to assess and plan to meet the needs of students with disabilities and learning difficulties and to establish an effective coordinated support for both the student and teacher.

Every teacher has taught students with special needs although they may not have been diagnosed as such. Teachers do, however, play an early role in the diagnosis of special needs. Once needs have become evident, teachers have to plan, write and implement individualised programs, as well as work with various support staff. All teachers become 'special educators' as they encounter students with special needs and provide learning experiences to meet those needs.

Students with special needs and science and technology

Science and technology are essential for understanding our existence, as well as providing individuals with enjoyment. Students with special needs may require more instructional and practice time, and more varied experiences to master skills or concepts, but should be allowed to discover and create order out of their daily experiences.

It should be stressed that a student with special needs can offer great advantages in lesson planning and enrichment in the area of science and technology. Fellow students may be

readily motivated to empathise, for example, with a learning disability and its presumed effects on the task design or parameters. The judicious use of simulation of various disabilities can expand the thinking of non-disabled students, and their general awareness can take on new dimensions. There will be opportunities in some units/tasks to use specific strategies in order to explore environments of students with special needs. Some activities in the unit Way Out Communication Stage 3 may relate directly to a student in the class, school or community.

General considerations for students with special needs

- The modifications and limitations which various disabilities might impose on a student's access to regular learning experiences need to be constantly kept in mind by the teacher. Since disabilities differ in nature, complexity and degree for each student, it is the individual teacher who must decide whether specific tasks should be expanded, modified or even omitted, depending on the particular students being cared for.
- The planning stage is particularly important. Students with special needs may be capable of carrying out some aspects of a task, or the whole task at a reduced level or rate. Teachers need to be aware of this, and should provide activities which are broken down into components.
- Teachers need to promote areas of excellence. Some students with specific physical/learning difficulties may have advanced skills in other areas. A student with an intellectual disability may be able to design and make at a complex level, whilst a physically disabled student might be very skilful in investigating a task by researching.
- Students with special needs require a high level of security and reassurance in their learning environment. Intervention and support may be necessary when the class is involved in a task. In such situations the worth of each student's contribution should be promoted. Students with learning difficulties may not value themselves or their work because of prior failure and need non-competitive, positive peer models.
- Teachers should adopt a flexible approach. The units of work allow teachers to provide activities which explore content at say, Stage 3, whilst developing knowledge, skills, values and attitudes at a lower level. Age appropriate material is important for the student's development and the maintaining of interest.
- Students with learning disabilities/difficulties need more opportunities to explore materials in different contexts in order to make 'discoveries'. It is appropriate for teachers or other students to model the discovery process.
- Students with learning disabilities/difficulties will be better able to participate in group activities where the outcomes/expectations are appropriate to their abilities, eg students with oral language difficulties may present a written report or drawing in response to a task. Students with written language difficulties may present an oral report.
- Students with learning difficulties may not be able to draw on previous experiences in order to participate meaningfully in the task, as they may not have well developed recall skills, or only limited experiences in the area of science and technology.
- Students with limited concentration span need tasks which can be completed within a short time frame. The whole task may need to be broken down into a series of more manageable tasks. The short term memory recall evident in students with language or learning disabilities has implications for long term projects.
- Students with special needs can be overlooked in a larger group. Smaller group work is particularly appropriate for those with language disabilities and mild intellectual disability as they need 'concrete' hands-on experiences in order to consolidate experiences. In larger groups this can be overlooked.
- Students need to reflect upon the processes in which they have engaged and should be given opportunities to apply these processes to new situations in order that the processes may be generalised.

Specific considerations for students with special needs

Students with language disabilities

For students who have slower language processing skills, additional response time is often needed. The language of science and technology has to be given special consideration. Instructions should be rephrased with different vocabulary, a vocabulary introduced in a systematic way. Demonstrations should be used to aid the understanding of instructions.

Students with hearing disabilities

Special modifications to class/group arrangements and teaching practices are often extremely important, to ensure that a student with a significant hearing disability has the best conditions for understanding and contributing to the lesson activity. There are specific ways to ensure maximum use of residual hearing, to facilitate supportive lip-reading, to enable genuine group interaction, and to lessen the problem of limited vocabulary and language disability that are so often the barriers to learning.

Students with physical disabilities

There is a range of devices and special technologies to help students with physical disabilities experience normal environments and standard lesson activities. The degree to which such students can have access to the regular curriculum depends upon the nature and degree of their handicap, and upon the success or otherwise of the assistance available.

Students with visual disabilities

There are also devices to help students with low vision. Substantial modifications to the teaching program may be necessary to accommodate their specific abilities and limitations.

Students with learning difficulties

As students are often not at a developmental stage which allows them to generalise, infer, deduce and find cause and effect, a support teacher may be able to assist the class teacher in providing continued and varied reinforcement to develop these abilities. Tasks presented in science and technology should be

both challenging and appropriate to the level of development. They may need to be broken down into smaller steps than would be needed for students without learning difficulties.

Talented students

Talented students are an extremely diverse group of learners. Their exceptional abilities, which result in outstanding performance in one or more learning areas, may become evident at any time. Such students' conceptual understanding and skills may be more advanced than those of their peers, and they frequently have learning styles and levels of performance different from those exhibited by other students.

Talented students should therefore be considered according to their individual levels of talent, motivation, independence and maturity.

Talents may be classified in many different ways, such as:

- creative
- academic
- performing
- social.

Identification of talented students

Talented students may be identified by:

- a variety of personnel both professional and non-professional from inside and outside school
- data collected from a number of sources, subjective and objective, using performances and products.

To say that a child is talented provides little information about the nature and extent of the student's specific abilities. Talented students are by definition exceptional. They are endowed with capabilities which allow them to perform at higher levels than their peers. They may:

- exhibit keen powers of observation
- display advanced reading ability
- possess a large store of information

- demonstrate speed and ability in basic skills
- derive great pleasure from intellectual pursuits
- demonstrate ability to:
 - formulate abstractions
 - conceptualise overall patterns and strategies
 - synthesise concepts, arguments, points of view
 - generalise about events, people and objects
- appear sceptical, critical, evaluative
- display organisational skills which allow them to attack complicated material by separating it into parts
- exhibit interests that are wide and intensely focused
- have rapid insight into cause and effect relationships
- pick up non-verbal cues and see inferences that others miss.

When identifying talented students remember ...

- It is normal for students with a talent in a particular area to make occasional errors or to experience difficulties in another area.
- If students can display talents at certain times and under certain conditions it is important to have an environment which provides activities likely to foster talents, eg open-ended problem-solving, and allowing talents to be identified.

Talented students and science and technology

Talented students often have above average ability, task commitment and creativity. Designing and making, investigating and the use of technology gives them the freedom to explore, experiment, follow interests and be involved in tasks that are not continually structured by the teacher. Previously, investigating and design tasks have been provided as extension activities for talented students. As such tasks are valid for all students, talented students can now add depth

to the class task or develop their own tasks. Many units accommodate the open ended problem solving model which is particularly appropriate for those talented in the science and technology area.

Teaching practices

Teachers may:

- establish standards of excellence
- encourage learning alternatives and self-paced lessons
- expect students to use time productively and expect that their work and learning will be of value
- become conversant with some strategies which will build on a student's knowledge and provide challenge for the range of abilities in the classroom, eg:
 - Bloom's Taxonomy
 - Renzulli's Enrichment Triad Model
 - Divergent Thinking Technique
 - Parne's Creative Problem Solving Model.

The learning environment

The learning environment should:

- be supportive of talents. This is necessary so that students can gain confidence in their abilities and are able to interact socially and influence that society, should they choose to do so
- upgrade the level and pace of instruction to fit the student's interests, ability and levels of achievement by providing extension material with an intellectual challenge
- avoid underachievement and disenchantment with learning by determining optimum time frames for the study of any particular topic
- allow students to group and regroup themselves voluntarily
- have a teaching day which is divided into blocks of time, within which students and the teacher determine their own routine cooperatively.

Learning resources

Human and material resources may include:

- mentors — community members who may have the specialised knowledge needed by some students
- learning interest centres, which expose students to a wide variety of topics to encourage the individual selection of problems for in-depth investigation. The material should provoke curiosity and interest in undertaking further investigative inquiry
- computers, which can become a vital part of the learning environment to:
 - give computer-assisted instruction
 - develop thinking skills
 - provide a tool for facilitating the accomplishment of specific tasksSome talented students may become avid computer users but all have the potential to develop higher level computer skills to meet a broad range of interests
- material resources which cater for lateral and creative thinking
- a range of environmental material which is problem based and thought provoking.

Parent and community participation

Children come to school with a wealth of experience and knowledge about their environment, their culture and their language. Home is the child's first place of learning, and teachers need to value the knowledge, skills and attitudes children bring to school with them.

Primary school students stand to benefit greatly when their parents have positive attitudes towards learning science and technology and an understanding of the intentions of *Science and Technology K-6*.

Parents' attitudes and expectations have an important influence on the way children approach science and technology. Children are more likely to attempt new tasks, and to keep trying, if their parents encourage and expect them to do so. Further, their ability to

take risks, to experiment and to seek further information will be promoted if they are encouraged at home.

Parental involvement in the implementation of this syllabus should be broadly based at the school level. Parents and community members can make a profound contribution through the experiences they provide for their children outside the school and the attitudes children develop.

Schools need to utilise the skills of parents and members of the local community. They need to realise there is a plethora of resources in the local community which can be used. The first step in this process is to inform the community of the aims, underlying principles and structure of *Science and Technology K-6*.

Schools need to elicit support by adopting a variety of strategies for community participation. Schools need to be aware that there are enormous pressures on parents and many do not have the skills or time to support every activity. Sensitivity therefore needs to be adopted in seeking assistance.

Learning experiences

Science and technology learning experiences should:

- recognise the needs of the diverse learner group
- be based on the learning principles that are common to other K-6 Key Learning Areas.

In providing learning experiences consideration will need to be given to:

- content
- activities
- learning resources
- learning environment.

Content

This syllabus requires that students will develop significant knowledge and understandings related to the six content strands. Students will develop these understandings by engaging in the processes of investigating, designing and making, and using technology.

It is necessary for teachers to ensure that programmed experiences will enable students to address the full range of learning outcomes. It is also necessary to ensure that learning experiences include content drawn from various locations and periods in time. Such content should be drawn from:

- the local area, including students' homes and school
- other areas of Australia
- beyond Australia.

Content also should range across:

- the present
- the past
- the future

and will need to be selected in accordance with the students' levels of development and their background experience.

As students progress from Stage 1 to Stage 3 it is suggested that the emphasis in content should shift from the students' immediate environment to other Australian areas and beyond Australia and from current situations to past and/or future situations.

Other considerations relevant to the selection of content include:

- particular interests of students
- local factors
- availability of suitable resources
- links with other key learning areas
- opportunities to develop language skills.

Activities

This syllabus advocates that students learn:

- through interaction with their natural and made environments
- by modelling the processes of investigating, designing and making.

This will require that teachers provide:

- interesting and appropriate tasks for students
- an environment designed to support the learning activity

- guidance and support during the completion of tasks.

It will be necessary that students relate their learning to environments outside the classroom. Appropriate structures will need to be established to support these activities.

Teachers will need to consider the range of management strategies in organising learning activities. These might include:

- individual tasks or activities
- small group tasks or activities
- class tasks or activities
- student negotiated tasks.

Learning resources

Learning is most effective when students acquire information through first hand experiences. Such learning experiences should provide opportunity to interact with a variety of resources. These will include human, material and direct information resources such as:

- interviews, excursions, camps, nature trails and sensory experiences
- graphics, models and other representations of reality, including dioramas, role plays, simulations, videotapes, films, slides, maps and pictures
- written material, including books, newspapers, magazines and brochures.

The resource references in this syllabus will assist teachers when planning learning experiences. The resources listed indicate a range of materials and organisations useful for this purpose. The references provided are not exhaustive. They should be adapted and developed by teachers to suit particular teaching and learning situations. It is essential that they are revised as new material becomes available.

Suggested resources for learning activities will include:

- items such as books, audiovisual kits, computer software (including databases), periodicals, journals
- places such as science and technology museums and centres, field study centres, factories, work places

- organisations which provide information and services
- people's knowledge and expertise
- commercially produced resource materials and equipment
- the mass media
- a range of equipment
- databases.

Further resources for teachers include:

- professional reading lists
- references to assist with the development of policies.

Learning environments

In science and technology students will learn directly from their environments. Particular care should be taken to create a physical and emotional environment that supports the learning experiences.

When designing the physical aspects of this learning environment, consideration should be given to:

- stimulus material
- students' access to appropriate tools, materials, equipment and other resources
- areas in which students can exhibit and discuss the development and outcomes of their activities
- general attractiveness.

It is particularly important that students have both the opportunity and resources to explore, to discover, to manipulate materials and to use different technologies. In particular students will need access to a range of computer and audio-visual hardware and software.

It is also important that teachers create an emotional environment that is secure, caring and supportive. In such an environment students will have confidence to pursue their own ideas and their contributions to class activities will be respected and valued.

School planning

Throughout the years K-6 all students should have the opportunity to undertake a cohesive learning program in the Key Learning Area of Science and Technology. Therefore, it will be necessary for schools to develop a structure that will ensure implementation of such a program.

It may be necessary to set up a team of people to support the implementation of the syllabus, and to nominate a coordinator who has relevant experience or interests.

Whatever approach is adopted, it is desirable that school planning promotes the sharing of information and ideas. In particular the expertise which parents and the community are able to supply in relation to content and cultural background is important and schools should seek to develop these links further.

In designing a school plan it should be noted that the learning outcomes and learning experiences presented in the syllabus have been based on providing each child with substantial access to the Key Learning Area in each year.

Planning considerations

Organisation can be developed through regular meetings to:

- define roles
- set priorities
- coordinate activities
- share information
- evaluate effective implementation.

Organisation may involve the following aspects.

Professional development and provision for ongoing support through:

- analysis of needs and identifying ways to meet them
- providing opportunities for teachers to increase their knowledge and understanding of the principles of science and technology which underpin this document

- ongoing professional activities within the school, (classroom visits, support in the form of team teaching)
- inter-school visits and teacher exchanges
- idea sharing at school, cluster and regional level
- visits to resources centres, businesses and industry.

Coordination of learning experiences between classes and grades through:

- grade/staff meetings to provide for breadth, balance and relevance when coordinating topics within the K-6 school curriculum
- collaborative policy making to
 - develop a long term strategy made up of a series of sequential stages
 - determine appropriate learning outcomes for each stage based on syllabus objectives
 - provide continuity of experience and allow students to progress at their own rates.

Addressing human and material resource needs by:

- utilising existing expertise on the staff fully
- using local industries and organisations
- promoting involvement in professional associations
- seeking local resources.

Formulating a school policy for safety that includes:

- guidance for the use and storage of materials, substances, equipment and machines
- programs for the maintenance of tools, equipment and software.

Integration with other Key Learning Areas through:

- corporate programming
- the approaches suggested in the sample units of work
- realistic time management.

Evaluation of a school plan

The effectiveness of school planning should be evaluated at regular intervals.

The evaluation process allows judgements to be made about the success of the plan and may suggest areas for improvement. It may provide a basis for decisions about:

- modification of existing school policies
- the adequacy of implementation strategies
- staff development needs
- allocation of funds and other resources
- school community links.

Questions which could be asked when evaluating a school plan may include:

- What allowance has been made for individual rates of learning?
- Is school organisation:
 - ensuring continuity of experience
 - avoiding needless repetition?
- Are the learning processes being effectively managed?
- Is there need for teachers to change how they manage learning experiences?
- Is further staff development required?
- Have any safety issues arisen?
- To what extent do programs achieve the learning outcomes specified in the syllabus?
- What steps need to be taken to identify the prior learning experiences of students who transfer into the school?

Developing a teaching program

The objectives of the syllabus can be best addressed through programmed learning experiences based on the processes of investigating, designing and making, and using technology.

Programming should begin with the initial evaluation of the students' prior learning as there will be a wide range of abilities within most classes. This evaluation can be used when identifying suitable objectives for a class or group program and when evaluating its effectiveness.

An outline is essential if planning is to be effective. **There should be provision for flexibility in both content and time allocation.**

Programs should contain details of:

- class or unit objectives based on the aim, objectives and learning outcomes provided in this syllabus
- planned learning experiences including content to be addressed, activities and resource requirements
- intended means of assessing student achievement of the stated outcomes.

Teachers need to work in consultation with other colleagues to discuss and clarify their ideas. This will involve:

- teachers of the same year
- teacher librarian
- computer coordinator
- ESL teacher
- ethnic aides
- executives.

Programs should be flexible enough to:

- allow for unexpected outcomes and for further development along lines not foreseen at the initial programming stage
- incorporate the interests and capabilities of students
- look beyond the classroom and utilise the community and its resources to enrich students' learning experiences.

Assessment strategies should:

- be constructive
- focus on what children can do
- look for strengths and encourage further learning by creating a non-threatening atmosphere
- involve systematic observation of students at work, questioning and appraising children's work records.

Developing a class program

Teachers should initially carry out an assessment of students' development in relation to the outcomes of the syllabus. This information will provide teachers with the basis to:

- develop their own units of work based on the objectives of the syllabus either for the whole class, groups within the class or individual students

OR

- select and adapt units of work from those provided in the support documents

OR

- where appropriate, adopt a thematic approach which relates learning in a number of Key Learning Areas. If this approach is adopted it will be necessary to **identify carefully the Science and Technology learning outcomes to be addressed in the broader study.**

Developing units of work

There will be a need for teachers to develop their own units of work. This need may arise from the interests of students, social or cultural background, geographic location and range of ability within a class group.

There can be many starting points for a unit of work. These would include:

- a recent event, eg an electrical storm, a discovery in space, a media event
- a current issue, eg recycling, petroleum prices
- an area of need, eg food at a school function, watering classroom plants during a holiday period
- a science concept, eg characteristics of plants in the school environment, sound, light
- a book being shared and enjoyed, a play, eg a story about Australia before European settlement
- a special school event, eg bicycle week, 'show and tell'
- the topic of a guest speaker, eg police visit, local celebrity.

Such starting points for programming can usually suggest a range of investigating tasks and design tasks which in turn will provide opportunities for the use of particular technologies. The selection of tasks will depend upon the objectives that need to be addressed in a balanced program.

Selecting and adapting units of work

The units of work included in the support document are outlines from which teachers can develop a more comprehensive program. In some instances only minor additions may be necessary to make them suitable for individual classroom environments.

Alternatively, the needs of a particular school environment may dictate considerable adaptation of unit outlines before implementation in individual classes. Factors such as the developmental stage and previous experiences of students, the availability of resources (human and material), the nature of the learner and the local community will need to be considered.

It will be necessary to ensure that programs for a full school year address each of the general objectives of the syllabus. The sample units of

work have been designed to address specified learning outcomes for each of the Stages 1, 2 and 3.

The sequence and units of work described here are **not** mandatory. Teachers are encouraged to develop their own work units and sequences that will fulfil the syllabus requirements but will be appropriate to the stage and needs of their students and their school environment.

If teachers choose to use the units in the following sequence they should select those units within each stage which are most appropriate and relevant to their school situation. The syllabus outcomes for each stage can be met by selecting a number of units. It is not expected that every unit in the sequence will be taught but that teachers select a sufficient number and variety of units to fulfil the outcomes for each stage.

Unit sequence

The units have been organised into sets of three so that a sequence of knowledge and understanding, skills, values and attitudes is developed through Stages 1-3. There is no implied sequence represented in the table within each stage. Each unit is presented with a brief description.

Units of Work

Units of work

The following sample integrated units provide a means of fulfilling the requirements of the syllabus through activities that develop understanding, knowledge and skills, values and attitudes about science and technology. They aim to provide a meaningful context that relates to students' experiences and the needs of people in society.

The relationship between the interrelated processes of Investigating, Designing and Making, and Using Technology is demonstrated in each unit. The way activities are presented by teachers should reflect the relationship between the various parts of the design process or the investigating process. For example, students' understanding of the relationship between identifying a need and generating the idea to meet the need is as important as the solution itself. At different times any one of these processes may provide the starting point for a unit of work.

The unit layout does not attempt to indicate possible starting points, nor do they imply a mandatory sequence of activities.

Each unit develops a number of activities covering different aspects of the unit topic. A series of specific lessons or experiences may be needed to build toward a particular understanding or exploration of a process. The activities outlined are not exhaustive, nor are they the sole way of achieving the objectives of the unit.

Where necessary, modifications should be made to suit the social, cultural and linguistic needs of the students, the school and society. The teaching/learning units take into account inclusive curriculum principles and strategies as outlined in the section 'Nature of the learner'.

Modifications can be made in order to fit in with experiences planned in other Key Learning Areas. In all these cases teachers should make sure that essential learnings which relate to scientific and technological

processes, as well as understandings, are retained in their programs.

Teachers may need to provide additional learning experiences to ensure that all students develop desired skills, knowledge and understanding.

Format of units of work

Introductory page of the unit

Content focus

This indicates those particular content strands that are relevant for a given unit.

Outcomes

This section lists outcomes that each unit of work can contribute to achieving. The learning outcomes are developed through the processes of investigating, designing and making, and using technology.

The outcomes are grouped into knowledge and understanding, skills and values and attitudes.

Assessment

The listed strategies have been selected from a range of possible methods of assessing student learning, as related to the stated unit outcomes.

Links with other Key Learning Areas

Points of reference are provided for activities in other Key Learning Areas. These may complement or extend the activities in Science and Technology and are listed, where applicable, for each learning area.

Teacher notes

This section details important teaching points and considerations that aid the successful implementation of the unit.

Suggested resources

This section provides a sample of resources and may include book references, computer software, audio/visual aids, people, places, materials and equipment.

Listed references are directly linked to the learning activities and are detailed in the section 'Suggested resources'.

Suggested teaching strategies

The strategies indicated provide direct support for activities in the units. They provide a range of activities that may be employed to consolidate, extend or supplement the experiences of individuals or groups of students. Teaching strategies appear elsewhere in the syllabus and are listed numerically.

Activities page of the unit

Task

The task provides a starting point or direction for each activity. It may be an investigation, stimulating inquiry and building on the curiosity of the students, or an open-ended design brief that sets the parameters or requirements for designing and making. The task can be further developed according to students' interests, needs or questions.

Investigating tasks provide the context for the choice and use of technologies to stimulate and aid inquiry. Designing and making tasks provide opportunities for many possible responses that could fulfil the identified need and incorporate the use of a variety of technologies.

Activities

These activities rely on the student being actively involved at each stage of the process of investigating and designing and making. Particularly important is the need to value and encourage students in the areas of investigating, designing and making and using technology identified by the students themselves.

Investigating will often lead to students designing and making, both as a means of aiding investigation and in order to demonstrate and apply their understandings. Designing and Making will often require students to undertake some form of investigation in order to achieve their desired task. This may include investigating the way things work, the properties and suitability of materials and how other people have solved similar problems.

Investigating activities highlight accuracy in observation and testing. Students should be encouraged to confidently propose explanations, make and test their predictions and accept the process of having these supported or disproved.

Designing and Making activities require the students to use a range of technologies at each stage of the designing and making process. Selecting appropriate equipment, processes and materials, operating and maintaining tools and equipment and evaluating products and technologies available to them are included in this process.

Unit coding

- [I]** Individual activity
- [G]** Group activity
- [W]** Whole class activity
- [TS1]** Suggested teaching strategy

Units of work: scope and sequence

Here are examples of possible units. The units of activities have been organised in sets of three so that a sequence of understanding, skills, values and attitudes is developed through the levels K-6. They are presented here in sequential form with a brief description of the unit.

STAGE 1	STAGE 2	STAGE 3
<p>Getting About</p> <p>Vehicles used to transport people and loads in the local community. Exploring vehicle movement. page 62</p>	<p>Out and About</p> <p>Transport used by students. How vehicles work and safety aspects. Using gears and cogs to move objects. page 88</p>	<p>On the Move</p> <p>Transport systems locally, nationally and internationally. Making the local transport environment safer. page 114</p>
<p>Look Around You</p> <p>How we use spaces at school and home. Detecting differences in the school environment. page 64</p>	<p>Indoors, Outdoors</p> <p>How the community uses spaces and structures. Useful materials which protect us against the environment. page 90</p>	<p>The Best Place to Live</p> <p>Specific services within the community. Helping to make our community a better place to live. page 116</p>
<p>Growing Up</p> <p>What living things need. Providing for the needs of plants, animals and people. page 66</p>	<p>Mini-worlds</p> <p>Environments of living things. Interrelationships and consequences of change in mini-environments. page 92</p>	<p>Out in Space</p> <p>The Earth's atmosphere. What we find beyond the atmosphere. page 118</p>
<p>Hot or Cold</p> <p>Energy in the surroundings. How people cope in different climates. page 68</p>	<p>Stuck on You</p> <p>Magnetism and static electricity. page 94</p>	<p>Switched On</p> <p>Electrical circuits. Uses of and safety with electricity. page 120</p>
<p>Let's Communicate</p> <p>Using senses, signals and symbols to communicate. Why living things communicate. page 70</p>	<p>Keep in Touch</p> <p>What is needed to keep in touch. page 96</p>	<p>Way out Communication</p> <p>Communication methods in the past and future. Ways humans communicate over distances and in different situations. page 122</p>
<p>Toy World</p> <p>Toys, games and sporting equipment. How toys and play objects can be made to move. page 72</p>	<p>Making it Easy</p> <p>Looking at simple machines. page 98</p>	<p>Sailing, Sinking, Soaring</p> <p>Properties of air, wind and water, and how they can be used. page 124</p>

STAGE 1	STAGE 2	STAGE 3
<p>What's Alive?</p> <p>Living and non-living things. Characteristics and diversity of plants and animals. page 74</p>	<p>Cycles in Our World</p> <p>Cycles in the non-living and living world. Plant and animal products used to satisfy human needs. page 100</p>	<p>What's the Weather?</p> <p>Observing and measuring aspects of weather and weather patterns. Using electronic information gathering services. page 126</p>
<p>Kids Care</p> <p>Natural and built local environments. Responsible use and reuse of materials. page 76</p>	<p>Our Australia</p> <p>Identifying and promoting Australian plants and animals. Traditional Aboriginal interaction with Australian environments. page 102</p>	<p>An Ancient Land</p> <p>Changes that have occurred over long periods of time. page 128</p>
<p>Sense of Direction</p> <p>Our senses and our surroundings. page 78</p>	<p>Sounds Great</p> <p>Sound and some of its properties. Making and using sound. page 104</p>	<p>Light Up My Life</p> <p>Light and some of its properties. Combining light and sound to produce effective visual images. page 130</p>
<p>Back to Nature</p> <p>Naturally occurring substances and some of their uses. page 80</p>	<p>Material World</p> <p>Properties of natural and made materials. Using, conserving, renewing. page 106</p>	<p>Environment Matters</p> <p>Effects of human activities on environments. Addressing some problems of environmental damage. page 132</p>
<p>A Place in Time</p> <p>Observing and recording changes in the weather. Seasonal change and its effects on plants, people and other animals. page 82</p>	<p>A Look Inside</p> <p>The systems in the human body. What affects good health. page 108</p>	<p>A Change for the Better</p> <p>How living things are suited to their environments. Inherited characteristics in living things. page 134</p>
<p>Picture It</p> <p>Information from pictures. Using pictures, sounds and language to tell a story. page 84</p>	<p>Moving Pictures</p> <p>Techniques used to create different pictures. How still pictures are made to move. Animation using film, video and computer technologies. page 110</p>	<p>Visual Ventures</p> <p>Features of film and video production. Sound and lighting in visual media. page 136</p>
<p>What's for Lunch?</p> <p>Healthy food and where it comes from. Food preparation and presentation. page 86</p>	<p>Eating Out</p> <p>Changes that occur in food preparation and cooking. Takeaway food and why we buy it. Preparing food for large numbers of people. page 112</p>	<p>Food for the Tucker Box</p> <p>Food processing from raw product to domestic use. Preserving and packaging foodstuffs. page 138</p>

Getting About

Stage 1

Vehicles in our school and local area

Content focus

Built Environments
Information and Communication
Physical Phenomena
Products and Services

Outcomes

This unit will contribute to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people organise spaces by assembling and arranging components to meet particular needs
- there are different ways of communicating with others
- pushes and pulls can make things move and stop
- living things and machines need energy to do things.

Students will:

- state the purpose of an investigation
- name possible needs and wants of people
- recognise that technological activity affects people and their environments
- show that equipment should be used with care and safety.

Skills

Students will:

- explore how things work and engage in guided play
- undertake an investigation as a result of individual curiosity or as a means of solving problems
- interpret data and explain their observations
- name possible needs and wants of people
- present ideas as to what they might plan as a design proposal
- describe to others the strengths and limitations of a design
- choose classroom materials and tools appropriate to the activity
- identify and use with safety the correct tools for specific purposes.

Values and Attitudes

Students will:

- demonstrate confidence in themselves

- have a positive view of themselves
- persevere with activities to their completion
- be honest in their dealings with others
- work cooperatively in groups
- be curious about the natural and made environment
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected example strategies that may be used in assessing this unit of work.

- Identify different types of vehicles for moving different types of loads.
- Discuss the features and function of a vehicle using a drawing or a model.
- Note student comments about design or safety aspects of a form of transport.

Links with other Key Learning Areas

English

Exploring the purpose and features of survey format. Focus on questioning techniques – writing and asking. Encouraging students to use talking and writing to explain how the vehicles work.

Mathematics

Interpreting pictorial graphs and graphs made from objects.

Human Society and its Environment

Exploring the effects of transport on lifestyles.

Creative and Practical Arts

Direct Drawing, drawing and/or model making from an imagined experience.

Personal Development, Health and Physical Education

Exploring road safety issues dealing with pedestrians, passenger and bicycle safety.

Teacher notes

When students are designing a means of transport, avoid suggesting stereotyped choices such as cars and trucks. This may require that the teacher provide a wide range of models, eg snowploughs, canoes, paddleboats, hot-air balloons.

Suggested resources

Things that go, Rockwell, A
Street Sense (kit), Road Traffic Authority

Computer software: prepared graphic software, eg Car Builder, Transportation/transformation, Logo, The Print Shop

People and places: excursion around the local area

Materials and equipment: building blocks, construction materials, transport pictures

Teaching strategies

- 10 *Proposing explanations*
- 11 *Predicting outcomes*
- 13 *Trialling and testing ideas and concepts*
- 16 *Applying understanding*
- 24 *Evaluating designs*
- 41 *Computer graphics*

Task

Design and model a means of transport of your own choice. [G]

Activities

Decide the specifications of your vehicle. Consider its purpose, who/what it will carry, where it needs to travel, making it safe as well as functional.

Generate ideas for the design. Try looking at existing vehicles for ideas.

Draw a plan on paper or use computer software to create the drawing. **[TS40]**

If using prepared graphics software to make the design from pre-existing components, eg wheels, body, wings, other features, trial different parts to see the effect. Discuss how easy it is to rearrange parts using computer software. Compare computer graphics to other modelling materials.

Collect materials and decide which are appropriate.

Decide on a final design to develop, considering available materials.

Make and present the model, explaining the features and their functions, eg features that provide occupant protection.

Evaluate the design. Does it meet all of the specifications? Can it be improved? **[TS24]**

Task

Design a modification to the transport environment. [G]

Activities

Discuss findings from local area research about the transport environment. **[TS12]** Identify any problem areas, eg bushes obscuring vision, heavy traffic flow, local bridge often covered by flood waters. Suggest possible solutions, considering possible effects on motorists and residents, as well as students. Choose a solution and devise a plan to carry it out. Represent ideas in drawings or models. Implement the plan wherever possible. Evaluate the success of the plan. **[TS24]**

Task

Investigate forms of transport in the community. [G]

Activities

Identify forms of transport in our community by collecting pictures, information and by observing the local area.

[I] Classify and reclassify vehicles observed using a variety of criteria, eg number of wheels, where they travel, how they are powered, what/who is carried.

Identify the characteristics and uses of different vehicles.

Identify safety features used, eg seat belts, sitting down on buses. Suggest others that may be useful.

Identify the things we need to transport, eg animals, objects; where we need to transport them, eg over water, mountains; and how the needs are catered for.

Task

Investigate methods of transport to school. [W]

Activities

Survey the class to discover transport used to get to school, eg foot, bus, car, bicycle. Record results as a pictogram.

Suggest reasons for these choices, eg walk because it's close, drive when it's raining, too far to walk. **[TS10]**

Predict whether students in another area would travel in the same ways, eg in a country town or inner city suburb. Consider how to test the prediction, eg contact schools in other areas. Compare predictions to the information received. **[TS11]**

Evaluate what makes a good way to come to school. Consider safety, keeping dry, enjoyment. Discuss whether it's the same for everyone. Suggest why or why not.

Task

Investigate the local transport environment. [W]

Activities

Observe how transport is organised in the local area. Walk around the district. Make a note of safety features, eg traffic lights, signs, footpaths, kerbs.

Make a pictorial record of transport types observed, eg on a painted background of locality, make a collage showing safety features, vehicles etc.

Identify any danger spots on the way to school, eg obscured corners, roads to cross. Suggest how these could be improved. List road safety rules that apply at such places to make people safer. **[TS12]**

Identify how roads have been made safe in other areas.

Explore how we can make ourselves safer, eg predict which colour cars or clothes stand out best. Devise a way of testing the predictions. **[TS13]**

Look Around You

Stage 1

Organising space in the local environment

Content focus

Built Environments
Information and Communication
Living Things
Physical Phenomena

Outcomes

This unit will contribute to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- there are different ways of communicating with others
- information can be stored for later use
- the senses are used to receive messages from all around
- some things feel hotter and some things feel colder than our bodies.

Students will:

- give examples of the ways the different senses can be used in observation
- recognise that discoveries can be made through play, exploring and experimenting
- demonstrate that tools and equipment can be used to aid observation
- name possible needs and wants of people
- give examples of how people plan to make in order to provide for their own and others' needs
- recognise that people plan and make changes in many aspects of their daily lives
- show that equipment should be used with care and safety.

Skills

Students will:

- observe using all the senses
- interpret data and explain their observations
- combine a variety of materials and images to make simple models, drawings and structures
- choose classroom materials and tools appropriate to the activity.

Values and Attitudes

Students will:

- demonstrate confidence in themselves

- persevere with activities to their completion
- respect the rights and property of others
- work cooperatively in groups
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Have students use their floor plans/ models to explain suggested arrangements of room spaces. The model should not be the focus of the assessment.
- Listen to students' comments during their exploration of spaces.
- Ask students to decide where they would put a new area (such as a toy display or computer area) in the classroom and ask for reasons for their choice.

Links with other Key Learning Areas

English

Developing the language of describing (oral and written).

Writing labels for objects and spaces in the classroom and for home models.

Mathematics

Comparing objects and spaces. Modelling and sketching positions of objects.

Comparing temperatures.

Human Society and its Environment

Investigating built environments of school and local area.

Comparing to other places or cultures.

Personal Development, Health and Physical Education

Extension work may include exploring personal space through movement, eg up, over, under, through.

Creative and Practical Arts

Listening to and identifying sounds.

Teacher notes

Encourage students to identify the sense they are using and to verbalise about the information only that sense is providing.

Activities to explore the classroom environment can be repeated in different seasons and comparisons made.

Home spaces need not be directly compared except to value the variations that exist within the group. Be aware of differing lifestyles and incomes and do not focus on specific rooms in the home.

Include the need for light, air when designing environments.

Suggested resources

The Source Book, The Built Environment Education Network

Students, Structures and Spaces, Eriksen, A

Houses and Homes (series), Wayland Ltd

Computer software: adventure game software, eg *The Playroom*, McGee, *Nature Park Adventure*. *Explore-A-Story Series*, Garfield, Logo, *My Town*

People and places: school grounds, classrooms, specialist rooms in the school

Materials and equipment: temperature strips, pictures of variety of homes, variety of materials to stimulate the senses

Teaching strategies

- 6 *Fostering curiosity*
- 7 *Observing to explore and discover*
- 11 *Predicting outcomes*
- 17 *Exploring needs*
- 18 *Clarifying a design task*
- 23 *Considering appearance and function*
- 33 *Adventure games*
- 40 *Video*
- 41 *Computer graphics*

Task

Design and organise specific work spaces at school. [W]

Activities

Negotiate areas to be established in the classroom, eg computer area, reading corner, games area. **[TS7]**

Identify desirable features for the area, eg computer area needs, power point, to be away from heat or window.

List requirements. Discuss whether these can be supplied. Make a list of the possible solutions to the problems **[TS17]**. Discuss plans with group. Can others make contributions to the plan?

Make a model of the classroom with building blocks or paint/draw packages using a computer. Use to show possible room arrangements.

Demonstrate proposed improvements by moving the things around on the model. Compare models – has everyone made the same suggestions? Discuss the appropriateness of suggestions. Select a plan for the class to implement.

Make selected alterations. Assess the success of the plan by comparing to original list of requirements. **[TS23]**

Task

Investigate the use of spaces around us at school. [W]

Activities

Observe the structure of the classroom. **[TS7]** Discuss the placement of desks, shape of the room, shape of the things in the room (desks, windows, doors, cupboards). Identify things that are pleasing/displeasing about the classroom.

Identify which side of the room is the sunny side, where are the shadows? (Do they move?) Measure the temperature at various spots around the room (use a thermometer or temperature strip with informal units).

Predict changes that may occur throughout the day. Test at different times.

Explain why the things in the room are placed the way they are, eg to share equipment, to face the board. **[TS22]**

Make predictions about the effect of moving things. **[TS11]** Discuss whether there would be enough space to move. Move things in the room to test the predictions. Compare results to the predictions.

Walk around school area and observe different buildings, spaces. Identify specific areas, their features and purposes, eg the library, the canteen. Match features to purposes, eg large open hall for assembly/many classes.

Task

Investigate how the senses can be used to identify places around us at school. [I]

Activities

Identify which senses we have and how we use them. **[TS7]** Make a sound map showing sounds you can hear at different places around the school. Blindfold students and have them identify where they are in the school by using the other senses. Do a scent map to identify odours around the school. Identify, using a temperature strip, hot/cold areas.

Task

Design and model areas you would like (toy room, games room). [G]

Activities

Make a list of features to include in the model. **[TS6]** Identify conditions that may affect the room, eg weather conditions, location. Clarify the requirements of the design, eg may include play area, particular features. **[TS18]** Consider features that will make the room comfortable as well as functional. Decide on methods of making the components of the room, eg matchsticks, buttons, match boxes, cotton reels, construction materials. Suggest materials to use to represent aspects such as windows, floor covering, furnishings, wood. Select materials from those available. Make the model, including decoration of structural features and arrangement of furniture and other items. Present the model to the class. Explain how the room is designed, highlighting selected features and their purposes. Indicate how available spaces are used and why.

Task

Use an adventure game to investigate the ways in which areas are organised. [G]

Activities

Discuss the types of rooms found in the places where we live. **[TS33]** Using a computer adventure game students navigate through the game identifying the features of each area. **[TS6]** Build up a chart of similarities and differences in these places.

Living things and their needs

Content focus

Living Things
Products and Services

Outcomes

This unit will contribute to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- all living things are different
- living things grow, reproduce, move, need air, take in nutrients and eliminate wastes
- living things and machines need energy to do things
- products can be created to fulfil specific purposes.

Students will:

- state the purpose of an investigation
- give examples of the ways the different senses can be used in observation
- name possible needs and wants of people
- give examples of how people plan to make in order to provide for their own and others' needs
- give examples from their immediate environment which show how resources can be conserved.

Skills

Students will:

- observe using all the senses
- interpret data and explain their observations
- name possible needs and wants of people
- present ideas as to what they might plan as a design proposal
- choose classroom materials and tools appropriate to the activity.

Values and Attitudes

Students will:

- demonstrate confidence in themselves
- have a positive view of themselves
- persevere with activities to their completion
- respect the rights and properties of others

- show informed commitment to improving the quality of their immediate environment.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Observe how students engage in discussion to clarify the design tasks.
- Have students describe to others how to load and operate computer simulations software.

Links with other Key Learning Areas

English

Exploring purposes, audiences and features of posters.

Exploring the language and purpose of matrices and flow charts.

Mathematics

Measurement activities. Comparing the sizes of plants as they grow. Graphing, using pictures, the plants that die or survive and giving reasons. Measuring and comparing, using informal measurements, the height of students within the class.

Human Society and its Environment

Exploring the ways people interact with their environments to satisfy their needs.

Personal Development, Health and Physical Education

Exploring students' needs for food, clothing, exercise.

Creative and Practical Arts

Movement: Observing and performing animal movements.

Art: Observing the texture of animal coverings and making prints to represent them.

Observing the lines in plants and representing them through drawings.

Teacher notes

People are classed as animals and have the same basic needs as other animals. Students may suggest 'needs' such as religion and aesthetics that will require sensitive consideration.

To familiarise students with the language to be used in this unit watch a video about animals (in particular one that shows how scientists make observations).

Suggested resources

Informazing (series), Nelson

The Arrow Book of Bush Creatures, Mackness, B

Keeping Small Animals, Andersen A
Watching Animals (video), Film & Video Library

Computer software: desktop publishing, eg Printshop: Learn about Insects, Sunburst, Zoopack, Learn about Animals, Learn about Plants, Story Starters Science, Compute-A-Graph

People and places: botanic gardens, parks, zoos, WIRES, RSPCA, veterinarians

Materials and equipment: Reverse Garbage scrap materials, construction materials, seeds and seedlings, containers for plants, animals for observation

Teaching strategies

11 *Predicting outcomes*

13 *Trialling and testing ideas and concepts*

17 *Exploring needs*

33 *Adventure games*

38 *Publishing*

Task

Design and make a way to satisfy a need for an animal, eg fish feeder, mouse exerciser. **[G]**

Activities

Identify the need to be met. Discuss to further develop ideas. Detail the requirements of the animal, eg space and safety.

Choose suitable materials (considering size, safety, position, composition).

Make and trial the device.

Evaluate success and make modifications if necessary.

Task

Design and use a way of identifying the needs of plants. **[G]**

Activities

Pose the problem – to find a way to tell what things affect how plants grow. Brainstorm ideas students think will affect the growth of a plant (ie variables).

Devise ways to eliminate one of these variables at a time. Explain the need for a control plant.

Discuss the need for keeping records, eg over a period of time for comparison of data.

Collect materials and set up test, exploring one variable per group, eg no fresh air, no water.

Make regular observations, recording and measuring changes.

Task

Design and make an advertisement for something that meets the needs of students. **[I]**

Activities

After discussion about needs of humans decide which need is to be satisfied by each group, eg to keep warm, be healthy. **[TS13]**

Select a product that satisfies the needs, eg a healthy meal, warm clothes in winter. Explain how the need is met.

Generate ideas to use to promote the item. List things you like about your product. Select points that might encourage other people to want the product. Choose the type of advertisement, eg poster, jingle.

Make the advertisement, organising images, slogan, information, eg using desktop publishing software. **[TS38]**

Reflect on the type of techniques that are used in advertisements in their immediate surroundings.

Task

Use computer software to investigate the needs of animals. **[G]**

Activities

Use computer simulation to investigate the needs of animals. **[TS33]** Familiarise students with the simulated environment. Discuss the type of decisions to be made and their effect on the simulation. Experiment within the simulation, eg removing water, food, to test the needs of animals. Compare the advantages of using simulation to a real situation.

Observe animals in the classroom, eg silkworms, mice, birds, fish. Make a list of how the needs of the animals are being met in the classroom.

Task

Investigate the needs of plants. **[G]**

Activities

Based on observation of plants growing at home and at school, predict what things plants might need to survive and grow. **[TS11]**

Test predictions and draw conclusions about the needs of plants.

Identify the needs that plants and animals have in common and what needs are specific to either group. Group or classify, eg using a matrix.

Care for the plants used to test the predictions over a longer period, eg the rest of the term/year.

Task

Investigate students' needs as human beings and some ways of meeting them. **[W]**

Activities

Brainstorm what are perceived to be students' basic needs. Give reasons for suggestions. **[TS17]**

Organise the needs in order of importance. Identify the things everyone thought were important. Draw conclusions about our needs.

Make flow charts to show the means by which we meet our basic needs, eg sheep - shearing wool - jumper.

Identify ways we use plants and animals, apart from satisfying our basic needs, eg animals for pets, plants to make our environment attractive.

Discuss what makes us 'want' things.

Compare how human needs are met in different cultures or places, eg clothing styles, housing.

Energy in the surroundings

Content focus

- Built Environment
- Living Things
- Physical Phenomena
- Earth and its Surroundings

Outcomes

This unit will contribute to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people alter their environment in response to natural conditions
- all living things are different
- some things feel hotter and some things feel colder than our bodies
- the weather can have a powerful effect on people.

Students will:

- state the purpose of an investigation
- give examples of the ways the different senses can be used in observation
- demonstrate that tools and equipment can be used to aid observation
- name possible needs and wants of people
- give examples of how people plan to make in order to provide for their own and others' needs
- recognise that technological activity affects people and their environments
- give examples from their immediate environment which show how resources can be conserved.

Skills

Students will:

- observe using all the senses
- interpret data and explain their observations
- name possible needs and wants of people
- make practical changes that could modify existing products or processes
- combine a variety of materials and images to make simple models, drawings and structures
- choose classroom materials and tools appropriate to the activity.

Values and Attitudes

Students will:

- demonstrate confidence in themselves
- have a positive view of themselves
- respect the rights and property of others
- show informed commitment to improving the quality of their immediate environment
- be curious about the natural and made environment.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Observe students discussing and recording observations.
- Use student evaluation comments on the design of posters etc to determine how well the students have understood the task provided.
- Engage in teacher-student discussion to assess student understanding of the process of classifying, investigating or designing and making.

Links with other Key Learning Areas

English

Writing short sentences to record findings of experiments. Labelling all diagrams, photographs, etc.

Stating facts about findings in experiments and from research.

Discussing experiments to explain observations.

Mathematics

2D and 3D shape of objects.

Describing and measuring size.

Categorising objects into hot, warm, cool and cold.

Human Society and its Environment

Needs and differences of some cultural groups.

Finding ways to get cooler or warmer.

Personal Development, Health and Physical Education

Health and safety issues need to be addressed.

Comparing students' body temperatures with informal measurements both before and after physical activities.

Creative and Practical Arts

Posters and signs.

Teacher notes

Teachers should stress care in touching objects that are hot or very cold and ensure that objects students are provided with are not dangerous. Give students safety warnings about hot/cold objects before they are asked to locate them in their surroundings.

Temperature is a measure of the heat energy of an object. Heat energy makes objects hot and a loss of heat makes them cold.

Suggested resources

Five Senses, Braithwaite

Investigate, HBJ

Computer software: graphics software, eg Deluxe Paint III, Hyperscreen, Slide Shop, Dazzle Draw, Archimedes Paint, Hyperpaint, My House, Thomas' Snowsuit

People and places: zoo, aquarium, farm, local fire brigade, Earth Exchange

Materials and equipment: ice, materials for making signs, posters, food containers, temperature strips, thermometers

Teaching strategies

10 *Proposing explanations*

15 *Explaining understandings*

24 *Evaluating designs*

26 *Organising tools, equipment and processes*

38 *Publishing*

Task

Design and make signs to identify the hot and cold areas in the classroom. [G]

Activity

Brainstorm ideas to determine the most important information needed on the signs, the most suitable size and the most appropriate material to be used to make the signs.

Explore possible ways of presenting the information (eg symbols, words etc). **[TS38]**

Make the signs for the hot and cold areas (eg taps, near heaters etc).

Evaluate the design and suitability of the signs made by the class. **[TS24]**

Propose possible changes/modifications that would make the signs more useful.

Task

Design and make a poster for the classroom to warn students about care with hot and/or cold objects. [G]

Activities

Discuss the information that needs to go on the poster. Decide the best way to present this information to students in your class.

Consider the design of the poster (eg size, shape, material to be used, etc).

Prepare a poster and present it to other groups in the class for them to evaluate.

Display all the group posters for other classes to see.

Task

Design and make a model reusable container for hot or cold food. [G]

Activities

Observe a variety of different types of containers that are used to store or transport hot/cold food.

Describe and record the shapes, size of the containers and the materials from which these containers are made. **[TS26]**

Classify the materials used to make the food containers as reusable, recyclable, disposable.

Design a visual model of the container showing its size and shape.

Design a logo to identify whether the container is for use with hot or cold food.

Present the design to the class and explain the reasons for your design.

Evaluate the class designs.

Task

Investigating objects that are hot or cold. [G]

Activities

Identify ways of deciding whether objects are hot or cold (eg sound, touch, sight).

Devise a method (eg touch, temperature strips) to identify a variety of objects as either hot or cold, eg metal, water, ice, glass.

Identify objects in the environment and at home which are hot or cold. Classify these objects into groups based on the amount of heat the object has.

Identify animals that are warmer or colder than us to touch. Visit an animal farm, zoo or aquarium.

Collect pictures of different types of foods. Make a pictograph using these so that you can identify how hot or cold they are when we eat them.

Propose an explanation for why some things are hot and others are cold. **[TS10]**

Task

Investigate some safety/warning signs used to identify hot and cold objects. [W]

Activities

Observe and record situations in our surroundings where warnings about hot and/or cold occur.

Describe how warnings are presented so that people from other cultures can understand them.

Discuss ways that hot and/or cold can be dangerous to people.

Visit the local fire station or have a guest speaker from the fire brigade to discuss fire safety.

Task

Investigate ways in which people respond to hot and cold in their environment. [I]

Activities

Discuss the different sorts of clothes that people wear in hot and cold weather.

Collect pictures of the clothes that people wear in hot and cold parts of the world.

Suggest reasons why people wear different types of clothes in hot and cold weather. **[TS10]**

Investigate ways that traditional Aboriginal peoples cope with hot and cold in their environment.

Describe changes to buildings that people make in hot and cold weather conditions and the reasons for these.

Propose ways that people in Australia can make changes to their buildings so they are more efficiently kept warm in winter or cool in summer.

Research some different types of leisure activities that people of other cultures carry out in hot and cold conditions.

Let's Communicate

Stage 1

Using senses, signals and symbols to communicate

Content focus

Information and Communication
Products and Services
Living Things

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people organise spaces by assembling and arranging components to meet particular needs
- there are different ways of communicating with others
- information can be stored for later use
- all living things are different
- products can be created to fulfil specific purposes.

Students will:

- give examples of the ways the different senses can be used in observation
- recognise that discoveries can be made through play, exploring and experimenting
- demonstrate that tools and equipment can be used to aid observation
- show that equipment should be used with care and safety.

Skills

Students will:

- observe using all the senses
- undertake an investigation as a result of individual curiosity or as a means of solving problems
- interpret data and explain their observations
- make practical changes that could modify existing products or processes
- present ideas as to what they might plan as a design proposal
- combine a variety of materials and images to make simple models, drawings and structures
- describe to others the strengths and limitations of a design
- choose classroom materials and tools appropriate to the activity
- identify and use with safety the correct tools for specific purposes
- recognise their own use of technology in the school and home environment

- maintain and care for equipment in their immediate surrounds and organise their immediate environment.

Values and Attitudes

Students will:

- demonstrate confidence in themselves
- have a positive view of themselves
- persevere with activities to their completion
- be honest in their dealings with others
- respect the rights and property of others
- work cooperatively in groups
- be curious about the natural and made environment
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Encourage students to gather feedback from their audience when assessing their own performance of a story without words.
- Discuss with groups of students the reasons for their choices of materials and symbols for use in their signs.
- Apply teacher or peer assessment to the group activity on how and why living things communicate.

Links with other Key Learning Areas

English

Writing messages represented by different signs/symbols, exploring/discussing interesting and creative styles, shapes and sizes of lettering on signs.

Exploring sensory language. Using oral language to describe how things feel, look, sound, taste and smell.

Mathematics

Making 2D shapes using various materials.

Recognising and creating patterns.

Observing and identifying shapes in road signs.

Human Society and its Environment

Researching ways people communicate to meet their needs.

Communicating research findings in this area.

Personal Development, Health and Physical Education

Communicating through movement.

Creative and Practical Arts

Drama: activities in improvising and organising sequences of movement in mime.

Craft/design: extending skills in creating symbols and images.

Teacher notes

If applicable, explore cultural differences in the meaning of gestures, eg shaking the head may mean no or yes in different cultures. Investigate systems of communication from a variety of cultures, eg message sticks in Aboriginal culture.

When making signs for the school/classroom, students should consider which language(s) should be used.

Emphasise the dangers of tasting unidentified substances. This unit provides an opportunity to explore sensory disabilities in the class. Be aware of Aboriginal students with hearing problems.

Suggested resources

Communicating by Signs, Mathews, R
Five Senses, Braithwaite, A

Eyewitness Guides (series), Collins
The Bionic Ear (Kit), Computer Education Unit

Potential Unlimited (video), Computer education

Faces, Galletly, M

Computer software: adventure games, eg Playroom; graphics packages, eg Mask Parade, Monsters and Make Believe, Face Maker, The Print Shop, Print Master, Slide Show, Storybook Theatre, Puppetmaker

Communications software: Email, Keylink

Materials and equipment: pictures of facial expressions, sample road safety and other familiar signs, Braille writing, practice telephone, cassette recorder, clothes for costumes

Teaching strategies

7 *Observing to explore and discover*

9 *Manipulating to explore and discover*

10 *Proposing explanations*

12 *Clarifying an investigation*

24 *Evaluating designs*

31 *Evaluating chosen technologies*

41 *Computer graphics*

Task

Design and make signs that indicate different activity areas in the classroom/school. [G]

Activities

Identify the areas to be labelled, eg wet area, reading corner, computer corner, large group area, listening posts, canteen, assembly area.

Suggest the key idea, person or object that needs to be recorded. Decide whether words are needed.

Make drawings of ideas, or use a computer graphics package to create the symbol. **[TS41]**

Present to other class members to identify and decide whether the message is clear. **[TS31]** Make changes if necessary. Ensure the sign is noticeable.

Choose materials that will be appropriate to go on the sign. Consider whether the sign will be inside/outside, how it will be attached/displayed.

Create the sign and display.

Task

Design a performance of a story without words. [G]

Activities

From the list of ways that we communicate choose ones that can be used to tell a story, eg clothing, facial expressions, sound effects, movement.

Select a story or event to perform.

Make decisions about where to use the different techniques, eg signs between scenes, clothing to tell more about a character. Consider how sounds and actions can be combined.

Try the ideas out. Suggest whether you need to make improvements to make the meanings clearer. **[TS23]**

Rehearse the performance and show it to an audience. **[TS39]**

Task

Use prepared graphics software to design and make masks. [G]

Activities

Explore the range of facial expressions that can be created using the prepared graphics. Select face, shape and facial features from graphics bank.

Move features, trying different positions to create the expressions desired. **[TS41]**

Print the mask. Decorate, selecting colours that best convey the meanings required.

Print out final designs and further decorate.

Use the masks in a performance.

Have other children identify the feelings expressed.

Task

Investigate ways we communicate using signs and symbols. [W]

Activities

Walk around the school local areas and observe signs around us. Discuss the messages they communicate.

[TS7]

Identify the sorts of actions they are asking for.

Explore the ways symbols are used in Aboriginal art to communicate and tell stories. Research how symbols are used in other cultures.

Collect other examples, eg road safety, international symbols, computer graphics. Note differences. Identify common features of signs and symbols, eg stick figures, just a few words. Explore the colours that are commonly used. Suggest why this may be.

Task

Investigate how we communicate without using words. [W]

Activities

View a mime or Aboriginal performance (live or on video) to observe how to communicate without using words. List the ways ideas are communicated, eg movements, facial expressions, clothing items, movement, props or objects, sound effects. Discuss whether everyone interprets things in similar ways. **[TS9]**

Experiment 'talking' to a friend using only actions. Show different emotions with face, whole body. Use 'dress up' materials to show different characters.

Explore the way sounds can create moods.

Explore provisions made for people with special communication needs, eg Braille for the blind, signing for the deaf, interpreters for non-English speakers.

Task

Investigate how living things communicate. [G]

Activities

Discuss the many ways we communicate. Identify some reasons why we need to communicate, eg danger, hunger, greetings, to find things out, happiness, sadness.

Identify the senses that other animals use. Research, eg by asking a vet, how animals' senses differ from human senses, eg dogs have a stronger sense of smell. **[TS10]**

Compare how animals use their senses. Are some senses more important to animals than others?

Collect pictures and describe with the pictures how these living things communicate and why (group activity project).

Games and toys

Content focus

Built Environments
Physical Phenomena
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people organise spaces by assembling and arranging components to meet particular needs
- pushes and pulls can make things move and stop
- products can be created to fulfil specific purposes.

Students will:

- give examples of the ways the different senses can be used in observation
- recognise that discoveries can be made through play, exploring and experimenting
- give examples of how people plan to make in order to provide for their own and others' needs
- recognise that people plan and make changes in many aspects of their daily lives.

Skills

Students will:

- explore how things work and engage in guided play
- combine a variety of materials and images to make simple models, drawings and structures
- identify and use with safety the correct tools for specific purposes.

Values and Attitudes

Students will:

- persevere with activities to their completion
- respect the rights and property of others
- work cooperatively in groups
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Conduct a group conference where students demonstrate similarities and differences between materials used in toys and games and equipment.
- Have students explain the workings of their toy, using drawings or models to exemplify their ideas (the drawing/model should not be the focus of the assessment).
- Explain how to use a toy or play a game.

Links with other Key Learning Areas

English

Joint construction of procedures for playing games, exploring audience, purpose, features of instructions. Using writing to label models and sketches.

Mathematics

Recognising, representing and investigating properties of 3D objects.

Personal Development, Health and Physical Education

Movement exploration, eg exploring equipment, exploring body movement, moving in spaces.

Developing understanding of students' physical capacities/characteristics and those of others.

Human Society and its Environment

Exploring individual and cultural differences.

Creative and Practical Arts

Visual arts: sequence based on direct experiences, eg toys.

Teacher notes

Use toys and games from other cultures to extend students' awareness of other possible designs and materials to use in their own toy or game design.

Suggested resources

Sport, Hammond, T
Themes from the Playground, Hope, C
Into Science (series), Oxford
Make and Discover (series), Collins
Games Around the World (kit), UNICEF

Computer software: adventure games, eg Playroom

People and places: library, museum, parent helpers, school playground

Materials and equipment: construction blocks, plasticine toys, sporting equipment, materials and tools as required for specific designs, games, reverse garbage material

Teaching strategies

- 6 *Fostering curiosity*
- 7 *Observing to explore and discover*
- 8 *Researching to explore and discover*
- 12 *Clarifying an investigation*
- 15 *Explaining understandings*
- 18 *Clarifying a design task*

Task

Design and make a toy or plaything that moves. [G]

Activities

Research which types of (non-motorised) moving toys students like. Bring to school some to share.

Model ideas for the toy using construction blocks or other materials.

Consider how the toy can be made to move. Select the type of movement required, eg sliding, rolling, jumping, flying. Also consider appearance, eg colour, shape, size.

Select materials and make a prototype. **[TS18]** Demonstrate to other class members how the toy works. Discuss possible improvements. Modify the toy if needed. Evaluate in terms of movement, interest, appearance.

Task

Design and make a toy. [G]

Activities

Generate ideas for a toy, using experiences with other toys as a model. Consider whether it would be used indoors/outdoors; what materials would be needed to make it; safety rules required.

Make a sketch. Explain ideas to others and see if they can suggest any improvements.

Make the toy and see how it works.

What do other students think of it?

Task

Use games equipment to make a new game. [G]

Activities

Generate ideas for possible new games. Ask students to bring in equipment and materials from home. From this each group selects some pieces of equipment/materials to make a new game. The group trials the game by playing it themselves, then suggests and implements improvements. Students teach the game to another group.

Identify the senses being used in the game.

Explain how the senses are important in playing the game.

Task

Investigate how toys and other play objects can be made to move. [W]

Activities

Gather a variety of toys that move. Use the toys to explore the concepts of still/moving, slow/fast. **[TS6]**

Classify toys according to the way they move, eg roll, spin, slide, fly.

Identify the parts of the object that move.

Explore the effect of a push or a pull (force) on a toy. Predict how a variation in the push/pull makes it go slower and faster. Apply different forces to the same objects to test predictions.

Identify objects that rely on pushes and pulls to be moved, eg chairs, skateboards. **[TS12]**

Task

Investigate toys, games and sporting equipment. [W]

Activities

Collect a range of toys. Include toys and games from many cultures. **[TS7]**

Classify according to commonalities, eg board games, balls, playground, indoor/outdoor etc. Identify characteristics, likes and dislikes, advantages, disadvantages.

Identify toys and games that can be made from naturally occurring or 'found' materials, eg sticks, string, stones.

Using a collection of balls and/or a variety of bats and racquets compare and contrast their shapes and the materials used to make them.

Explore their uses, eg throwing, kicking.

Relate their properties to their use, eg rolling, bouncing, stretching, soft, hard, long etc.

Task

Investigate games and toys from the past. [I]

Activities

Research information on some types of games or toys used in the past in our culture or some other culture. **[TS8]**

Identify the ways that toys and games have changed over time and record the information on a time line.

Discuss reasons why people construct toys and play games. **[TS15]**

What's Alive?

Stage 1

Characteristics of living and non-living things

Content focus

Living Things
Physical Phenomena
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- all living things are different
- living things grow, reproduce, move, need air, take in nutrients and eliminate wastes
- living things and machines need energy to do things
- some living things change according to the seasons.

Students will:

- recognise that discoveries can be made through play, exploring and experimenting
- show that equipment should be used with care and safety.

Skills

Students will:

- observe using all the senses
- explore how things work and engage in guided play
- undertake an investigation as a result of individual curiosity or as a means of solving problems
- choose classroom materials and tools appropriate to the activity
- identify and use with safety the correct tools for specific purposes
- recognise their own use of technology in the school and home environment
- maintain and care for equipment in their immediate surroundings and organise their immediate environment.

Values and Attitudes

Students will:

- demonstrate confidence in themselves
- persevere with activities to their completion
- be honest in their dealings with others
- respect the rights and property of others

- work cooperatively in groups
- be curious about the natural and made environment.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Collect samples of students' work as illustration of developing skills of observation.
- Have students describe the needs of chosen animals/plants and suggest how these should be provided for.
- Observe students using materials and equipment in designing and making activities.

Links with other Key Learning Areas

English

Using speech to clarify ideas when designing.

Identifying the purpose and audience for pamphlets. Drafting, editing and publishing information in pamphlet form.

Mathematics

Classifying objects according to similarities.

Human Society and its Environment

Identifying basic human needs. Recognising the need to care for all living things in the environment.

Personal Development, Health and Physical Education

Identifying individual needs and recognising needs of others.

Creative and Practical Arts

Drama: simple improvisation based on photographs of groups of plants or animals.

Teacher notes

Some animals suitable for classroom care include ants, guinea pigs, birds, tadpoles, fish, caterpillars and lizards. Accepted characteristics of living things include growth, movement, need for food/water, need for air, response to stimuli, reproduction, waste elimination. Breathing is not an

accepted characteristic of living things. Computers are often attributed with human characteristics, eg users talk to them. This unit can be used to identify that they are not living.

The living space for an animal need not be a permanent living space and may not necessarily be used.

'Pamphlet' production for younger students may involve simple pictures accompanied by captions. Older students may give greater emphasis to the text.

Suggested resources

My World (series), Macmillan

If you were a ... (series), Collins

Stop Watch (series), Hodder & Stoughton

Australian Wildlife and their Babies, Ridyard, D

Feathers Fur or Fins (video), ABC

Tracks to Primary Science, Freer, K and O'Toole, M

Look (series), Longman Cheshire

Computer software: publishing software, eg Children's Writing and Publishing Centre; wordprocessors, eg Fredwriter, Appleworks; graphics software, eg Printmaster Plus, Print Shop and simulations, eg Zoopack, Learn about Animals

People and places: zoos and farms; field studies centres

Materials and equipment: construction materials as required, various objects, audio-visual equipment, plants and animals

Teaching strategies

7 *Observing to explore and discover*

11 *Predicting outcomes*

15 *Explaining understandings*

16 *Applying understandings*

32 *Audio-visual technologies*

38 *Publishing*

Task

Design an environment for animals or plants to live in at school. [G]

Activities

(All designs should cater for all needs, eg enough room for animals to run around in.) Identify needs of classroom animals/plants based on the identified characteristics of living things. (These may also include other needs such as shelter, warmth, affection/care, company.)

Develop a design proposal to meet these needs. **[TS16]**

- For animals consider food/water supply, housing, keeping clear, providing sufficient air, room to move.
- For plants consider the plants' needs for water, sunlight, air etc.

Make suggestions as to how these needs may be met. **[TS11]**

Use the student design proposals and select appropriate materials to construct a space inside or outside the classroom to keep plants/animals.

If the space is to keep plants or animals it will need to be secure and provide the necessary requirements for the well being of the living things.

Task

Design and make a pamphlet advising other students how to care for a chosen plant or animal. [G]

Activities

Use simple pamphlets as a model for students' publishing. Model pamphlet production by jointly constructing a whole-class example. In groups, select the plant or animal to write about.

Discuss the types of information the audience (other students) might need. Identify headings/sub-headings as a guide. Use these to draft the text, based on observations and discussion of the chosen plant or animal. **[TS38]**

Create or select photos, drawings or computer graphics to illustrate sections of the text.

Organise the information and graphics into pamphlet form. Display/store in library for other students' reference.

Task

Investigate characteristics of living and non-living things. [W]

Activities

Observe and list characteristics of living things, eg movement, reproduction, growth. Use video or photographs to record observations. **[TS32]** Suggest how we know that things are alive.

Describe the needs of living things. Observe the differences between living and non-living things. Make a checklist of characteristics.

Collect a range of familiar items, eg pot plants, ruler, person, toys. Predict if a specified/selected item is alive or not. Test examples against the list of criteria established earlier, eg can it reproduce, does it need food, does it grow? Classify these items as living or non-living. Draw conclusions to identify the characteristics of living things. Classify other objects in the classroom as living or non living, eg ants, tree, people, pot plant, book, clothing, programmed toys, bike, table. **[TS15]**

Task

Investigate the diversity of animal and plant life in your environment. [G]

Activities

Explore the differences between plants and animals.

Observe the characteristics of different animals, in the playground, on a farm or at a zoo. **[TS7]** Compare and contrast characteristics of plants to those discovered about animals. Identify similarities and differences between plants and animals. Include reptiles, insects, fish and birds as well as mammals.

Identify Australian animals. Discuss how some animals have been named, eg kookaburra, cockatoo are Aboriginal names.

Use video, photographs and drawings to record observations of how the animals satisfy their needs, eg how they move, foods eaten. **[TS32]**

Explore and identify the parts of a plant. Observe/collect a variety of 'whole' plants (including the root system). Compare and identify common features, eg leaves and stems are often green. Infer or suggest the function of various parts of plants.

Collect drawings of native NSW plants and use these to construct a poster.

Conserving our local environment

Content focus

Built Environments
Living Things
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people organise spaces by assembling and arranging components to meet particular needs
- products can be created to fulfil specific purposes
- products can be made, processed or grown.

Students will:

- recognise that discoveries can be made through play, exploring and experimenting
- name possible needs and wants of people
- recognise that technological activity affects people and their environments
- show that equipment should be used with care and safety
- give examples from their immediate environment that show how resources can be conserved.

Skills

Students will:

- undertake an investigation as a result of individual curiosity or as a means of solving problems
- present ideas as to what they might plan as a design proposal
- combine a variety of materials and images to make simple models, drawings and structures
- describe to others the strengths and limitations of a design
- choose classroom materials and tools appropriate to the activity
- identify and use with safety the correct tools for specific purposes
- recognise their own use of technology in the school and home environment.

Values and Attitudes

Students will:

- demonstrate confidence in themselves

- have a positive view of themselves
- persevere with activities to their completion
- be honest in their dealings with others
- respect the rights and property of others
- show informed commitment to improving the quality of their immediate environment
- be curious about the natural and made environment
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are strategies that may be used in assessing the objectives of this unit of work.

- Observe students' willingness to listen to the ideas of others.
- Have students describe/assess the results of their designing and making.
- Consider how effective is the compost heap constructed by the students.

Links with other Key Learning Areas

English

Modelling and using the language of predictions, inferences and explanations.

Exploring the audience and language features of plays and advertisements.

Mathematics

Classifying objects according to one or more attributes. Pictorially representing groups of objects.

Human Society and its Environment

Developing understandings about natural and built components of school and local environments.

Personal Development, Health and Physical Education

Developing individual responsibility towards caring for the environment.

Creative and Practical Arts

Visual arts: drawing items in natural and built environments from direct observations. Noting how shapes, lines, colours are similar and different.

Teacher notes

When looking at built environments select small areas, eg local shops, or sections of larger shopping centres.

When on the excursion to the natural area, emphasise to students the importance of not damaging or hurting animals or plants.

Suggested resources

Do the Right Thing (kit), State Pollution Control Commission

Right on, Let's Clean the Air, Let's Clean the Water (kits), State Pollution Control Commission

The Biggest Bug (video), Austral Pacific Productions

Computer software: Children's Writing and Publishing Centre, The Print Shop, Printmaster, The Three Little Pigs

People and places: national parks, Forestry Commission, Mining and Geological Museum, parks, botanic gardens

Materials and equipment: a variety of 'disposable' materials

Teaching strategies

- 8 *Researching to explore and discover*
- 9 *Manipulating to explore and discover*
- 13 *Trialling and testing ideas and concepts*
- 15 *Explaining understandings*
- 16 *Applying understandings*
- 23 *Considering appearance and function*
- 25 *Selecting and using materials*
- 29 *Selecting appropriate technologies*
- 31 *Evaluating chosen technologies*
- 32 *Audio-visual technologies*
- 38 *Publishing*

Task

Design a way of maintaining a litter-free environment at school. [W]

Activities

Identify an area that needs protecting, eg near the canteen, and the problems experienced, eg students dropping paper.

Evaluate means that already exist to address the problem. Suggest additional methods that may be employed, eg novelty bins, incentives to pick up rubbish, publicity campaign. **[TS8]**

Novelty bins

In groups, generate ideas, eg paint funny faces to 'feed', and use on a bin for each grade. Present the plans to other classes, principal. Collect materials and implement the design. **[TS9]**

Publicity campaign

Brainstorm ideas about type of media, eg video, poster, jingle, presenting a play/poem, radio/announcements. **[TS32]** Use examples as models, to examine possible techniques etc. Consider presentation of the play including costumes, props; jingles, sounds and script for radio advertisement/announcement; pictures, words and their placement on posters. **[TS38]** Apply the design, eg position bins, put on the play, put up posters, 'broadcast' ads or make the announcement.

Evaluate the effect of the design on students' behaviour. **[TS13]**

Task

Design and make packaging for a gift that is environmentally friendly. [TS25]

Activities

Work out the steps needed to create the package.

Experiment with a variety of designs on rough paper. Decide on the type of package and choose the most appropriate materials to use. Get another opinion.

Collect selected materials.

Consider how the packaging looks and how it can be appropriately decorated. **[TS23]**

Evaluate the results — did it work out as you had hoped? Identify improvements that could be made. Try again if desired. **[TS31]**

Identify and list things that have been put in the playground by people, eg buildings, seat, flagpole, litter, gardens. Sketch or photograph items.

Create a card to accompany the gift from recycled material.

Observe a range of greeting cards. Evaluate how suitable they are for different people. As a group develop a design brief and make the card. Evaluate the card with respect to the brief.

Task

Devise ways of adapting used articles for a different purpose. [G]

Activities

Identify reasons for adapting or reusing materials, eg to conserve the material, to save money, because of a particular like of the material.

Develop ideas about adapting a range of products to perform a different function, eg cutting down a plastic bottle to make a funnel, a scoop or a boat; cutting up

Task

Investigate the effect people have on local environments. [W]

Activities

Collect items from around the playground, eg emu parade, treasure hunt. Classify them as naturally, or not naturally, found.

Compare the playground to another built environment, eg shopping area or main street of town. Observe and record all the elements of this environment, eg shops, signs. Draw pictures of the shops in the local shopping centre. Combine to make a collage.

Identify other local environments. Predict which things have been put there by people or have grown naturally. Observe and list the features of these, eg buildings, paths roads, grass areas.

Visit and observe a natural environment, eg national park, re-establishment area, local bush land, river. List all the items/elements observed. Record sounds, smells and textures. Compare this list to the list from the shopping area.

Compare 'natural' environments with 'built' environments, by direct observation, using videos and books. Explain the differences observed when people alter the environment, eg less trees/more trees, buildings, roads. **[TS15]**

Task

Investigate what happens to materials left in the environment. [W]

Activities

Observe local environments, park, school grounds, shopping centre. Record findings using a tape recorder, or in drawings. Classify as naturally found or left by people. **[TS32]**

Identify the types of materials in the 'left by people' group. Make predictions about items left by people, eg what will happen to them, how long will they stay there, which ones will stay longest. Devise ways of testing the predictions. **[TS13]** Compare different materials, eg plastics, paper, food scraps, metal cans. Keep systematic records to show what happens to these materials over periods of time, eg a day, a week, a fortnight. Make explanations of what has occurred.

Make a class compost heap.

Reflect on the effect of people leaving things in the environment. Include consideration of how areas look when litter is left around. Explore alternatives to throwing items away, eg reusing for another purpose.

material from worn-out clothes to make dolls' clothes, a bag or cover or protect something. **[TS16]**

Make multiple copies of the product and devise ways of advertising and marketing the adapted product. **[TS29]**

Sense of Direction

Stage 1

Using the senses to observe and explore

Content focus

Information and Communication
Living Things

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- there are different ways of communicating with others
- all living things are different
- the senses are used to receive messages from all around.

Students will:

- state the purpose of an investigation
- give examples of the ways the different senses can be used in observation
- recognise that discoveries can be made through play, exploring and experimenting
- give examples of how people plan to make in order to provide for their own and others' needs
- recognise that people plan and make changes in many aspects of their daily lives
- demonstrate that tools and equipment can be used to aid observation
- recognise that technological activity affects people and their environments.

Skills

Students will:

- observe using all the senses
- explore how things work and engage in guided play
- combine a variety of materials and images to make simple models, drawings and structures
- choose classroom materials and tools appropriate to the activity
- identify and use with safety the correct tools for specific purposes
- maintain and care for equipment in their immediate surroundings and organise their immediate environment.

Values and Attitudes

Students will:

- persevere with activities to their completion
- be honest in their dealings with others
- respect the rights and property of others
- work cooperatively in groups
- show a commitment to fair treatment to all
- be curious about the natural and made environment.

Assessment

Listed below are strategies that may be used in assessing the objectives of this unit of work.

- Use audience involvement and response to assess the design and production of the festival of the senses.
- To what extent have the students worked cooperatively in groups?
- How well have the students achieved their aims in the production of the Festival of the Senses?
- Is there evidence of students self-esteem being raised and/or an increase in respect of individuals by students?

Links with other Key Learning Areas

English

Exploring sensory language. Using oral and written language to describe how things feel, look, sound, taste and smell.

Mathematics

Using simple graphs to collate data.

Human Society and its Environment

Exploring individual differences.

Personal Development, Health and Physical Education

Developing understanding of students' physical capacities/characteristics, those of others and caring for our senses.

Creative and Practical Arts

Crafts/Design: designing and making props.

Drama: trust exercises.

Music: exploring the use of tone colour to create scary, pleasant, peaceful moods/atmosphere.

Teacher notes

It must be emphasised that tasting unidentified substances can be extremely dangerous.

The unit provides an excellent opportunity to sensitively explore sensory disabilities in the class. Be sensitive to Aboriginal students with hearing problems.

Suggested resources

Five Senses, Braithwaite, A

Eyewitness Guides (series), Collins

The Bionic Ear (kit), Computer education unit

Potential Unlimited (video), Computer education unit

Through Grandpa's Eyes (video), Film and video library

In Touch with the World (video), National Geographic

Computer Software: Make the Connection!, On the Playground, Silly Noisy House, Arthur's Teacher Trouble, Zoopack

People and places: Life Education centres, field study centres, guest speakers who are sight/hearing impaired, North Rocks Blind/Deaf School.

Materials and equipment: Reverse garbage materials, lighting, range of strongly flavoured foods and foods from different cultures, recordings of sound effects, a feely box.

Teaching strategies

2 *Reflecting*

3 *Evaluating resources*

7 *Observing to explore and discover*

13 *Trialling and testing ideas and concepts*

16 *Applying understandings*

18 *Clarifying a design task*

24 *Evaluating design*

28 *Learning safety procedures*

31 *Evaluating chosen technologies*

Task

Design and produce a Festival of the Senses. [W]

Activities

Clarify the task by discussing what is meant by a festival and a Festival of the Senses. **[TS18]**

Identify the types of things that stimulate our senses. This can be based on the results of some investigation of human senses. Make a list of the types of things people like/dislike seeing, hearing, tasting, smelling and touching.

Discuss how some of these things can be used in the Festival of the Senses.

Make a list of the types of things to include. Decide whether to include things people dislike as well as ones they like.

Consider available resources.

Brainstorm how many things can be found and used. Decide how effects can be created. Try out different devices, materials etc. Consider safety in using materials and equipment. **[TS28]**

Choose a venue for the Festival – a classroom, storeroom, hall, the playground etc. Decide how the area will be organised including seating, lighting, sound etc.

Make all props, selecting appropriate materials to fulfil identified needs.

Set aside work areas in which to prepare items.

Assign roles and responsibilities in producing sensory items and in presenting the event.

Decide whether to deprive visitors of one of their senses when they visit. Consider how this could be done, eg using a blindfold. Will you shock them, soothe them?

Invite your guests and see their reactions.

Evaluate according to how well you achieved your aims and whether the audience enjoyed themselves. **[TS24]**

Task

Investigate how people react to different sensations. [I]

Activities

Identify which senses we use when we get a shock, eg hear an unusual sound, see something unusual. **[TS2]**

Test images, sounds, odours, textures, flavours to see which are soothing, disturbing etc.

Explore the relationships between senses. **[TS7]** Test to see if senses are amplified when others are impaired, eg noise seeming louder when you can't see. **[TS13]**

Compare personal experiences and reactions with the rest of the class. Explore whether the same things frighten/shock/please everybody.

Make a record of scary, pleasant, peaceful things. **[TS16]**

Task

Investigate devices which help our senses provide information about our environment. [I]

Activities

Explain the need for devices to increase the ability of our senses to observe things around us or to warn of danger our senses may not detect.

Make a list of the devices that we use to help our senses (eg magnifying glass, ordinary glasses, hearing aid, red lights on hot stoves, stop lights, horns on cars etc).

Classify these according to the sense(s) used. Identify areas in the school/class where devices could be used to increase the information provided by the senses. **[TS30]**

Task

Investigate the human senses. [G]

Activities

Identify the various parts of the body, eg arms, legs, nose and describe what each is used for.

Refine the list to those organs/body parts that are used to gain information from around us, eg ears, eyes, nose, mouth (tongue, lips) and skin (touch, feel).

Identify which senses we have and how we use them.

Test the senses. Use a 'feely' box to identify hidden items, do some taste tests, make a sound map showing sounds you like/don't like, survey popular colours, do a sniff test to identify pleasant/unpleasant odours.

Compare how people use their senses. See whether people like the taste of the same things, whether everyone is able to see or hear as well as others.

Observe how blindfolding or covering the ears affects perceptions using other senses. Consider the things that affect the senses.

Identify items we use to see/hear better, eg binoculars, loudspeakers.

Back to Nature

Stage 1

Uses of naturally occurring substances

Content focus

Products and Services
Living Things
Physical Phenomena
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people organise spaces by assembling and arranging components to meet particular needs
- living things grow, reproduce, move, need air, take in nutrients and eliminate wastes
- the senses are used to receive messages from all around
- products can be made, processed or grown.

Students will:

- recognise that discoveries can be made through play, exploring and experimenting
- name possible needs and wants of people
- give examples of how people plan to make in order to provide for their own and others' needs
- recognise that people plan and make changes in many aspects of their daily lives
- recognise that technological activity affects people and their environments
- give examples from their immediate environment that show how resources can be conserved.

Skills

Students will:

- observe using all the senses
- name possible needs and wants of people
- make practical changes that could modify existing products or processes
- present ideas as to what they might plan as a design proposal
- describe to others the strengths and limitations of a design
- choose classroom materials and tools appropriate to the activity
- identify and use with safety the correct tools for specific purposes
- recognise their own use of technology in the school and home environment

- maintain and care for equipment in their immediate surroundings and organise their immediate environment.

Values and Attitudes

Students will:

- demonstrate confidence in themselves
- have a positive view of themselves.
- work cooperatively in groups
- show informed commitment to improving the quality of their immediate environment
- be curious about the natural and made environment
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Have students identify natural substances during other class activities.
- Observe the students' expressions when containers are complete.
- Ask students to write how they have used their containers.
- Ask children to classify a range of materials according to given characteristics.

Links with other Key Learning Areas

English

Developing menus or invitations through Process Writing. Considering the purpose and audiences. Discussing the presentation of the room, cutlery etc required.

Mathematics

Calculating the quantities of food required. Measurement activities when following recipes.

Human Society and its Environment

Considering 'waste' products from the meal. What can they be used for?

Personal Development, Health and Physical Education

Relating issues of health to natural products used, eg medicines, fibres for clothing, and shelter.

Creative and Practical Arts

Deciding on presentation of rooms, tables, cutlery, invitations etc. Decorating of made containers.

Teacher notes

When identifying the origins of materials use examples that are not complex combinations of substances.

With young students it is important that discussion of 'bush foods' be included, with an emphasis on the dangers of eating unidentified berries, fruits etc found in students' environment. You may wish to develop the 'lunch' activity together with another senior class.

Suggested resources

Cut It, Pluckrose, H

Join It, Pluckrose, H

Things I Make with Cloth, Lohts, S

What Did you Eat Today?

Short Cuts to Health and Living (kit), Australian Meat and Livestock Co-operative

Buying Lunch at School (video), Ministry of Education, Victoria

Computer software: desktop publishing programs, eg Print Shop, Print Master, Genesis, MS Word, MS Works. Thomas' Snowsuit, On the Playground, Taking Responsibility, Fantavision, Animation

People and places: Reverse Garbage, State Pollution Control Commission

Materials and equipment: cooking utensils, menus, ingredients as selected, pictures of foods, samples of vegetables to observe and group, a variety of materials, eg woollen cloth, wood, rock, plastic, leather, paper, wax, plaster.

Teaching strategies

7 *Observing to explore and discover*

8 *Researching to explore and discover*

9 *Manipulating to explore and discover*

11 *Predicting outcomes*

15 *Explaining understandings*

17 *Exploring needs*

18 *Clarifying a design task*

26 *Organising tools, equipment and processes*

27 *Understanding materials*

32 *Audio-visual technologies*

37 *Animation*

38 *Publishing*

Task

Design and make a container for a specific purpose using appropriate natural materials. [I]

Activities

Discuss the type of container to be made and its purpose, eg a basket, a pot, a bag. Identify desirable properties.

[TS18] Draw ideas of what the item could look like. Explore and describe a range of materials to determine whether they are appropriate, taking into consideration the properties of the materials. Consider also joining and decorating materials. Implement the design ideas. Evaluate the suitability of the material and design used. **[TS9]** Take the container home and use it.

Task

Investigate natural materials in the environment. [G]

Activities

Explore small areas of the playground to find substances which are natural, rather than made (plants, animals etc).

[TS7]

Explore a natural environment to find other substances by taking an excursion to a local area. Discuss the differences between natural and made substances. Categorise the substances into natural or made. From the 'made' group find out if there are any natural substances which were used in the making process. Add new 'natural' substances to the original category. Create pictures to represent natural substances and label them. Using materials identified, predict how these materials could be used. **[TS11]** List as many examples as possible in the classroom, eg wood – desk tops, cupboards, rulers, the door; wool – jumpers, carpet or curtains etc. Explore the use of natural materials by Aboriginal people and people of other cultures. **[TS8]** Discuss multiple uses of different materials including recycling. Explore the uses made by Aboriginal people and people of other cultures of natural and made materials. Discuss the importance of natural materials to our everyday life. Reflect on whether we could manage without them, whether we damage the natural environment when we obtain them. Suggest substitutes that could be used. **[TS17]**

Task

Investigate some characteristics and properties of natural materials. [G]

Activities

Explore a large variety of natural materials, eg clay, air, water, wool, rocks, metals, soil, plant materials (wood, cork). Classify according to shared characteristics, eg hard/soft, shiny/dull, bends/doesn't bend, hot/cold. Use a 'feely' bag containing objects made from a variety of materials. Describe as many properties as possible of a selected item. Predict what the object is and what it's made of. Predict the possible effect on materials of hitting with a hammer, wetting with water, leaving in the sun etc. Experiment to test the effects. Compare the effects on different materials. Suggest possible/appropriate uses for materials based on their characteristics and properties.

Task

Design and make a product from animal or plant material found in the playground. [G]

Activities

Explore the available products in shops/environment. Classify as plant/animal/combination. Discuss how value is added to raw materials by using them to produce useful items. Generate ideas for a product. Explore the range of materials available to determine whether they are appropriate. Consider also joining materials. Implement the design ideas. Evaluate the suitability of the material and design used.

Task

Investigate the use of some naturally occurring substances. [G]

Activities

Fibres

Explore some of the different types of materials used to make fabrics. Try the library, ask other people, refer to other cultures. Classify the fabrics as natural/made. Group natural fabrics as plant or animal. Match the fibre with its origin, eg cotton–cotton plant, angora–angora rabbit etc. Research how the fibres are collected, eg picked, clipped from the animal. **[TS8]** Invite a guest speaker to demonstrate how animal fibres can be spun into yarn, eg wool, angora. Explore some of the uses of each fibre and any special properties it has.

Building Materials

Explore the different types of building materials in the school environment. **[TS8]** Classify the material as 'natural'/'made'. Match the natural materials with the source, eg wood–trees, sandstone–rocks etc. Research some of the 'made' materials to find out if there are any natural substances used in the making process. Identify the origin of these substances. Explain some of the uses of each of the natural materials identified. **[TS15]**

A Place in Time

Stage 1

Weather and how it changes our surroundings

Content focus

Built Environments
Information and Communication
Living Things
Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people alter their environment in response to natural conditions
- information can be stored for later use
- products can be created to fulfil specific purposes
- time can be measured through change and regular events
- the weather can have a powerful effect on people
- some living things change according to the seasons.

Students will:

- state the purpose of an investigation
- give examples of the ways the different senses can be used in observation
- demonstrate that tools and equipment can be used to aid observation.
- name possible needs and wants of people
- recognise that people plan and make changes in many aspects of their daily lives
- show that equipment should be used with care and safety.

Skills

Students will:

- observe using all the senses
- undertake an investigation as a result of individual curiosity or as a means of solving problems
- name possible needs and wants of people
- make practical changes that could modify existing products or processes
- present ideas as to what they might plan as a design proposal

- combine a variety of materials and images to make simple models, drawings and structures
- describe to others the strengths and limitations of a design
- choose classroom materials and tools appropriate to the activity
- maintain and care for equipment in their immediate surroundings and organise their immediate environment.

Values and Attitudes

Students will:

- demonstrate confidence in themselves
- persevere with activities to their completion
- be honest in their dealings with others
- work cooperatively in groups
- show informed commitment to improving the quality of their immediate environment
- be curious about the natural and made environment
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Observe students designing and making charts, drawings and using equipment.
- Promote peer evaluation of the waterproof outfits designed by the students.
- Engage in teacher-student interviews to determine student understanding of how the changes in weather are related to human needs/behaviour.

Links with other Key Learning Areas

English

Using talking and listening to cooperatively select, plan, manipulate resources and make decisions in designing and making tasks.

Mathematics

Comparing two temperatures.
Naming and ordering the months of the year and the seasons.

Human Society and its Environment

Developing empathy with and appreciation for the environment.

Personal Development, Health and Physical Education

Identifying responsible behaviours in the sun, and before, during and after physical activity.

Creative and Practical Arts

Designing a class mural, model or collage of holiday destination.

Teacher notes

The activities in this unit should be repeated each term, eg February, April, July, October, in accordance with the seasons. Comparisons should be made between these observations. Compare also changes in our needs and behaviour.

Draw upon multicultural backgrounds of students where applicable to introduce events and climate of other cultures including Aboriginal cultures.

Suggested resources

Hunter for All Seasons, Harris, S
What is the Difference (series), Hodder & Stoughton

Season Themes Through the Year, Hope, C

Australian Dreaming, Isaacs, J
Season Projects (series), Wayland Pty Ltd

Australian Seasons, Fairely, A

Computer Software: Compute-A-Graph

People and places: botanic gardens, parks, zoos

Materials and equipment: temperature strips, clothing catalogues, a wide variety of materials, fabrics

Teaching strategies

7 *Observing to explore and discover*

13 *Trialling and testing ideas and concepts*

16 *Applying understandings*

17 *Exploring needs*

18 *Clarifying a design task*

31 *Evaluating chosen technologies*

Task

Design and make symbols for a weather chart representing the temperature, major weather features. [I]

Activities

Identify a range of weather conditions to be recorded, eg sun, clouds, wind, cold, hot.

Generate ideas for simple representations for class chart, personal charts. Consider ways of ensuring regular recording. Devise methods of creating standard symbols to use each day. Explain the symbols to the class. Evaluate each of these designs by trialling their use over a period of time. [TS13] Refine the symbols in the light of the evaluation.

Task

Design items for people to use in response to changing conditions throughout the year. [G]

Activities

Identify differing clothing needs and suggest appropriate clothing requirements for school, for play etc. Evaluate how well they meet our needs. Design changes to the classroom so it meets the needs of students in different seasons. [TS16]

Indicate how people's varying needs would be met in each case, eg foods, clothing requirements, activities enjoyed. [TS17]

Pool ideas based on your observations. Decide upon method of presenting the design, eg class mural, model, collage.

Use a variety of materials appropriate to the season, eg towelling, woollen fabrics, leaves, sand, twigs.

Keep designs from each season and make comparisons when complete.

Task

Design and make a waterproof outfit. [G]

Activities

Identify the things that will be needed, eg raincoat, hat, boots etc. Examine a range of wet weather clothing. Identify and evaluate characteristics in terms of effectiveness. Generate ideas for students' own design. Draw ideas. Select appropriate materials and make the outfit for the teddy bear.

Task

Investigate the weather conditions that we can experience at any time of year. [I]

Activities

Observe and identify a range of weather conditions, eg rain, sun, fog, hail. Predict the weather conditions you would expect at different times of the year. (Test predictions using unit activities through the year.) Discuss how the seasons differ from those in Europe and North America. [TS7]

Task

Investigate the changes that take place at different times of the year in:

- the weather
- plant and animal life
- human behaviour. [G]

Activities

Weather

Observe and record daily weather on chart. Make comparisons to other seasons.

Observe and informally measure wind in different parts of the playground, near buildings etc. Record on drawing or simple diagram of school. Observe and record sunny/shady areas of school on drawing, plan or map.

Use simple equipment to record rainfall over a month by measuring the quantity of water collected.

Construct a calendar using symbols to show rainfall over a month.

Plants and animals

Trace around and record colours of leaves. Do a tree/leaf survey. Visit local botanic gardens. Collect animal life from a tree by gently shaking a branch over a sheet. Identify and record the number of insects present. Count and record the number and varieties of birds in the playground. Compare results each season.

Human behaviour

Discuss effects of weather. Explore foods eaten, feelings, leisure activities, outdoor/indoor activity, health (eg sunburn, colds, hay fever), clothing, holidays, feasts. Discuss ways traditional Aboriginal people move in response to seasonal change, eg water supply and food resources.

Task

Investigate fabrics and their suitability for use in wet weather garments. [G]

Activities

Test a range of materials and fabrics to discover how well they protect from rain, dry when wet, etc. Predict how long various fabrics will take to dry. Test and compare results with predictions. Explore ways of drying fabrics faster. [TS31]

Communicating through pictures

Content focus

**Built Environments
Information and Communication
Products and Services**

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understandings

Students will know and understand that:

- there are different ways of communicating with others
- products can be created to fulfil specific purposes.

Students will:

- recognise that discoveries can be made through play, exploring and experimenting
- give examples of how people plan, to make in order to provide for their own and others' needs
- show that equipment should be used with care and safety.

Skills

Students will be able to:

- observe using all the senses
- interpret data and explain their observations
- present ideas as to what they might plan as a design proposal
- combine a variety of materials and images to make simple models, drawings and structures
- describe to others the strengths and limitations of a design
- choose classroom materials and tools appropriate to the activity
- maintain and care for equipment in their immediate surroundings and organise their immediate environment.

Values and Attitudes

Students will:

- work cooperatively in groups
- be curious about the natural and made environment
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected example strategies that may be used in assessing the objectives of this unit of work.

- Observe students designing and making their visual programs.
- Encourage peer evaluation of the stories created.
- Have students explain how they would create a mood using only pictures or textures.

Links with other Key Learning Areas

English

Discussing common features of stories (narrative) — characters, setting and events, structure. Encouraging students to draft, revise/edit and publish stories.

Mathematics

Comparing groups using pictorial representations. Using photographs to explore simple mathematics concepts.

Human Society and its Environment

Using skills developed in this unit to extend ways of organising and presenting information.

Personal Development, Health and Physical Education

Using movement to communicate ideas, messages or a story.

Creative and Practical Arts

Visual Arts: sequence using mediated images, eg asking questions, looking at pictures.

Teacher notes

Skills in 'reading pictures' should be developed progressively throughout every year of schooling. Students at Stage 1 can take photos using simple cameras, developing skills in framing objects and selecting visual information. A variety of visual products can be created, eg tape/slide sequences, photo montage, drawings with captions, picture sequences selected from magazines etc.

Teachers need to be sensitive to cultural and gender stereotypes represented on television. Discussion of how TV characters differ from students may be appropriate.

Suggested resources

Photography, Meadows, G

Hands On, Taylor, A

Photography: Take a Look, Herd, D

Classroom Photography, CDC

Learning by Making Photographs, CDC

Computer software: computer graphics software, eg Create With Garfield, Explore-a-Story Series, Picture Book, Big Book Maker

People and places: local TV stations, local theatre groups, local newspaper

Materials and equipment: magazines, storybooks, pictures and photographs, television timetables, audio-visual equipment

Teaching strategies

18 *Clarifying a design task*

25 *Selecting and using materials*

31 *Audio-visual technologies*

36 *Animation*

Task

Design and make a visual program accompanied by a sound track. [W]

Activities

Decide on a story (or ideas) to be told. Consider traditional stories from various cultures.

Choose a way of presenting the pictures and sounds or text, eg tape/slide sequences, photo story (using photos, drawings or OHP transparencies) with spoken/performed soundtrack.

Create an image for each part of the story. Consider the information to be included and how it will appear. Think about how to create the feel required.

Select and produce sounds that might accompany the story. Devise a way of ensuring the soundtrack matches the pictures when presented.

Present the program. Evaluate in terms of audience enjoyment as well as personal satisfaction.

Task

Use text and graphics software to create a visual story. [I]

Activity

Explore graphics available in the package, eg backgrounds, characters, objects. Combine selected elements to create visual scenes. Evaluate.

Write captions using text facility or word processor or add a sound track. Design a title page and credits.

Publish story by viewing on screen and playing the soundtrack, recording story and soundtrack on video or printing. Share with other students.

Task

Investigate how pictures can give us information. [G]

Activities

Gather a variety of pictures, photographs, drawings. Identify what is happening/present in the image. Group images according to different criteria, eg colours, things that seem far away, people, places. Discuss patterns or common features, eg colour creating mood, arrangement of figures, texture, moods etc.

Task

Investigate how pictures can be combined to tell a story. [G]

Activities

Identify how photos/images are part of continuing events. Suggest what may have come before the image, what will happen next. After some practice, students create stories from a given picture. Groups use the same image and each creates a story. Compare stories and note differences. Suggest reasons for these.

Using a number of images, sequence them to tell a story. Tell a story based on a given sequence of pictures. Compare results with other groups with the same pictures in the same sequence or the same pictures in a different order. Add captions and display. Compare results from different groups.

Rearrange images to tell a different story. Consider whether all images are needed.

What's for Lunch?

Stage 1

Food, meals and nutrition

Content focus

Built Environments
Information and Communication
Living Things
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will understand that:

- people organise spaces by assembling and arranging components to meet particular needs
- information can be stored for later use
- living things grow, reproduce, move, need air, take in nutrients and eliminate wastes
- products can be created to fulfil specific purposes
- products can be made, processed or grown.

Students will:

- give examples of the ways the different senses can be used in observation
- name possible needs and wants of people
- give examples of how people plan to make in order to provide for their own and others' needs
- recognise that technological activity affects people and their environments.

Skills

Students will be able to:

- interpret data and explain their observations
- name possible needs and wants of people
- present ideas as to what they might plan as a design proposal
- recognise their own use of technology in the school and home environment.

Values and Attitudes

Students will:

- persevere with activities to their completion
- respect the rights and property of others

- work cooperatively in groups
- gain satisfaction from their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Have students retell their experiences of the luncheon.
- Observe students during the designing and making of the luncheon.
- Ask children to design a healthy meal that could be prepared for different occasions, eg picnic.

Links with other Key Learning Areas

English

Exploring purpose, audience and features of interviews. Practising formulating and asking questions.

Discussing the language of invitations and menus, noting differences and similarities.

Mathematics

Classifying objects according to one or more attributes.

Human Society and its Environment

Identifying foods eaten by students in order to extend understandings of cultural diversity in their own community.

Personal Development, Health and Physical Education

Developing understandings about health and nutrition.

Creative and Practical Arts

Visual Arts: sequence beginning with remembered experiences, eg favourite foods.

Teacher notes

Discussion of diabetes, allergies etc, would be appropriate at this stage, especially if there are students in the class with diet restrictions.

Food groups to include in a healthy, balanced diet are bread and cereals,

meat and fish, fruit and vegetables, dairy products.

With young students it is important that discussion of 'bush foods' also emphasises the dangers of eating unidentified berries, fruits etc found in students' environment.

Suggested resources

What Did You Eat Today? Nelson
Short Cuts to Health and Living (kit)
Buying Lunch at School (video)

Computer software: graphics software, eg The Print Shop, Printmaster Plus, Deluxe Paint III, Children's Writing and Publishing Centre

People and places: The Royal Botanic Gardens; local markets; food market groups, eg Egg Board, Fish Marketing Authority

Materials and equipment: cooking utensils, menus, ingredients as selected, pictures of foods, samples of vegetables to observe and group

Teaching strategies

- 1 Cooperative learning
- 7 Observing to explore and discover
- 18 Clarifying a design task
- 26 Organising tools, equipment and processes
- 38 Publishing

Task

Design and make a healthy lunch for the class. Invite a guest, using computer technology to personalise invitations. Create an attractive menu. [W]

Activities

The meal

Discuss the range of foods that could be included in a lunchtime meal.

Survey to discover the foods people like to eat for lunch. Brainstorm ideas about the ways of gathering information. Suggest questions that could be posed. By consensus, decide on a final set of survey questions. Use the questionnaire to interview other students, family etc. Present the information, eg make a graph, use a computer spreadsheet. Use this information in deciding the meal to be prepared. Refer also to knowledge of healthy food to ensure the choices are appropriate.

Consider how the meal can be presented in an attractive way.

Identify the necessary ingredients and utensils. Organise a way of obtaining these.

The environment

Create a hygienic workspace for preparing the food.

Organise a suitable place for serving lunch to your guests. Consider space, appearance, accessibility, table setting, appropriate cutlery.

The invitations

Consider the requirements of the invitation, eg who is to be invited, how the name and address on the invitation can be changed, whether a reply is required. Select the information to be included.

Using computer software try different ways of organising and presenting the information by manipulating text and graphics.

Evaluate in terms of practicality and appeal.

Jointly construct the final invitation. Design and organise a way for each student to create an individually addressed invitation.

Produce the invitations and send to the guests.

The menu

Using a variety of simple menus, identify how information is presented.

Decide on format, and materials to be used.

Make the menus.

Task

Investigate our need for healthy food. [G]

Activities

Explore how we can find out what people need to eat. Try the library, ask other people, eg a nurse, dietitian, Aboriginal health unit.

Research whether all people need the same food, eg children, adults, grandparents, people with diabetes, allergies etc. Find out if people choose to eat the same foods. Discuss individual likes/dislikes of students in the class.

Classify foods into groups, eg foods with leaves, red coloured. Try again using different criteria, eg red meat, white meat, vegetables, by taste, smell or touch.

Identify healthy foods, why they are good for us and why it is important to provide a balance between different food types. Group foods into healthy and not so healthy.

Invite someone to speak to the class about food and diet, eg nurse, doctor, athlete.

Explore bush foods. Compare to other foods available to class. Research traditional Aboriginal diet.

Task

Investigate where our food comes from. [W]

Activities

Group the food items identified earlier as plant or animal. Identify the parts of plants that we eat, eg leaves, roots, stems. Classify common fruit/vegetables according to the parts we eat, eg leaves: lettuce, cabbage; stem: celery, onions.

Visit the local shops and identify the foods purchased at each, eg fruit and vegetables, meat, bread.

Explore where food comes from before reaching the shops. Visit a farm, orchard or cannery. Observe the production of milk, eggs, grains.

List common food eaten by the students and beside each name the source of food.

Task

Investigate what makes a healthy lunch. [I]

Activities

Individually list the types of food eaten for lunch (as opposed to other meals). Identify what makes these suitable for lunchtime eating, eg sandwiches are easy to wrap, salad doesn't have to be kept warm. Explain why certain foods are not eaten for lunch. Discuss the variety of food eaten by people from various cultures.

Explore social customs associated with eating lunch, eg in some places the main meal is sometimes eaten at 'lunchtime', different names for meals, implements used in different places/cultures.

Wheels and how students use them to move

Content focus

Built Environments
Physical Phenomena
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- environments are sometimes modified to fulfil new and different requirements
- production technologies have changed over time
- simple machines can make moving loads easier
- materials and resources are used to produce goods and commodities
- materials are joined, formed, shaped and finished.

Students will:

- demonstrate that investigation can take many forms
- recognise that the results of investigations can lead to more questions
- show that designing and making can lead to the need for investigations
- recognise that designs are constrained by time, skills, tools and materials
- identify the forms and components used in the production of a design
- relate planning and evaluating to each stage of designing and making
- relate the particular properties of materials to end uses
- justify the selection of processes, tools, equipment, materials, products and software to meet the requirements of the task.

Skills

Students will:

- state the issue or area to be investigated
- propose explanations using simple observations
- make a prediction based on data collected by themselves or others
- describe needs and wants of people in relation to design activities
- suggest modifications to design proposals to improve the original design

- recognise the appropriate use of tools, equipment, hardware and software
- report on the social and environmental costs and benefits of familiar technology.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- have a positive view of themselves and their capabilities
- show responsiveness to ideas
- persevere with activities to their completion
- be honest and open in their dealings with others
- work cooperatively in groups
- show a commitment to fair treatment for all
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- appreciate the scientific and technological contribution made by Australians.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Use cooperative assessment of group work in the design and making of futuristic transport.
- Observe students in their manipulation of gears/cogs.
- Consider their willingness to engage with the materials and how well their understandings are utilised in their designs.

Links with other Key Learning Areas

English

Exploring purpose and features of a report, to describe their means of transport.

Using talking and writing to explain how cogs and gears work.

Mathematics

Observing and exploring the shapes of moving parts of toys. Explaining how they fit together and affect other moving parts.

Human Society and its Environment

Researching effects of transport systems on local communities and other Australian communities, past and present.

Personal Development, Health and Physical Education

Emphasising road safety rules that apply to safe and responsible use of bicycles and other vehicles.

Creative and Practical Arts

Visual Arts: preparing a collage showing the different types of vehicles.

Music: creating a song using the sounds of different vehicles.

Teacher notes

When using their own means of transport, students must take a great deal of responsibility for their own safety and so need to be aware of the dangers involved.

If making cardboard cogs ensure a standard pattern is used.

Suggested resources

Street Sense, Level 1 and 2 (kit), Road Traffic Authority

Skateboarding is not a Book, Adams, V et al

Bicycles Down the Years (video), Curriculum Branch Ministry of Education, Victoria

Computer software: prepared graphic software, eg Car Builder, Transportation/transformation, Wild Science Arcade, All about Simple Machines

People and places: Powerhouse Museum, CSIRO centre, RTA, Wollongong University Science Centre

Materials and equipment: Osmiroid Teko, Lego Technic Duplo, Googolplex, Meccano, bikes, roller skates, skateboards

Teaching strategies

8 *Researching to explore and discover*

9 *Manipulating to explore and discover*

17 *Exploring needs*

23 *Considering appearance and function*

25 *Selecting and using materials*

Task

Design and make a means of transport for the future. [G]

Activities

Brainstorm ideas. Draw a picture to explain how the vehicle works. Include safety features.

Choose materials, considering their suitability. **[TS5]**

Consider how they can be joined and shaped.

Make the model. Test and evaluate its success.

Write a report describing your means of transport.

Include details of how it would be used, where it would be able to go, the fuel it needs, what it might be made of if it were real.

Reflect on the implications of using the chosen materials and fuel source.

Task

Design solutions to problems associated with the use of students' transport. [G]

Activities

Discuss and identify problems students experience in using rollerskates, skateboards. **[TS17]**

Identify problems that can be addressed by the class, eg nowhere to ride, kids not wearing helmets, cyclists being difficult to see.

In groups, suggest solutions to the problem or action that can be taken, eg design a bike path in most frequently used areas, a rollerskating area in a local park or school, a campaign to raise awareness of bike safety, safety equipment to make riders easier to see.

Evaluate any local facilities already provided. Model, construct or present the design. Wherever possible implement the design.

Evaluate the design in terms of how well it may solve the problem. Consult other people, eg parents, council, community members for their reactions.

Task

Investigate how gears/cogs make things move. [G]

Activities

Identify cogs/gears in the students' environment, eg parts of bicycles, toys, clocks, motors. **[TS8]**

Explore how cogs work using cardboard examples or Osmiroid Teko, Lego Technics, Meccano. Consider how they fit together, how one cog makes others move, the source of energy, eg pedals, motor, water.

Trace the path of movement from one cog to another.

Explore how different sized cogs change the movement.

Task

Investigate how transport needs have been met in the past. [I]

Activities

Research different means of transport and how they have been developed to meet specific needs, eg trucks to move heavy loads, ships for travel on water. **[TS8]**

Compare past and present forms of specific vehicles. Show how and why vehicles have changed. Identify safety features and how they've changed. Make a time line to show developments in transport.

List problems arising from developments in transport, eg more roads, runways, fuel use, pollution.

Predict what transport may be like in the future. Consider availability of fuel, impact of more roads and more cars, alternatives to present means etc.

Task

Investigate students' transport. [G]

Activities

Survey students to find their most commonly used means of transport.

Observe the structure of student vehicles and how they work, eg bicycle—wheels, gears; rollerskates—wheels, bearings. Draw diagrams of vehicles. Label working parts and explore their function. Research how to ensure they are operating correctly. Discuss the safety benefits of regular maintenance checks.

Discuss the advantages and disadvantages associated with these means of transport, eg bikes—head injuries, dangerous on the road; skates—nowhere to ride safely.

List road safety rules that apply to the use of student vehicles.

Explore ways of making riders 'stand out'. Predict which clothing colours are most noticeable. **[TS22]** Devise a way of testing the suggestions. Trial a variety of devices and methods to increase riders' visibility.

Task

Use gears to design and make a toy that includes something that moves, eg top launcher, merry-go-round. [G]

Activities

Explore how gears make things move and how they can be used to make a toy work. **[TS9]**

Select materials to build the toy, eg match boxes, balsa wood, construction materials.

Consider how the toy looks. Add decorations if appropriate.

Indoors, Outdoors

Stage 2

Organising spaces into structures and buildings

Content focus

Built Environments
Living Things
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people create specialised environments to meet specific needs
- structures are built from natural and processed materials and components
- environments are sometimes modified to fulfil new and different requirements
- computers are machines that store and process information
- plants and animals live in environments that supply their needs
- materials and resources are used to produce goods and commodities
- manufacturing processes convert raw materials into useful products
- there are benefits and problems associated with human changes to the physical environment.

Students will:

- show that designing and making can lead to the need for investigations
- give examples of predictions that are sometimes supported, sometimes disproved
- recognise that designs are constrained by time, skills, tools and materials
- relate the particular properties of materials to end uses
- justify the selection of processes, tools, equipment, hardware and software.

Skills

Students will:

- make accurate observations and describe these observations, or record them as diagrams, tables of data and graphs
- propose explanations using simple observations

- make a prediction based on data collected by themselves or others
- devise ways of checking or testing predictions
- evaluate materials and processes used
- recognise the appropriate use of tools, equipment, hardware and software.

Values and Attitudes

Students will:

- persevere with activities to their completion
- respect the rights and property of others
- work cooperatively in groups
- show informed commitment to improving the quality of their local environment
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Conduct conferences with students to identify the features of various outside/inside features.
- Have students present their findings in the form of similarity/difference charts.
- Discuss the materials that could be used in construction in different environments.

Links with other Key Learning Areas

English

Demonstrating how to formulate questions and access non fiction research material.

Using talking and writing to cooperatively plan, select and manipulate resources and make decisions.

Mathematics

Investigating the properties of 3D objects, especially prisms and pyramids. Describing objects from different points of view. Classifying and constructing 2D shapes.

Human Society and its Environment

Investigating built environments locally and in other Australian communities, past and present.

Creative and Practical Arts

Visual Arts: sequence starting with remembered experiences, eg places, building. Using colour.

Teacher notes

Care should be taken if discussing students' homes. The unit focuses on the specific use of materials related to the features of buildings.

Suggested resources

Bridges, Graham, R
How we Build (Series), Macmillan
The Source Book (kit), The Built Environment Education Network
The Blue Mountains, Threatened Wilderness (video)
Where the Forest Meets the Sea (Video), Film Australia

Computer software: graphics software: Swivel 3D, Build (Micro Primer Pack 3), Building Perspective, Dragon World, Flowers of Crystal, Town Builder

People and places: botanic gardens, local parks, Department of Planning, Powerhouse Museum, Sydney Tower, Canberra (a planned city)

Materials and equipment: building blocks, construction materials, photographs of homes and buildings

Teaching strategies

- 7 *Observing to explore and discover*
- 11 *Predicting outcomes*
- 15 *Explaining understandings*
- 16 *Applying understandings*
- 17 *Exploring needs*
- 24 *Evaluating designs*
- 25 *Selecting and using material*
- 41 *Computer graphics*

Task

Design and make a model of a playground. [G]

Activities

Gather information, by researching a variety of sources on how playgrounds are planned, eg what structures are required, other areas such as bridges, spaces and other facilities. **[TS15]** Discuss how the model will be made, eg materials needed for selected structures or to reproduce the look and feel of actual building materials. Consider how these methods and available materials may influence the design. Organise groups to make the final decisions about features to be included. Make a plan. Use models and rough sketches to try out different ideas. Draw a map or picture of the design. Show where items will be placed, eg swings, see-saws, bridges, open space, toilets. Explain to others decisions made regarding selection of structures and materials used, organisation of structures and spaces. Can others make suggestions to improve the design? Assign roles for completion of task. Gather materials. Choose suitable materials from those available. Make the model. Reflect upon your task considering the structures. Include how spaces have been used. Would you like to play in this area? Explain why.

Task

Design a plan for a city or community of the future, or suited to a different environment, eg underwater, in space. [W]

Activities

Establish conditions that may prevail in the selected environment, eg under water, polluted air, personal aerial transport, shortage of building space. **[TS16]**

Identify the special needs to be satisfied, eg provision of air to breathe, transport systems, food supplies, sealing out water. Brainstorm ideas regarding the structures and services required and possible ways to supply them. **[TS17]**

Use drawings, models or computer graphics packages to explore possibilities. Demonstrate how needs would be met or provided for. Consider the materials that would be appropriate in the given environment, eg underwater, for aerial buildings, underground. Construct a set of annotated drawings or plans, a model or computer presentation. Present to the class. Evaluate how well the needs have been satisfied.

Task

Investigate buildings and materials in a range of environments. [I]

Activities

Observe homes students live in. Make a record of different types of homes, eg a mural/collage, skyline silhouette. Compare differences in their physical structure. **[TS7]** Look at a variety of scenes – photographs, videos of cities, country scenes, past and present. Explain aspects of the buildings that appeal, eg shape, colour, surroundings. Identify a variety of buildings with different purposes, eg shops, factories, silos, halls, schools, offices. Observe differences in their features. Explain how the outside of a building can indicate its purpose, eg signs, features. Predict what a given building might be used for. **[TS11]** Test the predictions through further investigation. Discuss whether the area a building is found in gives rise to expectations as to its purpose. Suggest reasons for the observations. Visit a country town, inner city suburb. Record observations of buildings, spaces and their organisation. Use annotated sketches. Compare the placement of the homes as they appear in the city, country or in a suburb, past or present. Observe different uses of space. Research how cities have or have not been planned, eg Sydney, Canberra. Explore the needs for ‘green’ areas in a city or town. Make lists of the things that appeal/don’t appeal in the city or in the country. Compare the two lists. Consider whether everyone has the same opinion. Observe the features of buildings. List the parts of a building, eg windows, entrances, steps, doors, verandahs. Observe and sketch a range of different examples. Compare the shapes of the entrances and windows. Compare a variety of rooms to see the effect of different windows. Walk around the school, visit shops. Make a model to test the effect of large and small windows, eg light, temperature. List the things that buildings are made from. Identify materials used for different features, eg walls, roofs, window frames. Describe as many properties as possible of selected material. Predict the possible effect on material of wetting, leaving in the sun etc. Experiment to test the effects. Compare the effects of different materials. Suggest possible uses for these materials in construction based on their characteristics. Identify other structures found, eg bridges, towers. Identify shapes used in these structures, eg triangles, rectangles. Explain why these shapes are used. Predict and test what would happen if different shapes were used. **[TS24]** Test different shapes to find which are most stable.

Task

Use computer software to investigate created environments of animals and describe the features of each. [I]

Activity

Explore the graphics, graphics tools, objects, characters, backgrounds etc in the software package. **[TS41]**

Investigate environments created by the computer software, simulation or create own environment using graphics and graphics tools. Use draw and paint programs to create a habitat that has been investigated, such as floor plans, buildings. Discuss the advantages of being able to simulate environments and being able to easily manipulate graphics within the computer microworld. **[TS15]**

Interactions of living things

Content focus

Built Environments
Information and Communication
Living Things

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people create specialised environments to meet specific needs
- environments are sometimes modified to fulfil new and different requirements
- computers are machines that store and process information
- plants and animals live in environments that supply their needs
- living things depend on other living things to survive.

Students will:

- demonstrate that investigation can take many forms
- recognise that the results of investigations can lead to more questions
- give examples of predictions that are sometimes supported, sometimes disproved
- recognise that designs are constrained by time, skills, tools and materials
- relate the particular properties of materials to end uses
- explain that technology can be used to help people learn
- understand that the use of tools, equipment, software etc requires the development of specific skills
- show that technology can enable people to gain access to organise and use information.

Skills

Students will:

- state the issue or area to be investigated
- make a prediction based on data collected by themselves or others.
- devise ways of checking or testing predictions
- describe needs and wants of people in relation to design activities

- suggest modifications to design proposals to improve the original design
- use basic construction tools, materials and computerised data bases to refine observations.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- show responsiveness to ideas
- respect the rights and property of others
- work cooperatively in groups
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Conduct conferences with students to identify the modifications needed to attract different animals to an area.
- Have students use their database to find information.

Links with other Key Learning Areas

English

Modelling with students, reading and writing factual reports.

Exploring the purpose and features of reports.

Encouraging students to use talking and writing in formulating plans and conferring with others.

Mathematics

Comparing areas, measuring areas in square metres.

Measuring, graphing and comparing animals and insects and their body parts.

Human Society and its Environment

Investigating the impact of human activity on the natural environment in the local area.

Personal Development, Health and Physical Development

Extending activities to look at the behaviours of people in restricted environments.

Teacher notes

Interdependence can be shown in pictograms of food webs.

Other microenvironments could include fish ponds, terrariums, damp or shady areas, beneath rocks. An area of a flower bed is of great interest.

The effect of one thing on another, their relationship and interdependence are vitally important as a focus in this unit.

Suggested resources

Grounds for Learning, Cox, D et al
Looking at ... (series), Suzuki, D
The Puffin Book of Australian Insects, Hunt, H

Beastly Neighbours, Rights, M
How Does your Garden Grow? Heinze, K

Tracks into Primary Science, Freer, K and O'Toole, M

Look (series), HBJ

Insects (video), Film and Video Library

Amazing Ants (video), Coronet

The Hidden World (video), National Geographic

Computer software: graphics software: Explore Australia, Explore-a-Science-Whales, The Insect World, Heath Science, Animal Trackers. Adventure games: Frabon, A Deep-sea Quest, Kraken. Databases: Appleworks, FrEdbase

People and places: botanic gardens, parks, zoo, school playground, Department of Environment and Planning, local council, Forestry Commission, Australian Museum

Materials and equipment: magnifying glass/cube, bug catcher, microscope, measuring devices, garden tools

Teaching strategies

7 *Observing to explore and discover*

12 *Clarifying an investigation*

16 *Applying understanding*

24 *Evaluating design*

39 *Databases*

Task

Design and modify the playground to attract new types of animals. [W]

Activities

Select an area to be modified. Describe and evaluate the existing area. Note the animals present.

Discuss how the environment can be altered and how to attract

- (a) more of the same animals; and/or
- (b) different animals to the area.

Choose a range of animals that could be attracted to the areas based on students' investigation, eg birds.

Brainstorm ideas about changes to the environment, eg planting particular shrubs, making a bird bath to attract birds. Make a list of ideas to be considered.

Show suggestions on a plan of the school environment to demonstrate proposed alterations.

Explain reasons for making the changes.

Organise ideas into a series of steps to be followed.

Formulate a plan or combine suggestions to make a final plan. Consider tasks, eg presentation of plan to obtain permission, who will do the actual physical work. Illustrate the steps to be followed on a time line.

Discuss the plan and assign roles to carry out the various tasks, eg organising committee.

Decide how the alterations will be funded, eg raising money, donations. Explore ways of obtaining plants or other requirements cheaply.

Apply the plan to make modifications to the environment, eg plant bottlebrush bushes.

Make regular observations to help evaluate success of the plan.

Based on observations and evaluation, prepare a plan for the continued maintenance of the area. **[TS23]**

Include allocation of responsibilities in a systematic and fair way, eg watering, weeding, replenishing supplies.

Task

Design, make and use a database to record information on selected animals. [G]

Activities

Decide on fields in the database, eg name, habitat, food. Create record blanks on paper.

Record information about chosen animals into the record blanks.

Enter the information into a computer database.

Search the database as part of an investigation, eg food equals plants. **[TS30]**

Task

Investigate a micro environment. [W]

Activities

Observe a designated area on a regular basis for a period of time. This could be one square metre, under a tree, a 30cm cube of ground. Record a detailed description of the area, animals in it, how the area is used. Make drawings showing positions of items, detail of plants/animals present. **[TS7]**

Record changes in the area twice daily for a week.

After several days of observation predict the animals you would expect to find at the next time of recording.

Identify the relationship of the things within the area, eg snails eat plants; ants eat lunch crumbs.

Compare to other animals, eg use a computer simulation program.

Make a detailed drawing to record observations of an animal found in the area, make generalisations about its behaviour. Use a magnifying glass or cube to aid observation. Supplement observation with research. Label the parts of the animal.

Draw food chain/web.

Have students try to think up their own 'pictograms' which show interdependence.

Make comparisons between this area and

- another similar one, but in a different position, eg sunny, grassed area and shady, grassed area
- another very different environment, eg shady grassed area and asphalt. **[TS16]**

Record differences in physical features, flora and fauna present. Suggest reasons for the differences.

Research and identify animals that could be encouraged into the area, eg bees.

Task

Investigate the behaviour of an animal that uses the microenvironment. [W]

Activities

In the selected area identify suitable animals to observe.

Draw or photograph the animal showing characteristics. Make a record of the animal's behaviour. Describe what it is observed doing at specific times, at regular intervals.

Research the needs of the animal, using videos, books, databases. Identify ways that they are being met by the present environment. Suggest improvements that could be made.

Electrical energy in objects

Content focus

Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- magnets attract some materials but not others
- materials and resources are used to produce goods and commodities
- materials are joined, formed, shaped and finished
- most materials come from the earth and its surroundings.

Students will:

- show that designing and making can lead to the need for investigation
- relate the particular properties of materials to end uses.

Skills

Students will:

- state the issue or area to be investigated
- propose explanations using simple observations
- organise systems for small-scale mass production
- recognise the appropriate use of tools, equipment, hardware and software.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- have a positive view of themselves and their capabilities
- show responsiveness to ideas
- persevere with activities to their completion
- be honest and open in their dealings with others
- respect the rights and property of others
- work cooperatively in groups
- show informed commitment to improving the quality of their local environment

- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Challenge students to make a device which is able to compare the strength of two magnets.
- Ask students to compare the strength of several magnets and to place these magnets in order of magnetic strength.
- Discuss with students their understanding of how a magnet can be used to make a motor.
- Ask students to demonstrate how static electricity charges are produced.

Links with other Key Learning Areas

English

Conducting conferences with students to discuss the properties of magnets.

Using oral and written language to describe how students constructed the temporary magnet.

Talking about and developing role plays about situations involving static electricity.

Human Society and its Environment

Researching ways in which changes in this technology have impacted on society.

Investigating the wide variety of devices which use magnets in today's society and discussing alternative methods of performing the function of these.

Personal Development, Health and Physical Education

Using exploration of human needs and wants, and how they change, to lead into science and technology activities.

Teacher notes

Static electricity works best on cool, dry days. If investigations do not work, try again on another day when it is drier when electrons tend to stay rather than flow away in the moister air. Sometimes the static electricity which is produced by the investigators through their shoes on a woollen or nylon carpet can even interfere with the activities which are going on!

Investigations in static electricity can be quite exciting and it provides a great stimulus to the later investigation of electromagnetism.

Suggested resources

Light & Dark, Catherall, E

Simple Science (series), Hodder & Stoughton

Electricity and Magnetism, Whyman, K

Magnets to Dynamos, Fagan, M

Computer software: Make the Connection!, Wild Science Arcade

Materials and equipment

Magnets, bobby pins, pencils, large jar, string, water, pocket compass, rulers, cardboard, pile of books, horseshoe magnets, paperclips, thread, masking tape, metre rule, balloons, woollen cloth

Teaching strategies

10 *Proposing explanations*

14 *Modifying understandings*

15 *Explaining understandings*

19 *Exploring ideas*

26 *Organising tools, equipment and processes*

Task

Use magnets to make a game for a young child. [G]

Activities

Discuss games where magnets are used, eg travel games, drawing games, blackboard games, fishing games, boat games. Consider the specifications of the design. Who will play the game (individual or group)? What will be the theme? How will the end of the game be determined? [TS19]

Devise and make the game. [TS26] Play the game and suggest further modifications or improvements. Evaluate in terms of class enjoyment. Consider whether the game could be mass produced, ie identify which components would need to be made, how would the production line be organised. If possible produce a small number using this method. Consider cost of production, production methods available.

Task

Design and make a compass for use on a treasure hunt. [G]

Activities

Explore the different types of compasses available and identify their main components. Generate ideas as to how a compass could be made.

Make a sketch or plan of the design. Investigate and select appropriate materials and equipment. Make a prototype of the compass.

Judge the compass by using it on a course (to find 'treasure'). Compare with using an accurate commercially produced compass. Suggest improvements to the design.

Task

Design and make a device that will use an electromagnet, eg burglar alarm, toy train signal, industrial metal sorter. [W]

Activities

Gather information by researching the variety of devices that use electromagnets. Discuss how the device could be made, eg materials needed, size of the device.

Detail the proposal by making drawings. [TS10] Explain the device and how it works to classmates. Discuss possible improvements and incorporate them if needed. Produce the device.

Evaluate the design according to its effectiveness, and if appropriate, suggest further modifications. Identify how the device could be mass produced.

Task

Design a method of safely removing a static charge. [G]

Activities

Identify situations in which a static charge is produced. Discuss methods of removing the static charge. Sequence possible steps needed to remove the charge. Trial the method. Evaluate and modify method if needed. Repeat the trial. [TS14]

Task

Investigate the properties of magnets. [I]

Activities

Collect and observe different types of magnets, eg bar, horseshoe, circular.

Identify items that are known to be attracted to magnets. Predict whether other objects, metal and non-metal, will be attracted. Test the materials/items and record findings. Suggest common features of those items attracted to the magnets.

Map the magnetic field around a variety of magnets. Identify where the magnetic force is strongest. Explore and observe the relationship between different magnets.

Make statements to demonstrate understandings about the properties of magnets. [TS15]

Research and list possible uses of a permanent magnet.

Explore the use of a magnet as a compass.

Task

Investigate the construction and use of a temporary magnet (an electromagnet). [W]

Activities

Explore how a temporary magnet may be made using electricity. [TS19] Predict the factors that will make the electromagnet stronger. Test these predictions, then summarise these findings. Compare the properties of an electromagnet and a permanent magnet. Brainstorm possible uses for electromagnets where permanent magnets would be unsuitable. Research the use of temporary magnets in industries such as automobile wreckers.

Task

Investigate static electricity. [I]

Activities

Collect and observe different types of material that can be charged when rubbed.

Observe different types of materials that stick to charged object. Predict whether other objects will be attracted to the charged object. Test materials/items and record findings. Suggest any common features of those items affected by charged objects.

Make statements to demonstrate understandings about static electricity.

Research situations where static electric charges occur. (eg walking across nylon carpet, lightning).

Keep in Touch

Stage 2

Different ways of communicating

Content focus

Information and Communication
Physical Phenomena
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- computers are machines that store and process information
- people use different technologies to organise and communicate information in different ways
- production technologies have changed over time
- materials and resources are used to produce goods and commodities
- there are benefits and problems associated with human changes to the physical environment.

Students will:

- show that designing and making can lead to the need for investigations
- identify the forms and components used in the production of a design
- relate planning and evaluating to each stage of designing and making
- explain that technology can be used to help people
- justify the selection of processes, tools, equipment, materials, products and software to meet the requirements of the task
- understand that the use of tools, equipment, software etc requires the development of specific skills
- show that technology can enable people to gain access to, organise and use, information.

Skills

Students will:

- state the issue or area to be investigated
- make a prediction based on data collected by themselves or others
- use graphics, models and written data to record the exploration of different ideas for design proposals and to assist making
- suggest modifications to design proposals to improve the design
- evaluate materials and processes used
- recognise the appropriate use of tools, equipment, hardware and software
- report on the social and environmental benefits of familiar technology.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- have a positive view of themselves and their capabilities
- persevere with activities to their completion
- be honest and open in their dealings with others
- respect the rights and property of others
- show informed commitment to improving the quality of their local environment
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Observe students' comments and discussion when negotiating design requirements.
- Have each student state their own information, as deemed important when using the telephone.
- Determine whether the method of communicating a method across the playground meets the design task requirements and achieves the outcome.

Links with other Key Learning Areas

English

Demonstrating oral language techniques in presenting news, eg tone variation, voice inflection. Focusing on the differences between 'oral' news and 'written' news. Encouraging shared reading.

Identifying the purpose, audience and techniques needed to design and produce a performance.

Mathematics

Graphing time that messages take to be passed across the playground or from one building to another, by various methods.

Personal Development, Health and Physical Education

Investigating qualities needed for effective communication. Extending understandings about why and how communication needs to change in different situations.

Human Society and its Environment

Considering individual differences using knowledge and skills to present research findings in ways appropriate to the purpose.

Identifying newspaper articles relevant to current investigations.

Creative and Practical Arts

Selecting and assembling appropriate materials and music for a production.

Teacher notes

Regular 'news' sessions can provide a useful introduction to reporting and factual writing.

Electronic mail systems (eg Keylink) can give students the opportunity to exchange news items with other students around the state.

News records can be made for different audiences at different times during the unit. Audio recordings should provide an interesting alternative to written news items. Simple word processing and graphics programs provide other ways of recording news items. Teachers need to deal carefully with sensitive issues/events raised by students. Teachers may need to direct students toward the sorts of news/information to look for.

Suggested resources

Reading People, Cooke, D

Survival: A History of Aboriginal Life, Parbury, N

Let's Go to a TV Studio, Grahame, A
Messages, McPhee Gribble Publishers

You Can Get There From Here (video kit), OTC

Computer software: communications software: Apple Access II, Talk is Cheap, Telecom, Microsoft Works; publishing software, eg Children's Writing and Publishing Centre, Print Shop, Print Master

People and places: local Telecom office, OTC, libraries

Materials and equipment: packaging, magazines, newspapers, audio tape recorders, cassettes, players, paper

Teaching strategies

13 *Trialling and testing ideas and concepts*

15 *Explaining understandings*

26 *Organising tools, equipment and processes*

27 *Selecting appropriate technologies*

31 *Evaluating chosen technologies*

32 *Audio-visual technologies*

38 *Publishing*

40 *Video production*

Task

Design and make a method of communicating a message across the playground or from one building to another. [G]

Activities

Clarify the requirements of the design. Consider the many ways of communicating and evaluate whether they would fulfil the criteria. Choose a method or a combination of methods, taking into account your needs and available resources. Consider: materials needed, eg wire cable, trained animal, special writing implements; knowledge or skills required by receiver, eg how to operate equipment, code or system. Try the system including organisation of people and resources. **[TS28]**

Task

Design and make a method of communicating news to other classes or parents. [G]

Activities

Discuss ways of recording news for other people, eg writing, tape recorder, news presented through a series of pictures. **[TS40]** Consider whether some methods are best suited to different audiences, eg pictures for other classes. Decide on the audience, eg another class, parents, school assembly, local community. Gather news from a variety of sources, eg home, school, playground. Select items that would be of interest to the audience. Explain the reasons for the choices. **[TS15]** Choose a method of presentation, eg a tape recording may not be appropriate for reporting to parents. Make decisions about how the contents will be arranged, eg school news, playground events. Create pictures to accompany news. Add captions to pictures. Create the news product and present to the audience. Inter-class news can be swapped on a regular basis. Take part in 'news swapping' activities using bulletin board facilities on an electronic mail system (eg Keylink). Send faxes via electronic mail or fax machine.

Task

Investigate how news is recorded. [W]

Activities

Identify methods of recording news, eg papers, television, radio. Predict what technology has been used to record the news items, eg filmed with a video camera, stories written on a computer, photographs taken with a camera. Identify features of a news article using a variety of children's magazines, eg headline, pictures, captions. In groups, make illustrations of an item of news and add captions. Suggest 'headlines' for simple items. Illustrate one aspect of a news item in students' news stories. Discuss how the image is a part of the whole item. Add captions to the pictures. Explore how computer technology can be used to record and present news. **[TS29]** Use packages that combine word processing and graphics to experiment with arrangement of text, headings and graphics in a column format. **[TS38]** Print out and compare different layouts. Evaluate. **[TS13]**

Task

Use a telephone to communicate information. [I]

Activities

Demonstrate and discuss talking on the telephone using role play. Explore the use of a telephone. Decide what skills are important, eg knowing your own phone number, how to dial, correct answering, what to do in emergencies. **[TS31]**

Task

Investigate the variety of ways of communicating in specific conditions. [G]

Activities

Collect a variety of familiar objects (or pictures), eg TV set, tap, chair, radio, telephone, plant, comics, computers, CB radio, VHF radio. Match the machine to its purpose, eg telephone, talk to someone in another place. **[TS31]** Discuss and group those that involve watching, listening, reading, looking at pictures etc. Choose other ways to classify, eg don't use/use electricity, used alone/with other people. Observe communications devices in the local environment, eg satellite dishes, antenna, flags, lighthouses, telegraph wires, signs. Research the uses of items listed, eg satellite dishes used to receive television messages, flags used on ships. List other possible methods of communicating, eg pigeon, codes, Aboriginal sign languages. Identify the senses used for each method, eg hearing, sight, feel. Reflect on how this may affect the sensorially disabled. Observe and identify the conditions required for each system to work, eg needs electricity, needs to be able to see far enough, need to know the code, need to be able to read. Predict advantages and disadvantages of different systems, eg is cheap, secret, fast, reliable. Test by trying them out under different conditions.

Using machines to help us

Content focus

Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people use different technologies to organise and communicate information in different ways
- production technologies have changed over time
- simple machines can make moving loads easier
- materials and resources are used to produce goods and commodities
- materials are joined, formed, shaped and finished.

Students will:

- demonstrate that investigation can take many forms
- recognise that the results of investigations can lead to more questions
- recognise that designs are constrained by time, skills, tools and materials
- identify the forms and components used in the production of a design
- relate planning and evaluating to each stage of designing and making
- explain that technology can be used to help people learn.

Skills

Students will:

- make accurate observations and describe these observations, or record them as diagrams, tables of data and graphs
- describe needs and wants of people in relation to design activities
- use graphics, models and written data to record the exploration of different ideas for design proposals and to assist making
- organise systems for small-scale mass production
- report on the social and environmental costs and benefits of familiar technology.

Values and Attitudes

Students will:

- have a positive view of themselves and their capabilities
- persevere with activities to their completion
- respect the rights and property of others
- show a commitment to fair treatment for all
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- appreciate the scientific and technological contributions made by Australians.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Have students explain what simple machines can do.
- Evaluate students' devices against design brief.
- Listen to student discussions during group work.

Links with other Key Learning Areas

English

Exploring the purpose and features of written explanations including the nature of displays.

Mathematics

Introduction to ratio through enlarging and reducing drawings to scale.

Human Society and its Environment

Investigating the influences of relevant technologies on lifestyles and environments as part of cultural studies.

Creative and Practical Arts

Drama: improvising movement activities through mime.

Teacher notes

When investigating the historical aspect of machines, students will come in contact with 'simple machines', eg levers, ramps and pulleys. These often appear as part of more complicated modern machinery.

Simple machines enable humans to perform tasks more easily. Machines do not save or conserve energy but allow energy to be used in a more efficient way.

In this unit students should not be looking at the detailed analysis of the machine. Identifying machines as levers, pulleys etc is not essential to students understanding why and how we use machines. The emphasis of the teaching should be that machines allow tasks to be performed more easily.

Suggested resources

Finding Out About (series), Hodder & Stoughton

The Way Things Work, Macaulay, D

How Things Work, Kerrod, R

Tracks into Primary Science, Freer, K and O'Toole, M

40,000 Years of Technology, Australian Institute of Aboriginal Studies

Investigate (series), HBJ

Village Technology (kit), UNICEF

Good Cleaning Fun (video), Ministry of Education, Victoria

Simple Machines (video), Encyclopedia Britannica

Computer software: graphics software, eg Mouse Paint, MacDraw, MacPaint, Deluxe Paint III, Ist Paint, Artisan 2, Picture It; science software, eg All about Simple Machines

People and places: museums, historical societies

Materials and equipment: simple household equipment, Meccano, Lego, Osmiroid Teko

Teaching strategies

8 *Researching to explore and discover*

9 *Manipulating to explore and discover*

18 *Clarifying a design task*

19 *Exploring ideas*

31 *Evaluating chosen technologies*

Task

Design and make a useful device /simple machine. [G]

Activities

Negotiate selection of any one of the following design briefs or identify a need independently. **[TS19]**

Design and model a device to:

- crush cans for the school recycling system
- enlarge or reduce drawings
- move a load up a slope
- provide childproof safety locking for a cupboard or gate.

For each task, establish criteria for a satisfactory design – identify the need to be addressed, are there any restrictions, work out exactly what is expected of the device.

[TS18]

Working in groups, students should generate ideas for the task. Students may seek the advice of professionals or people with special expertise. Students may investigate and evaluate existing products as a source of ideas. Develop group ideas by modelling or using annotated drawings. Estimate the resource requirements (time, material and tools) and check on their availability. **[TS20]**

Produce a prototype of the design.

Present the design to class and invited experts.

Discuss how practical the design is and whether it would present any production problems if manufactured on a small scale. Detail the steps needed for the class to mass produce this product. **[TS31]**

Task

Design and present a museum display illustrating developments that have occurred in specific technologies. [G]

Activities

Identify the range of technologies to be represented, eg types of transport, household appliances, writing, photography or moving pictures, measuring time.

Research the implements, devices or procedures as they have evolved over time. Consult members of the community, grandparents or local museums.

Negotiate the style of presentation to be prepared by each group and items required, eg actual examples of devices, photos, captions/information cards, posters.

Collect available items, take photographs, prepare diagrams, write and publish text.

Obtain an area to be used. Organise the spaces to maximise viewing area and best display each item. Consider costs and whether admission needs to be charged. Publicise the grand opening.

Complete the project and invite the guests.

Task

Investigate simple machines. [G]

Activities

Explore circumstances when a simple machine makes a task easier, eg walking with a broken leg without crutches, opening a can without a can opener, sweeping the floor without using a broom etc.

Levers

Compare the effort needed to move large loads with/without using a lever, or long pole. Sweeping the floor with/without using a broom. Explore the use of similar simple machines in the classroom or home, eg spade, tyre lever.

Ramps/wedges

Compare the effort needed to lift a large load without using a ramp. Identify areas where ramps/wedges are used in community – as entry/exit to buildings, in pencil sharpeners, as door stops, in axes.

Pulleys

Visit a local garage, farm or industry and find out where pulleys are used and why. Explore the use of pulleys in the community and explain why these are used. **[TS9]**

Task

Investigate the use of simple machines in Aboriginal culture. [I]

Activities

Explore the various types of tools used in traditional Aboriginal culture. Identify the features of each and the reason for use. Invite a guest speaker to demonstrate their use. **[TS8]**

Cycles in Our World

Stage 2

Cyclic patterns in nature

Content focus

Built Environments
Living Things
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people create specialised environments to meet specific needs
- environments are sometimes modified to fulfil new and different requirements
- plants and animals live in environments that supply their needs
- change occurs throughout the lifetime of living things
- living things depend on other living things to survive
- there are benefits and problems associated with human changes to the physical environment.

Students will:

- demonstrate that investigation can take many forms
- recognise that the results of investigations can lead to more questions
- show that designing and making can lead to the need for investigations
- relate the particular properties of materials to end uses
- justify the selection of processes, tools, equipment, materials, products and software to meet the requirements of the task
- show that technology can enable people to gain access to, organise and use information.

Skills

Students will:

- make accurate observations and describe these observations, or record them as diagrams, tables of data and graphs
- propose explanations using simple observations
- make a prediction based on data collected by themselves or others
- describe needs and wants of people in relation to design activities

- use graphics, models and written data to record the exploration of different ideas for design proposals and to assist making
- evaluate materials and processes used
- report on the social and environmental costs and benefits of familiar technology.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- have a positive view of themselves and their capabilities
- show responsiveness to ideas
- be honest and open in their dealings with others
- show informed commitment to improving the quality of their local environment
- be curious about and appreciate the natural and made environment.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Have students publish their record of the life cycle of chosen species and use it to explain their understandings of relationships.
- Observe students' attitudes to the care of living things in the classroom.

Links with other Key Learning Areas

English

Reading, with students, scientific diaries and discussing features and language used. Using this as a model of recording growth of their plants. Discussing purpose of charts etc and how they complement text.

Mathematics

Measuring using informal and formal units. Sequencing events over time.

Human Society and its Environment

Investigating how people meet their needs in the local community and other Australian communities. Investigating the consequences of various types of pollution upon the Earth's cycles.

Personal Development, Health and Physical Education

Investigating growth and development in people, changes and influences.

Creative and Practical Arts

Visual Arts: sequence emphasising imagined experiences, eg fantastic animals.

Teacher notes

Many references provide ideas for exploring the stages of cycles not readily discernible in the immediate environment, eg transpiration in the water cycle.

Aboriginal people place great importance on the cycles of nature, eg seasons, sun/moon. Also compare seasonal change in Australia to that in other places. Include other ways of delineating seasonal changes, eg wet/dry seasons.

Suggested resources

Tadpole Diary Drew, D

Animal Families (series), Hodder & Stoughton

Tadpoles and Frogs (video), National Geographic

Australian Animals (video), Classroom Video

The Big Green Caterpillar (video),

Insects (video), National Geographic
Life Cycle of the Silk Moth (video), National Geographic

Computer software: databases, eg Appleworks, FrEd base, Monsters & Make Believe, the Critics choice, Carefile, Desktop, Datamanager

People and places: zoo, farms, markets, eg fish, vegetables; manufacturing and processing plants, eg cannery, flour mill, Botanic Gardens, Australian Museum.

Materials and equipment: measuring devices, construction materials, advertising brochures, plant seeds, audio-visual equipment, appropriate materials for chosen product.

Teaching strategies

7 *Observing to explore and discover*

8 *Researching to explore and discover*

15 *Explaining understanding*

17 *Exploring needs*

31 *Evaluating chosen technologies*

37 *Animation*

Task

Design and use a method of recording a life cycle. [G]

Activities

Design a method of recording growth of a plant or animal to show its cycle. Decide how often to record growth. Discuss methods of recording, eg pictures, drawings, video etc. **[TS7]**

Research standard measurement units in use. Choose a method of measuring changes and recording the measurements. Explain to others the changes that occurred during the cycle. Decide how to present this information to the class.

Choose a plant or animal to observe over time. Record appearance, movements and needs. **[TS37]** Record when a new cycle begins. Present a project and explain the life cycle.

Task

Design and make a model of an imaginary animal showing how it fulfils its needs. [G]

Activities

Design an imaginary animal considering its life cycle, how the animal fulfils its needs, where it fits in a food chain, what it will look like. **[TS31]**

Draw it showing details of its particular characteristics. (Try using a computer graphics creation program.)

Construct a model of the animal. Include the materials to be used, how the pieces will be shaped and joined, and how it can be made to move.

Design and make a shelter for the animal. Consider its needs, appropriate size etc.

Choose materials and tools needed and make the shelter.

Explain why the shelter is made in a particular way.

Write a science fiction story about the animal.

Task

Design and make an automatic watering device or system for the school's garden. [W]

Activities

Define requirements of the device or system, eg to water area 10m x 7m, activated once a week. Consider whether all plants need the same amount of water.

Seek advice, gather information, visit a nursery or native garden. Observe a variety of systems. Identify how the systems operate.

Consider options. Use annotated drawings to develop and try ideas. Detail the type of materials to be used try using recycled materials.

Draw a plan to show how the final design will work. Present the proposal to the class for evaluation. **[TS15]**

Construct the device. Demonstrate the watering system and evaluate its effectiveness.

Task

Investigate cycles found in nature. [W]

Activities

Classify a variety of things into living/non-living.

Discuss cycles in general (day/night, life cycle, water cycle). Draw the cycle of a chicken (eg start and end with egg). Record the cycle of a raindrop (start and end with drop). Discuss the human life cycle and compare with own families. Discuss the importance of cycles. Name other important cycles.

Discover recurring patterns in nature, eg water cycle, seasonal changes, life cycles, day/night. Record pictorially the life cycles that are identified.

Task

Investigate the life cycle of living things and how their needs change. [W]

Activities

Regularly observe and record changes in plants as they develop through their life cycles. Use photographs, diagrams, video to record findings. **[TS8]**

Explore how plants can be grown from seeds and grow plants in the classroom (choose plants with rapid growth patterns, eg radish, alfalfa).

Compare the needs of young animals, eg a puppy, the needs of adult animals, eg a dog. **[TS17]** Create a time line showing changes during the lifetime of given living things, eg humans, and their needs at each stage.

Task

Investigate how humans interact with other living things in fulfilling their needs. [G]

Activities

Identify the ways humans fulfil their need for food. Classify foods into plant/animals. Build up a food chain.

Explore the ways other animals obtain food.

Construct food webs, chains.

Identify how other human needs/wants are fulfilled by using animal or plant products, eg clothing from cotton plants and sheep, paper from trees etc.

Compare how people in different parts of the world satisfy similar needs.

Visit a food processing site, factory or mill to find out what raw products they process and from where they obtain them.

Unique Australian plants, animals and people

Content focus

Information and Communication
Living Things
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people create specialised environments to meet specific needs
- environments are sometimes modified to fulfil new and different requirements
- people use different technologies to organise and communicate information
- production technologies have changed over time
- living things depend on other living things to survive
- natural resources are limited and so need to be used wisely
- there are benefits and problems associated with human changes to the physical environment
- most materials come from the Earth and its surroundings.

Students will:

- demonstrate that investigation can take many forms
- relate the particular properties of materials to end uses
- explain that technology can be used to help people learn
- understand that the use of tools, equipment, software etc. requires the development of specific skills
- show that technology can enable people to gain access to, organise and use, information.

Skills

Students will:

- make accurate observations and describe these observations, or record them as diagrams, tables of data and graphs
- use graphics, models and written data to record the exploration of different ideas for design proposals and to assist making
- recognise the appropriate use of

tools, equipment, hardware and software

- use basic construction tools, materials and computerised data bases to refine observations
- report on the social and environmental costs and benefits of familiar technology.

Values and Attitudes

Students will:

- show responsiveness to ideas
- be honest and open in their dealings with others
- respect the rights and property of others
- work cooperatively in groups
- show a commitment to fair treatment for all
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- appreciate the scientific and technological contribution made by Australians.

Assessment

Listed below are strategies that may be used in assessing this unit of work.

- Listen to student discussion of the lifestyles of traditional Aborigines.
- Have students explain the results of their research to other classes.
- Explain what modern Australians have learned from Aboriginal lifestyles.

Links with other Key Learning Areas

English

Developing skills in accessing factual information, formulating questions, writing reports, using talking and writing to cooperatively plan, select, consult and make decisions in designing and making.

Mathematics

Measuring length, area, temperature.

Human Society and its Environment

Developing understandings about natural components of local environments and other Australian communities.

Personal Development, Health and Physical Education

Recognising the particular hazards of specific environments.

Creative and Practical Arts

Visual Arts: developing a sequence using Australian images around a particular theme, eg feelings, pictures of my world.

Teacher notes

Visits to gardens, zoos or animal parks are recommended, particularly if Education Officer lessons can be arranged. Visits to Aboriginal sites/parks should be organised with appropriate consultations with local Aboriginal communities.

Suggested resources

Australian Dreaming: 40 000 Years of Aboriginal Dreaming, Isaacs, J. *Bush Food Handbook*, Cherikoff, V. *Australia's Great Barrier Reef*, Coleman, N. *A History of Aboriginal Life in NSW*, Parbury, N. *Survival: The Australian Environment* (series), Hodder & Stoughton. *Animals of Australia in Close Up* (video), Film Australia. *Encounters with the Reef* (video). *Wildlife of the River* (video), Phil Simons Nature Films

Computer software: databases, eg Australian Mammals Database, FrEd base, Appleworks, Display Data, The Systems Within, Australian Lizards Database, Genesis, Australian Wildflower Database, Carefile

Materials and equipment: photographs of a variety of Australian environments, components for a watering system

People and places: Gould League, National Parks and Wildlife, Field Study Centres, Australian Museum, local environment groups, local Aboriginal community or resource people, local library, Royal Botanic Gardens

Teaching strategies

- 8 *Researching to explore and discover*
- 16 *Applying understandings*
- 15 *Explaining understandings*
- 22 *Selecting solutions*
- 24 *Evaluating designs*
- 39 *Databases*

Task

Design, make and use a database of Australian flora and fauna. **[G]**

Activities

Decide on fields for the database, eg name, animal/plant, habitat, food, type of animal/plant (reptile/mammal). Enter information onto record blank (paper). Enter the information into a computer database. Search the database, eg find animals with pouches. **[TS39]**

Task

Design and make an area of the school to regenerate as a native garden, or to grow bush tucker. **[W]**

Activities

Survey the school playground and evaluate the existing native areas, if any. Choose an area to regenerate or maintain based on availability, position and weather conditions, eg access to sun, drainage, other playground uses. **[TS12]** Consult with local Aboriginal communities, local councils, nurseries, to find out about suitable plants (especially for bush tucker). Make a plan of the necessary steps to regenerate the area. Consider – preparation of the soil; tools and equipment required to complete the design; how to organise tasks and workers; selecting suitable plants based on investigation and consultation; where funding will come from, eg Greening Australia grants. Design the layout of the area and the placement of plants. Seek advice from an expert if required. Implement the plan. Organise a maintenance plan including provision for watering, preventing damage. **[TS23]** Continue care and maintenance of the area.

Task

Investigate how traditional Aboriginal lifestyles were adapted to their environments and provided for all their social, cultural and material needs. **[G]**

Activities

Identify plants and other resources used by Aboriginal people and research their uses – food, medicine, fibres, implements, clothing, decoration and art. Explore methods of catching fish, birds and other animals for food. Include methods of locating food and technologies used in hunting. Research how Aboriginal peoples used natural forces, eg fire and floods, to guarantee their food supply. Include exploration of strategies used to preserve their environments. Compare and contrast to methods employed today. **[TS12]** Identify other ways the environment is important in Aboriginal culture, eg dance, stories, art. Observe Aboriginal dances, invite a member of the local Aboriginal community to visit the class, visit local sites or collections of Aboriginal art. Reflect on what may be learned by modern Australians from Aboriginal life.

Task

Investigate specific Australian environments, including flora, fauna and geographical features. **[I]**

Activities

Observe a variety of environments, eg visit botanic gardens, parks, zoos; watch video/slides; research books and pamphlets. Record particular features in drawings, photos.

Identify the features of particular environments. Suggest characteristics unique to certain areas, eg desert – lack of water.

Identify the characteristics of the animals and plants that occur in particular environments. Propose explanations as to how they satisfy their needs, eg koalas – gum trees.

Adopt an Australian plant or animal. Discover as much as possible about its habitat, characteristics etc. Use a variety of resources to gather information. Write to the National Parks and Wildlife Service for information about the effects of drought and bushfires on native plants and animals.

Research the role of zoos, national parks and botanic gardens.

Start a conservation club.

Task

Investigate the contributions made by Australian scientists and technologists to our country. **[I]**

Activities

Discuss resources which can be used to research information about Australian scientists and technologists. Research, using a variety of resources, scientific and technological advances that have been made in Australia. **[TS15]** Prepare a class talk about an Australian scientists, or technologists, their discoveries/inventions and how these have contributed to the development of Australian scientific/technological knowledge.

Entertainment and sounds

Content focus

Living Things
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people create specialised environments to meet specific needs
- sounds are produced by vibrating objects and travel through materials
- materials and resources are used to produce goods and commodities.

Students will:

- demonstrate that investigation can take many forms
- show that designing and making can lead to the need for investigations
- devise ways of checking and testing predictions
- give examples of predictions that are sometimes supported, sometimes disproved
- relate planning and evaluating to each stage of designing and making
- show that technology can enable people to gain access so as to organise and use information.

Skills

Students will:

- make accurate observations and describe these observations, or record them as diagrams, tables or data and graphs
- state the issue or area to be organised
- describe needs and wants of people in relation to design activities
- suggest modifications to design proposals to improve the original design.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- show responsiveness to ideas
- work cooperatively in groups
- show a commitment to fair treatment for all

- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Conduct teacher/student interviews regarding students' selection of fields for the database.
- Encourage peer assessment of the presentation of the sound show.
- Note student involvement in and contribution to the sound show.

Links with other Key Learning Areas

English

Exploring pitch and sound in language, eg in poetry, songs.

Identifying and discussing words spelt as they sound. Playing with sounds of words, eg alliteration, rhyming.

Exploring the purpose, audience and features of surveys, diaries and permission notes. Focusing on questioning techniques and formats. Ensure students engage in drafting, revising, editing and publishing permission notes.

Mathematics

Reading and interpreting timetables, organising simple retailing activities, informal measurement of time.

Human Society and its Environment

Participating in planning an excursion to supplement learning in this area.

Personal Development, Health and Physical Education

Investigating balance of work, rest and exercise.

Moving to sound.

Creative and Practical Arts

Visual arts: sequences based on remembered experiences of the excursion.

Drama: simple improvisation involving recreation/leisure situation.

Music: designing and making musical instruments. Composing musical scores for various sound effects using percussion instruments.

Teacher notes

A high proportion of Aboriginal students suffer intermittent hearing loss due to middle ear infections. Teachers should be aware of this possibility.

Didgeridoos are now increasingly used to give an authentic Australian sound to music. However, women are not permitted to play the didgeridoo in Aboriginal society. Teachers should consult appropriate Aboriginal groups, eg AECG.'

A database is far more useful when there are many records inserted, and when the information needs to be searched on more than one category.

Suggested resources

Exploring Science (series) Lothian
Home Among the Gum Trees (video) Music Magazine

Computer software: music software, eg Bars and Pipes, Fanta vision, Music Construction Set, Sticky Bear Music

People and places: National Sound Laboratory, Sydney Opera House, Sydney Symphony Orchestra, bush bands, Powerhouse Museum, National Science and Technology Centre, Canberra.

Materials and equipment: variety of percussion instruments, wires, strings, pieces of wood, metals, tape recorder.

Teaching strategies

7 *Observing to explore and discover*

9 *Manipulating to explore and discover*

10 *Proposing explanations*

18 *Clarifying a design task*

24 *Evaluating designs*

32 *Audio-visual technologies*

Task

Design and make bush band instruments. [G]

Activities

Gather materials similar in type to those used in bush Band instruments. Also try a few other materials to see if they can be used to make original instruments.

Use information gained from investigation to assist with the making of instruments. **[TS9]** Try to make instruments that can change their pitch. Try to amplify the sound some of the instruments make.

Make the instruments and try them out. **[TS32]** Record the sounds and play them back to listen to them. Consider whether improvements can be made.

Combine instruments to play in a Bush Band performance.

Explore moving to the sounds made by the band.

Task

Design and make a device that carried sound over a long distance, eg string telephone. [I]

Activities

Set criteria for a successful design, eg decide distance to be travelled, description of a successful 'transmission'. **[TS18]**

Draw up plans to help design the device.

Consider materials to use for the 'line', eg string, wire, hose and for other parts, eg funnels, cans.

Conduct tests and make modifications if necessary. **[TS24]** Reflect whether this principle has been used elsewhere or in the past.

Identify devices that are used today to send messages over long distances.

Task

Design and make a sound map indicating locations and types of sounds in the playground. [I]

Activities

Identify sounds in the environments. Collect sounds using a tape recorder. Play back and identify. **[TS32]**

Discuss the sources of sounds – living or a machine, moving towards you or stationary.

Decide on a method of recording, eg pencil and paper. Consider materials to use, eg suitable materials if recording is done outside.

Select symbols that will be used to indicate the variety of sounds. Decide on a way of denoting strength/loudness of sound.

Listen to sounds. Make your record, indicating differences between sounds. Show it to another person. Explain choice of symbols. Has anyone else used the same ones?

Task

Investigate the variety of ways that sounds can be made and uses for sounds. [G]

Activities

Explore how we can make sounds.

Identify parts of the body involved, eg vocal cords, shape of mouth and position of tongue.

Identify that only moving (vibrating) objects make a sound, still is silent. **[TS10]**

Use a variety of materials and combinations to see what sounds they can be made to make.

Explore how to make the pitch higher or lower, shorten or lengthen string, larger and smaller drum skin etc.

Explore how to amplify sound. From these explorations make predictions on what alters sound. Test the predictions.

Explore how sounds are used, eg music, communication, warning, measuring distance (sonar).

Task

Investigate that sound travels through a variety of materials. [I]

Activities

Explore sound moving through solids, ie desk tops, fence, rail etc. **[TS9]**

Explore sound moving through a liquid, eg using a hydrophone.

Predict which medium carried sound best. Test predictions.

Task

Investigate how sound is detected and measured. [G]

Activities

Identify sounds in the environment. Collect sounds using a tape recorder. Play back and identify each sound. Discuss the sources of sounds – living or a machine, moving towards you or stationary.

Identify the parts of the ear and how it functions. **[TS7]**

Discuss sounds that may be harmful to health.

Discuss ways of measuring sound, explore the decibel as a standard unit for measuring sound.

Characteristics of natural and made materials

Content focus

Built Environments
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- structures are built from natural and processed materials and components
- materials and resources are used to produce goods and commodities
- manufacturing processes convert raw materials into useful products
- materials are joined, formed, shaped and finished
- natural resources are limited and so need to be used wisely
- there are benefits and problems associated with human changes to the physical environment
- most materials come from the Earth and its surroundings.

Students will:

- recognise that the results of investigations can lead to more questions
- show that designing and making can lead to the need for investigations
- recognise that designs are constrained by time, skills, tools and materials
- identify the forms and components used in the production of a design
- relate planning and evaluating to each stage of designing and making
- relate the particular properties of materials to end uses
- explain that technology can be used to help people learn
- justify the selection of processes, tools, equipment, materials, products and software to meet the requirements of the task.

Skills

Students will:

- state the issue or area to be investigated
- propose explanations using simple observations
- make a prediction based on data collected by themselves or others
- describe needs and wants of people in relation to design activities

- suggest modifications to design proposals to improve the original design
- organise systems for small-scale mass production
- recognise the appropriate use of tools, equipment, hardware and software
- use basic construction tools, materials and computerised databases to refine observations.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- have a positive view of themselves and their capabilities
- show responsiveness to ideas
- persevere with activities to their completion
- respect the rights and property of others
- work cooperatively in groups
- show informed commitment to improving the quality of their local environment
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Discuss with students times when designing and making has resulted in the need to investigate.
- Arrange interviews between students and members of the targeted audience in order to assess how well students have identified their specified need.
- Have groups of students discuss and evaluate each phase of the mass production activity.
- Have students construct a flow chart of the production process.

Links with other Key Learning Areas

English

Using talking and writing to cooperatively plan, select, consult and make decisions in designing and making their product, recording ideas.

Exploring the language use targeted for certain groups, eg teenage slang.

Mathematics

Comparing characteristics of objects. Comparing length, mass, volume of objects.

Human Society and its Environment

Investigating how people use the environment to satisfy their physical and social needs.

Personal Development, Health and Physical Education

Using exploration of human needs and wants, and how they change, to lead into science and technology activities.

Creative and Practical Arts

Exploring ideas of texture and colour. Designing paper with characteristics to meet particular needs.

Teacher notes

When identifying the origins of materials use examples that are not too complex combinations of substances. Mass is the amount of matter making up an object. It is not the same as weight.

Distinguish between needs and wants of people.

Suggested resources

Natural Materials, Burt, E

Bridges, Graham, R

How we Build (Series)

Computer software: The Factory, The Super Factory, Puppetmaker, Toy Shop

People and places: museums: Powerhouse, Earth Exchange

Materials and equipment: variety of materials natural and made, moulds, paper

Teaching strategies

6 *Fostering curiosity*

11 *Predicting outcomes*

14 *Modifying understandings*

15 *Explaining understandings*

17 *Exploring needs*

18 *Clarifying a design task*

19 *Exploring ideas*

23 *Evaluating design*

25 *Organising tools, equipment and processes*

Task

Design and make a structure or device to perform a given task. [G]

Activities

Negotiate the design task.

Clarify the requirements of the design. **[TS18]**

Allot students into teams to develop their own structure. Specifications should include such things as being able:

- to support a particular weight
- to transport material
- to protect something
- to keep something dry.

Consider availability of resources and range of materials, eg cupboard, split pins, cotton wool, masking tape. **[TS19]**

Make the devices.

Present and demonstrate the devices and evaluate according to the requirements of the design brief.

Task

Investigate materials that can be recycled, renewed and conserved. [I]

Activities

Examine current waste disposal in the school. (If a recycling system already exists, evaluate its function.) Trace where waste products go. Measure the amount of rubbish thrown away in a day, a week. Evaluate the effects of this on the school and wider community. **[TS17]**

Identify materials that can be recycled, eg food scraps, paper, plastic containers, glass, aluminium cans. Separate

Task

Design and make and organise a system to mass produce a product using changes of state. [W]

Activities

Suggest materials which can be moulded, eg plaster of Paris, chocolate, water/ice, jelly, wax. **[TS6]**

Select product to be made, considering available moulds, preferences of the class group or other market. Consider costs involved and price that needs to be charged. Publicise the product's availability.

Identify steps of the process involved, eg mixing ingredients, melting, filling moulds, cooling.

Organise a suitable workspace, ensuring production needs are provided for, eg power points, access to refrigerator.

Collect materials and equipment, including moulds.

Allot roles for individuals. Ensure the production line works effectively.

Make a prototype and evaluate materials, space and responsibilities. Effect any modifications, as required. **[TS24]**

Trial the production of larger numbers. Make the product and distribute to purchasers.

Evaluate the whole procedure.

Task

Investigate the properties of materials. [G]

Activities

Obtain a selection of materials, eg paper, cardboard, straws, plastics, wood, cotton wool, rubber, glass, ceramics, cork, pumice, metals, fibreglass, plasticine. **[TS26]**

Classify the materials according to several different properties, eg ability to float, comparative mass, colour, attraction to magnets, transparency, flexibility, conducting heat/electricity.

List suitability for particular tasks, eg for writing on, insulation, absorbing shock, roofing, allowing light to pass through, playing with.

Explore how one or more of the properties may be changed, eg concerting a sheet of paper to increase its strength, heat wood to cause it to burn and char, heating metal may cause a colour change. **[TS19]**

Identify materials used at other times and other places to perform a particular task, eg axe made of stone, fish hook made of bone. Suggest why these particular materials were chosen. Examine new materials which have replaced conventional materials, eg ceramic instead of amalgam tooth fillings, kevlar for canvas sails. **[TS14]**

Discuss which system of classification is most useful.

materials that can be usefully reused within the school, eg yoghurt pots. Organise recyclable materials into those to be recycled at school, eg food scraps made into compost, and materials that can be sent to a recycling service, eg paper, glass.

Identify how materials used at home and school could be conserved. **[I]**

Record for a period of two weeks how they conserved or wasted materials at home. **[TS16]**

Design a chart to show the family ways in which common household materials can be conserved.

Classify materials as renewable/non-renewable/recyclable.

Task

Investigate change of state from solid to liquid. [W]

Activities

Discuss the properties of solids and liquids. Compare the properties of several materials. List materials which are liquid at room temperature, eg water, ice cream, orange juice, or solid at room temperature, eg butter, chocolate, candle wax, toffee. **[TS 6]**

Discuss materials which can be changed from liquids to solids and solids to liquids, eg water, chocolate, solid cooking oil, candle wax.

Propose explanations as to how solids are changed to liquid/liquids changed to solid. Gather materials and test.

Devise a method to demonstrate the changes, eg melt chocolate in sun, resolidify in refrigerator. Discover the temperature at which the materials will melt/solidify. (Extreme caution is needed when handling hot liquids.)

Consider the effect on people if the Earth warmed several degrees and a lot of the ice on the poles melted. **[TS11]**

The human body

Content Focus

Living Things
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- plants and animals live in environments that supply their needs
- living things depend on other living things to survive
- materials and resources are used to produce goods and commodities.

Students will:

- recognise that the results of investigations can lead to more questions
- give examples of predictions that are sometimes supported, sometimes disproved
- recognise that designs are constrained by time, skills, tools and materials
- relate planning and evaluating to each stage of designing and making
- show that technology can enable people to gain access to, organise and use, information.

Skills

Students will:

- propose explanations using simple observations
- devise ways of checking or testing predictions
- suggest modifications to design proposals to improve the original design
- use basic construction tools, materials and computerised data bases to refine observations.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions
- have a positive view of themselves and their capabilities
- show a commitment to fair treatment to all
- show informed commitment to improving the quality of the local environment

- appreciate the scientific and technological contribution made by Australians.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Discuss with groups the ways of maintaining a healthy body.
- Listen to students' discussion during group work.
- Have students explain how the device for measuring lung capacity works.

Links with other Key Learning Areas

English

Exploring questioning for different purposes, eg surveying other students, interviewing guest speakers.

Exploring the language used in media advertising, eg emotive, persuasive language.

Mathematics

Graphing data in a variety of ways.

Human Society and its Environment

Investigating the ways in which advertising appeals to our thoughts and emotions.

Personal Development, Health and Physical Education

Extending understandings of role and functions of body systems. Promotion of positive health habits and behaviours.

Teacher notes

Some areas are served by mobile Life Education units.

Teachers should be aware of their role as a model for appropriate behaviours.

Suggested resources

The Magic School Bus – Inside the Human, Cole, J

How our Bodies Work (series), Macmillan

The Human Body – A Three Dimensional Study, Miller, J

How My Body Works (series), Collins
About the Human Body (video), Film and Video Library

Blood Lines (video), Red Cross Blood Bank

Computer software: The Human Body, Senses

People and places: Life Education centres

Materials and equipment: stethoscope, television ads on tape, newspapers and magazine advertisements, a variety of materials for construction of product

Teaching strategies

8 *Researching to explore and discover*

12 *Clarifying an investigation*

13 *Trialling and testing ideas and concepts*

15 *Explaining understandings*

16 *Applying understandings*

20 *Developing ideas*

22 *Considering appearance and function*

23 *Evaluating design*

Task

Design and make a simple device that will assist in measuring lung capacity. [W]

Activities

Clarify the requirements of the design, eg component to catch air breathed out, way of measuring/comparing. **[TS12]**

Invite a guest to discuss the instruments used in measuring temperature, blood pressure etc. Try these instruments out. Note how they work.

Generate ideas for a device to measure lung capacity. **[TS20]**

Discuss how the device will work, gauges, measuring readings, calibrating. Draw the ideas.

Make a sketch, label the parts. Show how it will work. Seek the opinion of others.

Make the device. **[TS16]** Use the device to test the lung capacity of students in the class.

Task

Design a fair test to measure the effect of exercise on pulse rate. [G]

Activities

Identify the things to be measured and how they will be measured. **[TS13]**

Discuss what makes a fair test.

Suggest ways in which the effect of exercise on pulse rate could be made a fair test. Identify how the data collected will be recorded.

Select appropriate method and trial the test. Discuss the test with other students who may suggest refinements. **[TS15]**

Make any alterations before using the method and recording results.

Explain the effects of exercise on pulse rate to the group.

Task

Design and make a fashion accessory that will promote behaviour to avoid skin cancer. [I]

Activities

Identify the cause of the problem, eg too much sun, fair skin. Suggest ways of preventing the adverse affects, eg using skin screens, hats, changing behaviour.

Decide elements to be incorporated in the design, eg features that provide protection or ways of changing behaviour.

Select appropriate methods and materials to meet identified requirements. Consider appearance as well as function, eg colour, style as well as durability. **[TS22]**

Make a model or prototype.

Trial the product. Survey reactions.

Make alterations to the design, if necessary, based on survey results. **[TS23]**

Task

Investigate the systems of the human body. [G]

Activities

Research the systems that are part of the human body, eg circulatory, respiratory, digestive systems. **[TS8]**

Listen to a guest speaker, watch a video, visit a Life Education centre.

Identify characteristics that indicate performance of respiratory systems, eg pulse, lung capacity. Test class members by measuring pulse, breathing rate. Record and graph results. Predict how these may change after exercise. Test and explain the differences.

Explore the path of the digestive system. Identify significant organs, eg mouth/tongue/teeth, oesophagus, stomach, intestines and research their functions.

Identify the functions of skin, muscles and skeleton. Observe X-rays of different limbs. Discuss how skin, bones are treated when damaged, eg splints/casts on broken bones.

Identify individual differences between class members. Research ways to improve fitness, eg daily fitness program, balanced diet.

Task

Investigate how people's behaviour and habits can affect their health. [I]

Activities

Research diseases that seriously affect people's health. **[TS8]** Talk to experts, visit a Life Education centre. Include the behaviour and habits that result in these diseases, eg smoking, poor nutrition, lack of exercise. Identify things that influence people's behaviour and habits, eg the idea is popular with others.

Construct a survey to determine people's current habits and/or attitudes, eg exercise regularly, wear hats in sun. Graph the results. Make hypotheses from results. Predict the likelihood of individual students suffering from particular diseases at some time in the future. Explain how their behaviour is contributing.

Observe and discuss media campaigns designed to influence others. Identify different aspects of a campaign, eg leaflets, TV commercial, radio ads, posters.

Identify positive behaviours that result in good or improved health, eg personal hygiene, sufficient rest. Research the benefits to our health.

Reflect on how everyday activities can affect the health of individuals.

Moving Pictures

Stage 2

Making pictures move

Content Focus

Built Environments
Information and Communication
Living Things
Natural Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people use different technologies to organise and communicate information in different ways.

Students will:

- demonstrate that investigations can take many forms
- give examples of predictions that are sometimes supported, sometimes disproved
- recognise that designs are constrained by time, skills, tools and materials
- relate planning and evaluating to each stage of designing and making
- understand that the use of tools, equipment, software etc requires the development of specific skills
- show that technology can enable people to gain access to, organise and use, information.

Skills

Students will:

- state the issue or area to be investigated
- propose explanations using simple observations
- devise ways of checking or testing predictions
- suggest modifications to design proposals to improve the original design
- evaluate materials and processes used
- recognise the appropriate use of tools, equipment, hardware and software.

Values and Attitudes

Students will:

- show responsiveness to ideas
- be honest and open in their dealings with others

- work cooperatively in groups
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected example strategies that may be used in assessing the objectives of this unit of work.

- Students draw pictures of or photograph various objects or scenes, showing a variety of perspectives and sizes of shots.
- From the results of students' efforts to video or make computer animations, ascertain the students' skill development in
 - using the video and/or computer technology appropriately;
 - coordinating sound effects, dialogue, music, text and graphics.
- Through class discussions assess the students' ability to critically evaluate the finished products.
- Through discussion ascertain the students' ability to generalise the concept of animation, ie in animation each successive picture is only slightly different from the previous one in a series.

Links with other Key Learning Areas

English

Reading stories/discussing what makes stories effective, eg introduction, problem and resolution. Have students use this knowledge when creating stories to animate.

Mathematics

Extending understandings of time. Measuring in seconds.

Human Society and its Environment

Investigating the human capacity for aesthetic expression.

Personal Development, Health and Physical Education

Investigating, through movement, the human capacity for aesthetic expression.

Creative and Practical Arts

Craft/design: extending understandings concerning images and their creation. Combining sound and images.

Teacher notes

Standard shot sizes (still and moving): vls – very long shot; ls – long shot; ms – mid or medium shot; cu – close up. Camera angles and shot sizes can be explored using practice devices, eg cardboard frames, an unloaded camera or hands held to make a 'frame'. Advertisements and music videos are particularly useful for exploring the range of camera techniques, eg shot size, camera angles.

Many simple devices can be made to explore the ideas of 'persistence of vision'. Refer to references on animation.

Suggested resources

Film Animation for Schools, Gross, Y
Hands On, Taylor, A

Making It Move, Trojanski, et al

The Animation Game (video)

Animation: with Oliver Postgate (video)

Computer software: computer graphics software, eg Deluxe Paint III, Fantavision, Survival 3D, Animate

People and places: art galleries, Powerhouse Museum

Materials and equipment: flip books, eye puzzles, magazines, newspapers, photographs, framing device, cameras

Teaching strategies

4 *Manipulating to explore and discover*

18 *Evaluating designs*

24 *Selecting and maintaining tools and equipment*

30 *Sound and lighting*

31 *Animation*

34 *Video production*

Task

Investigate how pictures are created in different ways.

Activities

Identify different types of images from magazines and newspapers. Classify according to students' own criteria. **[I]**

Introduce standard shot sizes and identify the different information provided by each type of shot, eg close ups show facial expression or detail, long shots give information about the setting. Predict how things might appear from down very low, eg a tree, building, teacher, or how they appear from a high angle. Test using a camera, cut-out or framing device. **[TS4]**

Collect and display examples of shot sizes, camera angles. Use a framing device to explore different camera techniques, the information contained in them and how to create them.

View a variety of videos and observe the effects of different camera angles and shot sizes. Explain how the camera techniques affect the messages. **[W]**

Task

Investigate how pictures appear to move. **[G]**

Activities

Explore how the eye sends contradictory messages to the brain, eg persistence of vision. Using simple devices, such as colour change top, thaumotopes or flip books, demonstrate how movement changes what we see. Predict the effect of varying the number of pages of a flip book, or the speed of movement. Try it out to test the prediction. **[TS34]**

Explore other ways our eyes are 'tricked', eg ambiguous images, optical illusions.

Examine a piece of 16mm film. Observe the number of individual images and differences between each image. Using a VCR with simple frame advance, observe the changes between images and how the images change.

Using a video camera, create simple animations using cut out figures, common items, people etc. Predict and test what happens if items are removed, larger/smaller changes are made between shots or the camera is moved to a different position. Identify 'special fx' that may be generated using these techniques, eg making people/objects vanish.

Explore how an image is animated on the computer by moving, rotating or changing position of one or more objects on the screen. Explore the effects of making the motion faster/slower.

Compare animation using computer technology with other methods. Identify the features of each method and discuss the advantages and disadvantages.

Task

Design and make an animated program. **[G]**

Activities

Decide on a short story to animate. **[TS31]**

Select a method of animating, eg cut outs, pixilation, computer graphics, models, line drawing. Explore and evaluate a range of possibilities.

Prepare characters, props and backgrounds, titles or credits. Carefully plan the sequence of events and record for reference, eg using a storyboard or script.

If using computer software to make the animation, decide on graphics to use to represent the plot, eg prepared graphics or individually drawn. Use the software to make the animation. View on screen or record on video.

If using film or video, organise how each job is to be done, eg camera operator, person responsible for movement of each cut out/model/role and a system for coordinating movement and shooting (be careful not to get hands in the way!). Rehearse the sequence of action so each role or move is familiar. Shoot the footage. View and evaluate. Consider whether a reshoot is required.

Check video, film or computer equipment operation and ensure techniques are well understood. **[TS24]**

Add soundtrack including sound effects, dialogue and music as appropriate. **[TS30]**

Screen for the class/school audience. Be receptive to their reactions. Compare different production methods and their effects.

Task

Design and make a photo story exploring a theme/topic. **[G]**

Activities

Individually or in groups, choose a subject, eg Me!, bicycles, or a technique, eg looking tall, getting closer. Plan the types of images required, trying out different effects using practice devices. Try to use different shots to convey particular messages. **[TS34]**

Take photos/video images (this could be supplemented by collected images if necessary).

Critically evaluate whether the resultant images/photos are as expected. If not, explore why and suggest solutions, eg seems too far away – move closer for mid shots, image is blurry – camera needs to be held still, or supported on a chair, railing. (This may require further practice or research.)

If necessary, retake photos/images making improvements. Try different arrangements and note any differences in effect.

Arrange images for display. Add captions or text and present final product.

Food production on a larger scale

Content Focus

Built Environments
Information and Communication
Living Things
Natural Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people create specialised environments to meet specific needs
- environments are sometimes modified to fulfil new and different requirements
- plants and animals live in environments that supply their needs
- living things depend on other living things to survive
- materials and resources are used to produce goods and commodities
- manufacturing processes convert raw materials into useful products.

Students will:

- demonstrate that investigation can take many forms
- give examples of predictions that are sometimes supported, sometimes disproved
- relate planning and evaluating to each stage of designing and making
- relate the particular properties of materials to end uses
- justify the selection of processes, tools, equipment, materials, products and software to meet the requirements of the task.

Skills

Students will:

- state the issue or area to be investigated
- propose explanations using simple observations
- devise ways of checking or testing predictions
- describe needs and wants of people in relation to design activities
- suggest modifications to design proposals to improve the original design

- organise systems for small-scale mass production
- recognise the appropriate use of tools, equipment, hardware and software.

Values and Attitudes

Students will:

- show responsiveness to ideas
- persevere with activities to their completion
- be honest and open in their dealings with others
- work cooperatively in groups
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected example strategies that may be used in assessing the objectives of this unit of work.

- Conduct group conferences to assess cooperatively how effectively the students have influenced their designs.
- Have students keep a log book of their findings about the effects of food preparation.

Links with other Key Learning Areas

English

Observing restaurant menus, and compiling menus of their own.

Reading recipes and writing other recipes for others to use.

Mathematics

Informal measurement of temperature, time and 2D space.

Organising simple retailing activities. Giving change.

Human Society and its Environment

Investigating how commercial organisations have affected Australian culture and society.

Personal Development, Health and Physical Education

Extending understandings regarding the nutritional value of foods, and the need for hygiene in food preparation.

Creative and Practical Arts

Drama: simple improvisations in association with fast food restaurants and role play based on the operation of a restaurant.

Teacher notes

'Eating out' may include eating at the home of relatives or friends, eating at a range of restaurants from different cultures or eating out 'at home', ie take-away food.

The fast food service could be provided at a school event, eg sports carnival, fete, or simply as a special event in itself.

Consideration needs to be given to individual dietary needs, eg kosher foods, diabetics, vegetarian.

Suggested resources

Kids in the Kitchen, Leng, V

Understanding Science in the Home, Picton, M

Nutritious Snacks for Kids, Ryles, J et al

Computer software: desktop publishing software, eg The Print Shop, Printmaster, Children's Writing and Publishing Centre; simulation software, eg Lemonade Stand, The Factory

People and places: food outlets, supermarkets

Materials and equipment: menus, recipe books, newspapers, magazines

Teaching strategies

8 *Researching to explore and discover*

13 *Trialling and testing ideas and concepts*

Task

Investigate methods of preparing food in large quantities.

Activities

Observe the methods of production while visiting a fast-food restaurant. Identify different roles of people. Identify purposes and function of machinery/utensils. **[W]**

Follow materials/ingredients from their raw state to finished product. Compare processes used to produce different goods. Create a flow chart to record the processes observed.

Reflect on how people of other cultures are able to cater for groups of people, eg Aboriginal fish bake.

Task

Investigate the changes that occur in the preparation of foods. **[TS8]**

Activities

Classify foods: eaten raw/eaten cooked/either.

Examine recipe books. Identify and compare the suggested methods of cooking, eg baking, frying, grilling, boiling.

Predict the effects of cooking foods, eg colour, texture, consistency, flavour, odour. Try different ways of cooking selected foods. Compare changes that take place, eg fried potatoes, steamed potatoes.

Explain why we cook some foods and not others.

Identify other ways foods are changed before eating, eg beating cream or eggs, cooling/freezing, dissolving, grating/mashing, adding other ingredients. Experiment and observe the effect of these processes.

Reflect on the reasons why we prepare foods in a variety of ways.

Task

Investigate 'eating out' in the local area. **[TS5]**

Activities

Identify the places where we 'eat out'. Observe local area, consult phone books, newspapers. Group to show variety of food available, different styles of venue, eg take away, set menu, a la carte, cafeteria etc. **[G]**

Do a daily survey. Record results. Make inferences about when people eat out. Suggest (other) times that we like to go out to eat, eg special occasions, just for fun, when on holidays. **[W]**

Consider all the data about where and when people eat out and draw conclusions about reasons why.

Explore the ingredients of take-away food. Evaluate their nutritional value.

Explore the costs of eating out. Prepare a meal similar to a bought one and calculate the costs involved. Suggest reasons for any differences between the two.

Consider other advantages/disadvantages, eg saves washing up, quality of product, packaging, waste.

Task

Organise a visit to a fast-food restaurant for lunch. **[W]**

Activities

Identify the class's lunch needs and individual preferences.

Suggest a range of possible venues. Consider: location, eg how to get there, whether it would be crowded; the meal, eg whether all preferences and special needs can be catered for, prices; time, eg how long is needed, fitting in with other arrangements; any special requirements as identified, eg individual dietary needs; other arrangements/preparations that may be required.

Given the range of factors, decide on venue, dates etc. Organise transport, permission, funding etc.

Evaluate the meal in terms of nutritional value, value for money, provision for individual preferences. Compare with lunch at school.

Task

Design and make a 'healthy alternative' fast-food service for a day. **[TS13]**

Activities

Discuss plans in the class group. Evaluate existing take-away foods, noting positive and negative qualities. **[G]**

Use computer simulation software to explore the processes involved in mass production and marketing. **[G]**

Consider decisions regarding:

- food – selecting food items to supply, based on nutritional value and preferences of potential customers;
- prices – prices of ingredients, shop around to get the best prices; other costs involved, eg advertising, equipment, fuel, packaging; prices to charge for the product;
- methods – methods of food preparation, how to make it appealing, equipment needed, cleaning up.
- packaging the food – type of wrapping to protect and preserve the products, colours to use, materials available;
- advertising the service – look at advertisements in newspapers/magazines, TV, radio, as sources of ideas; list qualities that could be promoted and consider possible techniques, eg appeal to the desire to be healthy, good taste; decide on a way to advertise the service, eg posters, word of mouth, announcements.

Make a set of plans to illustrate the steps to take in each aspect of production. **[W]**

Assign roles for the day, ensuring all tasks are covered equitably. **[W]**

Moving loads locally, nationally and internationally

Content focus

Built Environments
Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people live in communities and build environments to service their common needs
- both aesthetic and functional factors need to be considered when people make changes to their environments
- there are various forms of energy
- systems are designed to provide particular services
- systems are used to deliver and distribute goods
- environments on Earth have been affected by technology.

Students will:

- recognise that investigations may be conclusive/inconclusive
- describe the social, environmental or economic implications of new materials and processes
- identify investigations which involve discoveries leading to unexpected outcomes
- show some relationship between the process of investigation and the process of design and make
- describe the process of investigation exploring and discovering phenomena and events, proposing explanations initiating investigations, predicting outcomes, testing modifying and applying understanding
- describe the factors that influence design
- justify the decisions made in designing and making
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- identify that new technologies increase the options for designing and making
- explain that particular technologies are significant causes of change in the way people live.

Skills

Students will:

- identify data which support a particular prediction

- modify and apply their understanding in the light of their investigation
- use investigation techniques to identify opportunities for design activities
- develop a design proposal by selecting and refining ideas and justifying choices
- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task
- test or propose ways of testing the extent to which a product satisfies the design intentions
- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function and in order to gather information
- identify and report unsafe conditions.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions
- exhibit self direction in their own learning
- show flexibility and responsiveness to ideas
- initiate and persevere with activities to their completion
- be honest and open in their dealings with others
- respect different viewpoints and ways of living
- work cooperatively in groups
- show a commitment to fair treatment for all
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- appreciate education as a continuing process.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Have students interview potential users of their proposed transport system/modifications. Encourage students to use these results as part of their own self assessment of the design.
- Have students create a concept map illustrating their understandings of how traffic systems can be controlled.

Links with other Key Learning Areas

English

Modelling with students reading/writing graphic and tabular information, eg timetables, classification tables. Refer to English strategy 'Mapping factual texts'.

Mathematics

Investigating topology, numbers to 1,000,000 and bigger.

Human Society and its Environment

Researching ways in which transport systems facilitate interdependence of Australians and people of other countries, eg migration, trade.

Personal Development, Health and Physical Education

Identifying road user responsibility in responding to traffic control systems.

Teacher notes

Students can investigate the use of power sources such as hot air, batteries, air pressure, solar energy, in a variety of ways before deciding on the one to use for their model.

Computer software such as Logo can be programmed with sets of instructions to control systems.

Suggested resources

Street Sense (kit), Road Traffic Authority

The Know How Book of... (series), Usborne

Technology in Action (series), Lothian

Computer software: programming languages, Lego Logo, Lego TC Logo; databases, eg FrEdbase, Appleworks, Microsoft Works, Datasweet

People and places: Minerals and Energy Centre, travel industry, Power House Museum, local area excursions

Materials and equipment: Meccano, Lego Logo, Dick Smith components, construction material, pictures, pictures of traffic control means, eg lights, pedestrian crossings

Teaching strategies

8 *Researching to explore and discover*

11 *Predicting outcomes*

15 *Explaining understandings*

20 *Developing ideas*

22 *Considering appearance and function*

33 *Control systems*

38 *Databases*

Task

Design modifications to a transport system to make it more efficient.

Activities

Evaluate the local transport system. Consider how easy it is to get from place to place; how often facilities run, eg trains, buses; costs; comfort; energy use; convenience etc.

[TS20] Identify any shortcomings or needs for improvement in the organisation or running of local facilities, eg infrequent train service, lack of protection from weather while waiting, no direct link between suburbs/towns.

Generate ideas for improvements by making comparisons between local and other systems.

Present a detailed proposal to improve the service. Include drawings/plans, eg altered route system or timetable.

[TS15]

Model the system where appropriate.

Consider the social and environmental effects. **[TS22]**

Evaluate the plan by presenting the proposal to other potential users.

Contact appropriate authorities or organisations and present the plan.

Task

*Use computer technology to design a method of controlling traffic in a model transport system. **[TS33]***

Activities

Identify aspects of the transport environment to be modelled, eg roads, rivers, rail, harbour, buildings. Suggest where traffic control is needed, eg to stop traffic at a level crossing, raise a bridge. **[W]**

Generate ways of addressing the problem, eg warning light, boom gate, lighthouse. Draw a plan that demonstrates where devices will be located.

Choose the type of sensor, eg light, pressure, and decide how it will be activated. **[G]** Discuss the type of software program to be used. Write a program for the computer that will control the model.

Construct the model including vehicles, structures and control device. Test the program to ensure it runs. Make adjustments if necessary.

Reflect upon applications of similar systems, eg traffic light, the sensor systems used.

Task

Investigate how things are moved throughout the local area.

Activities

Identify major transport systems in the local city/town, eg bus, train, taxi services, road networks. **[TS8]** Map the routes available and collect information about frequency of service, costs etc. Explore how people and goods can be moved from one point to another, combinations of systems used, how long it takes, costs etc.

Task

Investigate how things are moved throughout Australia and internationally.

Activities

Identify major transport systems that operate nationwide and internationally, eg air, ship, rail, road. Explore for each transport form the characteristics of the system. Consider the destinations; time taken; quantities carried; energy used; frequency; how goods are carried and protected, eg containers; how people are accommodated; costs etc.

Create a database to record findings. **[TS38]** Use the database to compare and contrast the different means of transporting goods and people. Identify advantages and disadvantages of various options.

Predict/suggest the best means (system or combination) of transporting goods from one place to another. Give reasons for the suggestion.

Task

Investigate ways the traffic is controlled.

Activities

Observe the variety of transport in a given area, town or locality and how it is organised.

Predict the consequences of allowing unrestricted use of vehicles. **[TS11]**

Identify techniques used to regulate or control individual vehicles or traffic flow, eg light houses, police officers, signs and signals, air traffic controllers, level crossings, road markings, roundabouts, traffic lights, one-way streets. Group or classify following students own criteria, eg involves people, permanent/temporary, involves monitoring devices etc. **[TS8]**

Identify those means that involve computer technology, eg traffic lights, level crossings, toll booths. Identify elements of the system, eg detectors, timers and how they are related or linked. Visit a traffic control centre or invite a guest technician, to aid investigation of the ways such systems work.

The services and products in our community

Content focus

Built Environments
Information and Communication
Living Things
Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people try to control the conditions in the environments they build
- people live in communities and build environments to service their common needs
- Both aesthetic and functional factors need to be considered when people make changes to their environments
- the activities of people can change the balance of nature
- there are environmental consequences of production and consumption
- systems are designed to provide particular services
- systems are used to deliver and distribute goods
- environments on Earth have been affected by technology.

Students will:

- show some relationship between the process of investigation and the process of design and make
- justify the decisions made in designing and making
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- explain the need for safe, ergonomically sound work environments
- describe the process of design and make which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments, and evaluating outcomes
- explain that the future must be considered when making choices of particular technologies
- evaluate technological activity in terms of social and environmental cost and benefits
- explain that particular technologies are significant causes of change in the way people live
- describe ways in which resources can be conserved.

Skills

Students will:

- modify and apply their understanding in the light of their investigation
- use investigation techniques to identify opportunities for design activities
- develop a design proposal by selecting and refining ideas and justifying choices
- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task
- produce a model, prototype, product or procedure to meet a specific design brief
- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function and in order to gather information
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas
- use resources with consideration for the environment and adopt procedures which minimise waste.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions
- have a positive view of themselves and their capabilities
- show flexibility and responsiveness to ideas
- initiate and persevere with activities to their completion
- work cooperatively in groups
- show informed commitment to improving the quality of society and the environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- appreciate the scientific and technological contribution made by Australians and members of other societies and cultures
- develop rational and creative thinking.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Have students explain to others the various services provided in their local area.
- Present a plan for new services to the principal/council.

Links with other Key Learning Areas

English

Collaboratively developing appropriate questions to ask councils etc. Exploring purposes and features of flow charts. Jointly constructing flow charts as a way of organising information.

Human Society and its Environment
Developing understandings about the way the local area is managed and the effect on our natural environments and human society.

Personal Development, Health and Physical Education

Identifying community services in relation to health education and health promotion.

Creative Arts

Making pictures, mobiles etc out of garbage.

Mathematics

Developing coordinate mapping skills through map reading, drawing pictures following directions through coordinate names. Finding actual measurements from scaled drawings and maps.

Teacher notes

The emphasis in this unit is in evaluating existing products and services and the impact of these on the local environment.

Suggested resources

City, Macaulay, D

What a Load of Rubbish! Skidmore, S
Down the Plughole!

Wind and Water Power, Sauvin, P

People Who Help Us – series (video), Ministry of Education, Victoria

Computer software: programming languages, Lego Logo, Space, Lego TC Logo, Lego Lines; simulation software, eg SimCity, SimAnt, Map Skills

People and places: Snowy Mountains Scheme, State Pollution Control Commission, Department of Planning, local council

Materials and equipment: rate notices, local newspaper advertisements

Teaching strategies

6 *Fostering curiosity*

7 *Observing to explore and discover*

8 *Researching to explore and discover*

17 *Exploring needs*

18 *Clarifying a design task*

19 *Exploring ideas*

Task

Design and make a product or service to meet a need of a person or group. [G]

Activities

Identify the problem or type of special need, as above. **[TS17]** Detail the specific requirements needed to address the problem. Suggest the type of product or service that may be of use, eg shopping service for elderly residents, devices to assist people with specific tasks. Ideas should be based on research. Make a plan or detailed description of the product or service. **[TS18]** Consider the methods, equipment, techniques to be used in the proposed design. Suggest where new technologies could be employed. Discuss with others the method of production or organisation. **[TS19]** Can they make suggestions to assist? Consider costs and whether they could be reduced by mass purchasing, or other organisational changes. Collect materials, basing choices on availability and research. Decide on methods of informing intended users about the product/service. Try contacting existing organisations or self-help groups. Seek users' evaluations of how well the design meets their needs.

Task

Design and make a model fun park. [W]

Activities

Visit a fun park. Watch a video. Make a list of services that are included in the fun park, eg rides, food outlets, rest areas, shops.

Identify the possible needs people may have when visiting the fun park. List the services that will need to be provided, eg food, rest areas, lost children area, first aid. Consider legal safety requirements for proposed services and activities.

Make a plan of the fun park using modelling materials or drawings. Indicate where activities will be situated, how power will be supplied to equipment, food outlets, ambulance station etc.

Assign roles to carry out different tasks, eg making decisions about layout, construction of individual pieces.

Construct a variety of activities for the park. Decide whether they are to be battery powered, or controlled by a computer program. Construct other service buildings and facilities, ensuring all identified requirements are addressed.

Devise a plan detailing how to proceed in the case of emergency. Ensure this information is prominently displayed. Include a map of the park.

Advertise the park, using a number of different media, eg posters, radio/television ads. Identify the main features to be used as a selling point.

Consider pricing structures, eg special arrangements for groups, families etc.

Task

Investigate services as an aspect of the built environment. [I]

Activities

Identify the range of services that are supplied in the built environment, eg water, electricity, garbage collection, roads, shopping centres, health care and education. Compare to experiences of students from other cultures. Classify into physical, social. Visit the places where services are supplied, eg hospitals, libraries. Identify particular characteristics of each site. Include how space is used or managed, materials used in construction, lighting, regulations on behaviour, facilities available. Suggest reasons for selections, eg carpet in a library to reduce noise, stainless steel, glass, in a hospital because of ease of cleaning. Research how these services are provided or are controlled, eg local, state, national governments. Compare to other areas, countries and communities - do they have the same services? Identify similarities, differences. Match services to the need they satisfy

Task

Investigate the supply of a service such as electricity. [G]

Activities

Identify services supplied to households, eg water, electricity, garbage collection. Identify the original source in the supply of the service, eg powerhouse. Research activity that occurs at such a site, eg producing electricity, water purification. Go on an excursion, watch a video or listen to an expert guest.

Analyse the steps required to bring the service to a house or school, eg high tension wiring, transformer stations, street wiring. Make a flow chart to show how a service is provided, eg garbage collection. Compare to flow chart of a different service.

Identify the people, and their roles involved at each stage, eg pollution controller to check water. Identify the group that has responsibility for providing each service. Research how the service is maintained, eg replacing wires affected by storms.

Explore how the service is paid for, eg people pay water rates, government subsidy. Identify how the service is used when it reaches the home or school, eg lights, doorbell. Research the history of identified facilities and how they have been provided at different times in the past. Research areas where services are not supplied and how people compensate, eg on farms people have their own water tanks.

Out in Space

Stage 3

Looking at environments beyond Earth

Content focus

Built Environments
Information and Communication
Living Things
Physical Phenomena
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes:

Knowledge and Understanding

Students will know and understand that:

- people try to control the conditions in the environments they build
- people live in communities and build environments to service their common needs
- information can be represented in a number of different forms, including graphics, sounds and texts
- the sun is the source of most of the energy on the Earth
- there are various parts to the physical environment, eg stars, planets, earth, air and water.

Students will:

- identify investigations which involve discoveries leading to unexpected outcomes
- show some relationship between the process of investigation and the process of design and make
- identify that new technologies increase the options of designing and making
- describe the process of design and make which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments, and evaluating outcomes
- evaluate technological activity in terms of social and environmental cost and benefits
- explain that particular technologies are significant causes of change in the way people live.

Skills

Students will:

- make detailed observations using appropriate technologies
- modify and apply their understanding in the light of their investigation
- use investigation techniques to identify opportunities for design activities

- develop a design proposal by selecting and refining ideas and justifying choices
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions
- exhibit self direction in their own learning
- show flexibility and responsiveness to ideas
- initiate and persevere with activities to their completion
- be honest and open in their dealings with others
- show a commitment to fair treatment for all
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- appreciate education as a continuing process
- appreciate the scientific and technological contribution made by Australians and members of other societies and cultures.

Assessment

Listed below are selected examples of strategies that may be used in assessing the objectives of this unit of work.

- Describe the features of the device which uses the sun's energy.
- Explain to another class their model of the solar system.
- Assess production of the play.

Links with other Key Learning Areas

English

Viewing videos and reading plays to gain ideas for play writing. Discussing structure of narrative stories. Using writing to explain models of the solar system.

Mathematics

Explaining the basis of time measurement in terms of movement of the earth around the sun. Measuring in kilometres.

Reading and using numbers to a million and beyond.

Personal Development, Health and Physical Education

Exploring strategies related to sun protection.

Creative and Practical Arts

Drama: organising, improving and performing movement and language through role play of space adventures.

Teacher notes

In building an environment of outer space students should be able to explain how they've catered for people's needs. Models of the solar system should be large enough to demonstrate the relative lengths of planet orbits. Modelling to correct scale may not be possible.

Suggested resources

Library of the Universe (series), Collins

Technology (series), Ashton Scholastic

Solar System (video), Classroom Video
Seasons and Days (video), Churchill Films

Solar System (video), Encyclopedia Britannica, Travelling through the Solar System

Computer software: Solar System database, Planetary Construction set, adventure games, eg Mickey's Space Adventure, Space Apprentice, Space-ship Earth. Orrery, Orbits, Destination Mars

People and places: Earth Exchange Museum, Powerhouse Museum, observatories, Energy Authority of NSW

Materials and equipment: magnifying glasses, foil, various modelling/construction materials

Teaching strategies

8 *Researching to explore and discover*

9 *Manipulating to explore and discover*

17 *Exploring needs*

23 *Considering appearance and function*

33 *Adventure games*

35 *Telecommunications*

37 *Animation*

39 *Databases*

Task

Design and make a model of the solar system. [G]

Activities

Select appropriate materials to create a model of planets, comets, moons, asteroids. Decide on a method of construction, including organisation of equipment and steps in the process. [TS9]

Demonstrate relative size of planets, distance from the sun, shape of orbit, relative time taken to complete an orbit.

Task

Design and produce a play or video based on a 'Lost in Space' theme.

Activities

Identify the needs of people on earth. [TS17] Compare these to particular needs 'in space'. Identify the different requirements of people in space, eg coping with weightlessness, oxygen-free atmosphere, food needs.

Create an environment which would support life outside Earth's atmosphere. Points to consider:

- the interior of the space vehicle (props)
- the environment on another planet, eg land forms, plant life, creatures etc (props and backdrop)
- appropriate clothing (costumes)
- power sources, movement
- social needs of people.

Represent ideas in drawings, or a plan (eg use grid paper, a computer graphics program).

Build your model using available materials. Explain how the planned apparatus would work to meet the identified needs.

Create the story, script and/or storyboard. Organise the production and perform the play or make the video. [TS32]

Task

Design and make a device or system that utilises the sun's energy or design a solar still. [G]

Activities

Decide the purpose of your device, eg to cook with, dry substances etc. Draw a plan or model the design. Consider appearance as well as function. [TS23] Make and trial device. Evaluate. Select ways of launching the new product and promoting its potential sales.

Design a solar still using clear wrap, a pebble and a glass with a little water in it. Put a rock/weight on the plastic so that it sinks down a bit, then put rubber band around the plastic and around the cup.

Task

Use a computer adventure/simulation game to stimulate students' interest and further investigate the solar system. [G]

Activities

Navigate through the fixed environment of the solar system. Record journey in diary or map form.

Use the factual information provided in the game to help solve the problems posed. Experiment within the simulation.

Task

Investigate what we find in 'space' and the environment and conditions beyond Earth's surface. [G]

Activities

Identify planets and conditions beyond Earth's atmosphere. [TS8] Use a database and other resources to research planet features, eg distance from sun. [TS39] Use the students' model to explore the relationships between the sun and planets, the movement of planets and how this determines night and day, eclipses. Visit an observatory or planetarium, or invite a travelling planetarium to the school.

Identify conditions that characterise/sustain life on earth (including gravity). Research how the earth's atmosphere provides for our needs, eg air to breathe, protection from the sun. Compare the atmosphere. Chart discoveries as similarities/differences.

Reflect on our responsibilities in maintaining a life-sustaining environment on Earth.

Task

Investigate the contribution Australia has made to the exploration of space. [I]

Activities

Collect information from Siding Springs Observatory. Contact OTC and CSIRO for information on astrospace. [TS35] Post a message on Keylink or Fredmail Bulletin Boards requesting answers from other students. Find out about Australian satellites and telescopes.

Task

Investigate the sun, its energy and its effects on earth. [I]

Activities

Observe and identify the ways the sun is part of our lives, eg heat, light, shadows. [TS8] Identify the times when the sun has a negative effect, eg sunburn. Explore and explain how we cope with this. Explore how the sun's qualities are used to help people in our society and in other societies.

Using and generating electricity

Content focus

Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- there are various forms of energy
- a complete circuit is needed for an electrical device to work
- the sun is the source of most of the energy on the Earth
- systems are designed to provide particular services
- there are many physical phenomena which change the environment.

Students will:

- show some relationship between the process of investigation and the process of design and make
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- explain the need for safe, ergonomically sound work environments
- describe ways in which resources can be conserved.

Skills

Students will:

- make detailed observations using appropriate technologies
- discuss the factors that might affect an investigation
- devise fair tests
- devise a test that will support or disprove a prediction
- modify and apply their understanding in the light of their investigation
- test or propose ways of testing the extent to which a product satisfies the design intentions
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas
- use resources with consideration for the environment and adopt procedures that minimise waste
- identify and report unsafe conditions

- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- exhibit self direction in their own learning
- show flexibility and responsiveness to ideas
- show a commitment to fair treatment for all
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit.

- Have students set up a simple circuit.
- Have students demonstrate the device that uses a simple electric circuit.
- Listen to students' comments during presentations.

Links with other Key Learning Areas

English

Modelling and jointly constructing questions to ask while on an excursion.

Human Society and its Environment

Researching the use and management of renewable and non-renewable resources including the effects on lifestyles and the environment.

Personal Development, Health and Physical Education

Health and safety, particularly with regard to electricity in the home.

Teacher notes

Try to avoid complicated explanations.

It is important that students do these activities themselves. Previous experience that some students may have had with circuits will be diminished if the teacher merely demonstrates. Students should be warned of the danger of household current. These activities should only be done using batteries.

Avoid leaving batteries on for long periods of time as they will be quickly 'flattened'.

Suggested resources

Electricity and Magnetism, Lafferty, P
Explore Together 3, Jacob, C
Energy and Natural Resources (series)
Exploring Energy (series), Macmillan
The Flick of a Switch (video), Cooper, D

Computer software: simulation software, eg Rocky's Boots, Robot Odyssey, Lego TC Logo, Make the Connection!, SimCity

People and places: Minerals and Energy Centre, CSIRO Centre, Electricity Commission

Materials and equipment: electrical components, wires, batteries, bulbs, small electric motor or generator, for conductivity test; pipe cleaner, thread, cotton, toothpicks, foil, metallic looking thread, plastic

Teaching strategies

- 8 *Researching to explore and discover*
- 9 *Manipulating to explore and discover*
- 11 *Predicting outcomes*
- 13 *Trialling and testing ideas and concepts*
- 18 *Clarifying a design task*
- 24 *Evaluating design*
- 29 *Learning safety procedures*
- 30 *Selecting and maintaining tools and equipment*
- 31 *Evaluating chosen technologies*

Task

Design and make a device that uses a simple electric circuit. [I]

Activities

Observe items that are powered by simple electric circuits, eg lights, toys, alarms, door bells. Decide on the type of device to be made, eg eyes that light up on a simple model, a game that matches question and answer by completion of circuit, an alarm, toy box, jewellery box or manual dexterity device. **[TS18]**

Sketch a plan (circuit diagram) of the device. Include construction of the housing, if applicable. Include a switching mechanism to turn on and off.

Collect materials and components needed.

Make device and test its operation.

Task

Using a simple circuit design, make a device to test which materials will/will not conduct electricity. [G]

Activities

Decide on the type of device to be made and draw a diagram to show how it will be constructed, taking into account cost and durability. **[TS30]**

Assemble the apparatus and design a fair test, using materials known to conduct electricity. **[TS13]**

Test a range of unknown materials. Discuss the factors that may affect the investigation.

From findings, suggest which materials could be used as electricity insulators and conductors. **[TS31]** Find examples of these applications.

Task

Design and make a presentation demonstrating how energy may be supplied to a community without using fossil fuels. [G]

Activities

Discuss the power needs of the community. Identify physical features that may be utilised, eg coastal town may use water.

Decide if the energy source would be appropriate.

Use drawings/models to generate and develop ideas.

Demonstrate source of power, transportation of power to users, environmental impact.

Collect materials that would be needed, eg wires, generator, light globes, construction materials.

Model the environment and present details of the plan.

Critically evaluate group presentation. **[TS24]**

Task

Investigate the use of electrical circuits in our environment. [W]

Activities

List items in our environment powered by electricity, eg lights, toaster, computer, torch, portable radio, digital watch.

Classify according to their electricity source, ie mains or battery. Discuss the function of batteries.

Identify common features, eg wires to carry the current, power sources.

Identify safety features of electrical goods, eg insulating wires. **[TS28]** Suggest behaviours that ensure safe use, eg turning off at power point.

Task

Investigate the conditions needed to be fulfilled to make an electric circuit. [G]

Activities

Research the basic components of a simple electric circuit, eg by observation, reference to examples.

Using a variety of materials to choose from, construct by guess and check a basic circuit using wires, battery, light globe. **[TS9]**

Discuss how it could be turned on and off, eg by completing then breaking a circuit.

Trial a variety of components to see how they work within the circuit, eg buzzer, motor, heater, light. **[TS24]**

Predict the effects of additional batteries, bulbs, different wiring etc. **[TS11]** Test and revise hypothesis.

Draw a plan of a circuit and label it to show the components.

Predict which materials could be used to create a circuit (those that conduct electricity).

Task

Investigate the generation of electricity for everyday use. [I]

Activities

Explore where the electricity we use comes from, eg power point, wires in the wall, circuit board, power lines, power station, fuel source.

Research how electricity is produced, eg a visit to a power station, refer to videos, books.

Observe how a generator operates. Research and trial the range of ways of turning the generator, eg human action, moving water, wind, air, steam.

Do further research about the uses of fossil fuels. **[TS8]**

Identify advantages and disadvantages. Make predictions about impact of their use.

Suggest alternative sources of energy, eg solar, nuclear, tidal.

List and discuss advantages and disadvantages.

Way out Communication Stage 3

Communications to different places and in different times

Content focus

Built Environments
Information and Communication
Physical Phenomena
Products and Services
The Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- both aesthetic and functional factors need to be considered when people make changes to their environments
- information can be represented in a number of different forms, including graphics, sounds and texts
- technologies continually offer new ways of creating and sending messages
- there are various forms of energy
- systems are designed to provide particular services
- environments on Earth have been affected by technology.

Students will:

- describe the social, environmental or economic implications of the investigation of new materials and processes
- identify investigations which involve discoveries leading to unexpected outcomes
- show some relationship between the process of investigation and the process of design and make
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- describe the process of design and make which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments, and evaluating outcomes
- explain that the future must be considered when making choices of particular technologies
- explain that particular technologies are significant causes of change in the way people live.

Skills

Students will:

- identify data which support a particular prediction
- use investigation techniques to identify opportunities for design activities
- develop a design proposal by select-

ing and refining ideas and justifying choices

- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task
- produce a model, prototype, product or procedure to meet a specific design brief
- select tools, hardware, materials, equipment or software on the basis of their specific function and in order to gather information
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas
- identify and report unsafe conditions
- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- show confidence in themselves and willingness to make decisions and to take responsible action
- have a positive view of themselves and their capabilities
- show flexibility and responsiveness to ideas
- initiate and persevere with activities to their completion
- be honest and open in their dealings with others
- respect different viewpoints and ways of living
- respect others' rights and property
- work cooperatively in groups
- show a commitment to fair treatment for all
- show informed commitment to improving the quality of society and the environment
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology
- demonstrate rational and creative thinking.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Have students present the results of their research and show how this has influenced their decisions when designing and making.
- Ask students to describe how they would communicate to different places and in different times of history.

Links with other Key Learning Areas

English

Exploring the purpose and features of various communication forms, eg fax messages, letters, telegrams. Jointly constructing examples.

Exploring the language of radio, eg ads, news items, radio plays. Constructing examples.

Mathematics

Recording events as part of a sequence, eg time. Tabulating information and recording in a variety of graphs and TimeLiner

Human Society and Its Environment

Recognising individual differences. Considering past and present developments in communications technologies. Predicting future developments.

Personal Development, Health and Physical Education

Assessing effective communication.

Creative and Practical Arts

Selecting and assembling appropriate materials for radio play production.

Teacher notes

Contact consultants for assistance with electronic information service.

Suggested resources

You Can Get There From Here (kit), OTC. *Radio Then and Now* (kit), NSW Department of Education. *TV and Video Technology*, Wayland. *Making a Record*, Bassett, A. *Media for kids - Radio*, Butler, M. *Technology in Action* (series). *Sound Effects* (audio tape)

Computer software: database FrEdbase, Carefile, Desktop, Data Manager, The Critics' Choice, Make the Connection!, TimeLiner, Compute-A-Graph

People and places: OTC, local radio stations, SSP schools, hospitals, old people, homes, museums, post office
Materials and equipment: cassette recorders, pictures of rock paintings, hieroglyphics, radio, fax, modem

Teaching strategies

- 9 *Manipulating to explore and discover*
- 13 *Trialling and testing ideas and concepts*
- 16 *Applying understandings*
- 17 *Exploring needs*
- 18 *Clarifying a design task*
- 29 *Selecting appropriate technologies*
- 35 *Telecommunications*
- 36 *Sound and lighting*
- 38 *Publishing*
- 39 *Video production*

Task

Design and make a program for people with special needs. [G]

Activities

Decide on a story (or ideas) to be told. Consider traditional stories from various cultures.

Consider the special needs of the audience. [TS17]

Choose a way of presenting the story or text that allows for people with special needs. [TS40]

Create each part of the story. Consider the information to be included and how it will appear. Think about how to create the feel required.

Select and produce aids that might accompany the story. Devise a way of ensuring aids match the story when presented.

Present the program. Evaluate in terms of audience enjoyment as well as personal satisfaction. [TS13]

Task

Design and make a way of communicating about present-day life to people in future generations. [G]

Activities

Consider the range of ways to record messages. Refer to investigations for the ideas. [TS18] Choose methods to be used, eg illustration, audio recordings, photographs, videos, tapes, writing. Brainstorm subject matter to be included. What aspects of life would be interesting to future generations, eg impressions of school, sporting results, current affairs? [TS16] Jointly decide on a period of time for the information to be kept, eg 5 years, 20 years. Perhaps a number of suggestions can be actioned. Make the items to be preserved. Evaluate, determining whether others can understand what is being said. Can they suggest things that are missing? Consider ways of preserving the materials. Consider the materials used, where to store the messages, how long they are to be kept. Identify what things will affect the materials used, eg water, pollution and methods of preventing damage. Choose a method of preservation, and put into action. [TS29]

Task

Use appropriate technologies to organise data and communicate information. [I]

Activities

Explore how to use a range of technologies, eg use an electronic information service (Keylink, Fredmail) to communicate with radio service, other schools or pen pals, or to gain access to a remote data base, eg AAP. Use a fax to communicate with schools or services in the local area; use an electronic information service to make a newspaper. [TS35]

Identify communication systems. Observe in environment, eg satellite discs, visit facilities, eg post office; use a variety of resources to discover how they operate. Demonstrate how some of these work, eg write for the bulletin board to communicate with another school. [TS38]

Task

Investigate how science and technology have been used to assist people with special needs in communicating. [G]

Activities

Predict situations or circumstances where people in the community may have special needs in communicating. Specific conditions encountered by people could include:

[TS17]

- geographical isolations, eg living on an isolated cattle station
- sensory impairment, eg blindness, deafness
- learning difficulties.
- restricted mobility, eg the elderly, those unable to get around easily
- social isolation, eg being homebound, new to the community
- physical disabilities, eg paraplegia, severe arthritis, amputees
- language difficulties, eg non-English speakers.

Identify the difficulties that may be experienced.

Choose different methods of gathering information, eg interviewing people, direct observation or role play. Observe, in the local environment, adaptations that have been made for people with special needs, eg universal symbols, subtitling for hearing impaired, pedestrian crossing beepers, English classes, community language broadcasting.

Invite a guest speaker to visit the school.

Explore how computer technology has been used to provide for people's special needs.

Do a case study to discover changes that have occurred over time and developments that address the need, eg medical advances, refinement of devices to aid the senses, improved long distance communication, changes in social awareness and understanding. Compare and contrast past situations to the present. Include the roles of scientific research and technological innovation. Suggest further advances that may occur in the future.

Explore an organisation catering for people with special needs, eg Royal Blind Society. Research their function and the services they provide.

Reflect on how and why attitudes to people with special needs have changed since past times.

Task

Investigate the changes that have occurred in communication. [I]

Activities

Using various resources, research communication methods used in the past, eg rock paintings, drums, morse code.

[TS9] Observe examples that have been preserved and interpret the messages, eg Aboriginal rock paintings, Egyptian tomb paintings. Evaluate how successfully they have been preserved. Experiment sending messages using other methods identified, eg semaphore, morse code. Identify advantages/disadvantages of each method. Research how communication technologies evolved to their present forms. Record using a time line.

Sailing, Sinking, Soaring Stage 3

Some properties and uses of air and water

Content focus

Physical Phenomena
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- there are various forms of energy
- there are various parts to the physical environment, eg stars, planets, earth, air and water.

Students will:

- recognise that investigations may be conclusive/inconclusive
- describe the social, environmental or economic implications of the investigation of new materials and processes
- describe the process of investigation which can involve exploring and discovering phenomena and events, proposing explanations, initiating investigations, predicting outcomes, testing, modifying and applying understandings
- describe the factors that influence design
- justify the decisions made in designing and making
- explain the need for safe, ergonomically sound work environments
- identify that new technologies increase the options for designing and making.

Skills

Students will:

- make detailed observations using appropriate technologies
- discuss the factors that might affect an investigation
- identify data which support a particular prediction
- devise a fair test
- devise a test that will support or disprove a prediction
- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task
- produce a model, prototype, product or procedure to meet a specific design brief
- test or propose ways of testing the extent to which a product satisfies the design intentions
- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function in order to gather information

- use resources with consideration for the environment and adopt procedures that minimise waste
- identify and report unsafe conditions
- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- have a positive view of themselves and their capabilities
- initiate and persevere with activities to their completion
- respect the rights and property of others
- work cooperatively in groups
- show informed commitment to improving the quality of society and the environment
- be curious about and appreciate the natural and made environment
- appreciate the scientific and technological contribution made by Australians and members of other societies and cultures
- develop rational and creative thinking.

Assessment

Listed below are selected examples of strategies that may be used in testing the objectives of this unit of work.

- Have students describe the results of testing materials and explain how they have incorporated their findings in their kite designs.
- Observe how prepared students are to try out a variety of ideas in generating a design proposal.
- Have students demonstrate their knowledge and understanding of methods of joining and shaping the materials selected for model production.
- Observe and discuss with students the testing procedures for their predictions.
- Have a teacher - student interview concerning the process of investigation.

Links with other Key Learning Areas

English

Demonstrating how to access factual information on air, water, pollution.

Modelling the language of prediction, eg I think this will sink.

Modelling the construction of information in the form of a report.

Mathematics

Describing and naming simple objects and their properties.

Classifying and sorting objects into groups according to their similarities.

Personal Development, Health and Physical Education

Examining water safety aspects.

Creative and Practical Arts

Craft/design: designing and making paper/balsa wood plane.

Drama: improvising dance and movement activities associated with floating and sinking.

Teacher notes

Although density determines whether things float, it is not necessary to explain this concept at this level.

Collect a range of kite designs from around the world, especially those brought in by students.

Suggested resources

Water, Soil and Air, Houghton G et al
Aircraft and Space Rockets, Johnson, H
Experiment With (series)

Travel by Water, Pollard, M

Kites to Make and Fly, Newham, J

The Environment World Issues Series, Markham, A

Icarus (video), Film Australia

Water, Walpole, B

Wondering About Air (video)

Computer software: publishing software, eg Writing & Publishing Centre, Appleworks, FrEdbase, Compute-A-Graph

People and places: Sydney Maritime Museum, Sydney Children's Museum, Powerhouse Museum, State Pollution Control Commission, Water Board

Materials and equipment: a variety of materials for testing construction materials for boats and kites, soluble materials

Teaching strategies

8 *Researching to explore and discover*

11 *Predicting outcomes*

13 *Trialling and testing ideas and concepts*

16 *Applying understandings*

20 *Developing ideas*

22 *Considering appearance and function*

24 *Selecting and using material*

27 *Learning safety procedures*

29 *Selecting and maintaining tools and equipment*

30 *Evaluating chosen technologies*

Task

Use simple equipment to measure air and water pollution. [I]

Activities

Measure solid air pollution at various locations around the school playground, eg close to a corner window sill, outside, inside etc. Monitor substances found at different locations in a local creek or drain, over a period of time, eg acids, mud, greasy slick, litter. Record and graph results. [TS8]

Task

Design and make a water wheel. [G]

Activities

Draw ideas for constructing a wheel. Discuss and decide what materials could be used, eg plastic, wood, something waterproof. [TS25] Collect materials and construct wheel and trial finished product. Discuss possible uses for finished product, eg generate electricity, grind cereal into flour etc.

Task

Design and make a sailing boat that will float. [G]

Activities

Collect scrap materials, eg plastic containers, polystyrene foam, straws, paper, cloth. Experiment with designs for a sailing boat. [TS23] Consider shape, materials, staying upright, travelling in straight lines. Use drawings or a model to help develop the design. Explore ways of joining and shaping materials. Select materials that best fit the need, eg can float, be joined, be shaped. Make the boat, including the sail. Test the design's sea worthiness and ease of movement. Make repairs or alterations if necessary. [TS30] Consider ways of improving its performance. Research how some Australians have been involved in and Australian technology has been used in sail boat design, eg America's Cup yacht.

Task

Design and make a kite. Devise a useful purpose for the kite. [I]

Activities

Collect a variety of kites. Compare the different designs, noticing how they fly, materials used, how they are controlled. Use these examples as a source of ideas for individual designs. Establish criteria for a successful kite. Develop designs using drawings or models as needed. [TS20] Present the designs for discussion with peers. Select and obtain materials that are appropriate for specific design. Consider the best methods of construction, including joining materials. Evaluate work at each stage of making. On completion, test fly the kite. Compare to others. Make adjustments as desired, especially to alter performance, eg lengthening/shortening the tail. Evaluate according to initial criteria. [TS31] Brainstorm ways of using the kites for a useful purpose, eg to advertise a school event or a product suspending a sign from the kite.

Task

Investigate the effect of pollution on air and water. [I]

Activities

Discuss what a pollutant is, ie any substance which can damage health. Research the more common forms of pollution, eg exhaust fumes from cars, sewage into the oceans, chemicals discharged into sewers. Collect newspaper articles over a term about water and air pollution in their local area and produce a scrapbook.

Task

Investigate the properties of water. [I]

Activities

Observe the properties of water, eg flows, exerts a push/pull, expands when freezes. Use a fair test to identify which materials may dissolve in water, eg sugar, salt, sand, flour. [TS13] Discuss with students what is meant by a fair test and how this applies to this investigation, eg equal amounts of water, equal amounts of the materials to be tested etc. Identify that water can exist as a liquid, solid or gas. Identify that air can be dissolved in water.

Task

Investigate buoyancy with various materials. [G]

Activities

Using a range of readily-available objects observe whether they float or sink. Collect a wider variety of objects, particularly ensuring a variety of different materials, eg coins, woollen objects, plastics, other metals, plasticine, fabrics. Predict which will float and which will sink. [TS16] Test the predictions and observe the results. Discuss common characteristics of items that float, and of items that sink. Can students suggest any modifications that could be made to materials to make them float. Examine and discuss safety devices used on boats and when swimming. Predict the types of materials and shapes that could be used for this purpose. Test the predictions by direct observation of flotation devices brought in. Research correct procedures for use of safety devices, eg talk to experts, refer to pamphlets, videos. [TS28]

Task

Investigate the properties of air and how moving air (wind) moves objects. [G]

Activities

Observe the properties of air, eg a gas, exerts a push/pull, compressible, takes the shape of its container. Feel the effects of the wind, eg by running into the wind, running with the wind behind, running across the wind. Observe things that are moved by the wind, eg clothes blowing on the line, flag, windmill, leaves. Devise a way to observe and record the direction of the wind, eg by making a paper windmill. Measure the strength of the 'pull' of the wind. Try different ways of measuring. Compare the mass and strength of different materials and how they may be moved in the wind. [TS13] Predict those that would be strongest, lightest, best as sails etc. [TS11] Devise fair tests to check the predictions. Use your investigation to suggest material for use in kite construction. [TS25] Consider the purpose of each component, eg the frame, the fabric, and the qualities that would be suitable, eg strength, lightness, appearance. Explore the flight of gliders in the wind, eg using paper or balsa planes. Predict how the glider could be made to fly further, higher or in any other specified way. Make changes and test the new design. [TS13]

What's the Weather?

Stage 3

Natural occurrences and their effects

Content focus

Built Environments
Information and Communication
Physical Phenomena
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people try to control the conditions in the environments they build
- information can be represented in a number of different forms, including graphics, sounds and texts
- technologies continually offer new ways of creating and sending messages
- there are various forms of energy
- the sun is the source of most of the energy on the Earth
- there are environmental consequences of production and consumption
- systems are designed to provide particular services
- there are many physical phenomena which change the environment
- there are various parts to the physical environment, eg stars, planets, earth, air and water.

Students will:

- recognise that investigations may be conclusive/inconclusive
- show some relationship between the process of investigation and the process of design and make
- describe the process of investigation which can involve exploring and discovering phenomena and events, proposing explanations, initiating investigations, predicting outcomes, testing, modifying and applying understandings
- describe the factors that influence design
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- evaluate technological activity in terms of social and environmental cost and benefits.

Skills

Students will:

- make detailed observations using appropriate technologies
- devise a test that will support or disprove a prediction
- produce a model, prototype, product or procedure to meet a specific design brief
- test or propose ways of testing the extent to which a product satisfies the design intentions
- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function and in order to gather information
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas.

Values and Attitudes

Students will:

- initiate and persevere with activities to their completion
- work cooperatively in groups
- show informed commitment to improving the quality of society and the environment
- be curious about and appreciate the natural and made environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are suggested strategies that may be used in assessing this unit of work.

- Have students predict the weather for various times of the future year.
- Students can demonstrate the windspeed device to successfully measure the wind's speed/direction.
- In conferences, students could be encouraged to justify explanations supporting or disproving results of weather predictions.
- Consider whether students demonstrate rational and creative thought.

Links with other Key Learning Areas

English

Demonstrating ways of taking notes

from an address by guest speaker or during an excursion.

Exploring the purpose and features of written explanations.

Jointly constructing explanations of natural phenomena.

Mathematics

Exploring aspects of position, focusing on mapping.

Measuring temperature, volume and wind speed using both formal and informal units.

Human Society and its Environment

Investigating the influences of natural phenomena on lifestyles and environments as part of cultural study on a current affairs issue.

Teacher notes

Weather conditions to measure and monitor should include temperature, rainfall, wind direction and speed.

Suggested resources

Our Planet (series), Eagle Books

World Disasters (series), Macmillan
Weather (video), Mason, J Classroom Video

Volcanoes (video), Classroom Video

Computer software: communications software, eg Telecom V3, U-Connect, K-Connect, Diga, Apple Access II, Netcomm

People and places: Forestry Commission, museums, World Vision or Community Aid Abroad, Dick Smith electrical components, State Emergency Services

Materials and equipment: electrical components, eg wire, batteries, bulbs, mercury (trembler) switches, barometer, rain gauge, weather sections of newspapers

Teaching strategies

10 *Proposing explanations*

11 *Predicting outcomes*

16 *Applying understandings*

18 *Clarifying a design task*

19 *Exploring ideas*

22 *Selecting solutions*

31 *Evaluating chosen technologies*

35 *Telecommunications*

Task

Design and make an instrument to indicate windspeed or direction on a windy highway, bridge or airport. [I]

Activities

Discuss the need to measure natural conditions, eg to warn of changes. Research and identify the ways that natural conditions are measured. Decide on requirements of the device, eg must demonstrate wind direction and strength, be clearly visible.

Brainstorm ideas about how the indicator will work. Use examples from the environment as models. **[TS18]**

Draw a plan of the design. Discuss it with others. Trial selected materials for visibility, durability.

Make the device and trial it.

Task

In groups, design and present a weather report. [G]

Activities

Identify the sorts of details required in weather reports. Gather information from around the state, over a period of time.

Provide each group with identical information. Select details to be included. Design and prepare graphics, text and method of presentation. (Extension: try to predict tomorrow's weather.) Assign roles to be filled, eg graphics creation, director, presenter.

Class presentation: compare each group's report and note similarities and differences. **[TS16]**

Task

Design a plan to cope at school, in the event of a disaster. [G]

Activities

Identify a phenomenon that may affect the local area, eg flood, fire, earthquake.

Discuss the action that will need to take place. **[TS22]**

Include alerting people, evacuation, accounting for everyone, communicating with the outside, aiding the injured, equipment that may be required, informing everyone of procedures. Evaluate technologies which could aid communication. **[TS31]**

Make a plan of the action to be undertaken. **[TS19]**

Consult with other classes to ensure their needs are considered. Discuss the plan with a friend. Can they identify any important steps that you have missed?

Conduct a drill to trial the plan and evaluate its success.

Task

Investigate weather patterns. [I]

Activities

Observe weather patterns over time by collecting weather information/maps from newspapers, TV or radio. Discuss observations of temperatures, wind direction and cloud patterns in different areas.

Research methods used to measure weather patterns, eg gauges, weather balloons, satellites.

Record and graph rainfall readings over time and in different parts of the state/country. Predict wettest/driest areas or times of year. **[TS11]** Test predictions by comparing readings with other months of same year and same month in other years. Note which months are the wettest, driest, windiest etc.

Visit a local weather station and observe the ways weather information is gathered and disseminated.

Task

Use an electronic information service to collect information about weather throughout NSW. [I]

Activities

Define the information required, eg temperature, wind speed, wind direction, rainfall. Write the message to be used. **[TS35]**

Use the bulletin board to post a message to schools in NSW. Log in and read replies.

Analyse the data received. Compare similarities and differences around the state. Propose explanations regarding patterns that emerge. **[TS10]** Continue data collection to support/disprove proposed explanations.

Task

Investigate natural phenomena. [G]

Activities

Research natural occurrences that may cause a disaster, eg earthquake, volcano, flood, cyclone. Use books, slides, videos, a guest speaker.

Include causes, variations in force, areas most likely to be affected, early warning systems, occurrences in Australia.

Discuss what makes a natural phenomenon become a disaster, eg its effect on the environment and people. Reflect on whether an earthquake in an unpopulated area or cyclone in the middle of the ocean, would be considered a disaster.

List phenomena that may occur in Australia. Identify areas most likely to be affected by each variety. Research whether any disasters have occurred in your local area. If so, describe the damage sustained.

Research organisations and systems involved in dealing with disasters in Australia, eg SES. Visit their headquarters or invite a member to visit the class.

An Ancient Land

Stage 3

Changes that have occurred over time

Content focus

Living Things
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- the activities of people can change the balance of nature
- groups of living things have changed over long periods of time
- there are various parts to the physical environment, eg stars, planets, earth, air and water.

Students will:

- describe the process of investigation which can involve exploring and discovering phenomena and events, proposing explanations, initiating investigations, predicting outcomes, testing, modifying and applying understandings
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- describe the process of design and make which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments, and evaluating outcomes.

Skills

Students will:

- make detailed observations using appropriate technologies
- devise a test that will support or disprove a prediction
- modify and apply their understanding in the light of their investigation
- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task
- produce a model, prototype, product or procedure to meet a specific design brief
- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function in order to gather information

- use appropriate equipment and tools to carry out a particular task, understand the technology involved to record and present ideas.

Values and Attitudes

Students will:

- have a positive view of themselves and their capabilities
- show flexibility and responsiveness to ideas
- initiate and persevere with activities to their completion
- respect different viewpoints and ways of living
- respect the rights and property of others
- be curious about and appreciate the natural and made environment.

Assessment

Listed below are strategies that may be used in assessing this unit.

- Have students explain the features in their model of different landforms (the focus should not be the model but their understanding of the features).
- Listen to students' explanations of their created environment to visitors.

Links with other Key Learning Areas

English

Demonstrating taking notes from a variety of sources, eg research speakers, videos. Modelling organisation of information to facilitate making comparisons. Writing stories about the past.

Teacher notes

The emphasis in this unit is on the changes that have occurred over long periods of time.

Because Aboriginal people have occupied Australia for many years, records of geological and species changes, eg sea level, volcanoes, species extinction, are found in Dreaming stories. The first archaeological finds of fossils of extinct megafauna were found following such references.

Suggested resources

First Facts (series), Macmillan
Australian Dinosaurs, Pride, M
The Magic School Bus Inside the Earth, Cole, J

Eyewitness Guides (series), Collins
Living in Australia (series), Macmillan
64,000,000 Years Ago (video), National Film Board of Canada
Dinosaurs (video), Ministry of Education, Victoria

Computer software: graphics software, eg Explore-a-Science Dinosaur Construction Kit, Tyrannosaurus Rex, Super Print, What Makes a Dinosaur Sore, The Print Shop, Fantavision, Slide Shop, Graphics Bank, Geoworld, PC Globe

People and places: national parks, local area, Gould League, Soil Conservation Service, local historical society, Mineral and Mining Museum, Australian Museum, Earth Exchange

Materials and equipment: construction materials, pictures of erosion, containers of sand and soil, collection of natural materials, eg leaves, bark

Teaching strategies

7 *Observing to explore and discover*

8 *Researching to explore and discover*

10 *Proposing explanations*

13 *Trialling and testing ideas and concepts*

15 *Explaining understandings*

16 *Applying understandings*

25 *Selecting and using materials*

27 *Understanding materials*

Task

Design and make a model of particular landforms. [G]

Activities

Identify a range of different landforms, eg coastal, desert, mountain/valley. In groups research the characteristics to include for each model. Select a method of representing the landforms, eg plasticine modelling, papier-mache, plaster of paris. Sketch ideas, trying out different combinations of elements. Evaluate and make refinements. Make a final plan of the model. Choose and collect materials suitable to the environment being represented, eg sand for beaches, twigs etc. **[TS25]** Create the model using appropriate methods of shaping, joining and combining materials. Label the features.

Task

Design and make models of animals and their habitats by changing the classroom into a prehistoric environment. [G]

Activities

Identify the range of creatures to be modelled, eg land animals, flying animals, species that live in water. Research individual features that need to be represented, eg physical characteristics, foods eaten, style of movement. Consider relative sizes. Make suggestions of methods to use in reproducing the model. Visit theatres, museums and observe techniques used. **[TS7]** Use as models or obtain advice. Explore materials that could be used, eg papier-mache, plaster of paris, plasticine. Consider ways of making appropriate sound effects, moving parts, lighting effects. **[TS36]** Create the models using appropriate methods of shaping, joining and combining materials. **[TS27]** Create the landscape considering materials needed to simulate the textures, colours and atmosphere required. Position the models. Invite other classes to make the trip back in time.

Task

Investigate different landforms. [W]

Activities

Identify natural landforms, and their characteristics, in the local environment, eg hills, rivers, valleys, beaches. Research and identify natural landforms in other environments. **[TS8]** Research how land masses have changed over time. Compare representations of what Australia may have looked like at different times over many thousands of years. Compare with current shape and size. Suggest reasons for rise/fall in sea level. **[TS15]** Observe weather and other natural conditions, eg running water, wind in identified areas. Predict the effects of these elements on the land. Create a model to test the predictions. Research using videos, reference books or invited speakers, to collaborate the results. Collect a variety of rocks from the local area. Classify by various attributes. Identify common characteristics. Research to determine how they were formed, eg ask an expert. Observe weathering in local environment, eg areas of erosion, roadside cuttings. Explore how these effects occurred. Suggest ways of preventing further erosion or addressing the problem. **[TS16]**

Task

Investigate animals that existed in prehistoric times. [I]

Activities

Explore sources of evidence of life in prehistoric times, eg fossils, amber. Make predictions as to how these were formed. Test ideas, by simulating/trying proposals or through research. Research animals that existed in prehistoric times. Identify species that were peculiar to Australia, eg diprotodons, giant mammals. Include information on their characteristics, habitat, place in the food chain. Identify species which have become extinct, eg dinosaurs. Suggest possible causes. Explore changes which may have caused extinction of species, eg climate, balance of nature. Discuss the features of plants and animals which led to their survival/extinction.

Light Up My Life

Stage 3

Light and visual images

Content focus

Built Environments
Information and Communication
Physical Phenomena
Products and Services

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- both aesthetic and functional factors need to be considered when people make changes to their environments
- information can be represented in a number of different forms, including graphics, sounds and texts
- technologies continually offer new ways of creating and sending messages
- the sun is the source of most of the energy on the Earth
- light can pass through some materials and not others and when it does it forms shadows
- systems are designed to provide particular services
- there are many physical phenomena which change the environment.

Students will:

- show some relationship between the process of investigation to the process of design and make
- describe the factors that influence design
- justify the decisions made in designing and making
- explain that particular technologies are significant causes of change in the way people live.

Skills

Students will:

- discuss the factors that might affect an investigation
- devise fair tests
- modify and apply their understanding in the light of their investigation
- develop a design proposal by selecting and refining ideas and justifying choices
- produce a model, prototype, product or procedure to meet a specific design brief

- use appropriate equipment and tools to carry out a particular task, understand the technology involved and record and present ideas.

Values and Attitudes

Students will:

- show flexibility and responsiveness to ideas
- work cooperatively in groups
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected examples of strategies that may be used in assessing the objectives of this unit of work.

- Discuss informally the processes experienced in creating the puppet show, shadow play or tape/slide program.
- Have students create a flow chart of the sequences in their play, show or program developed.
- Have the students use a computer for telecommunications and/or multi-media productions.
- Have children predict when light will/will not pass through a variety of materials.
- See if children can adapt, changing size and position, strong/weak/multiple lights, to produce the desired effects on puppets and shadows.

Links with other Key Learning Areas

English

Exploring the purpose, audience and features of entertainment.

Focusing on the descriptive language associated with light, shadows and reflection.

Mathematics

Measuring and calculating duration of events. Reading and interpreting timetables.

Personal Development, Health and Physical Education

Identifying the need for protective clothing and equipment.

Human Society and its Environment

Organising and presenting information. Extending understandings re aesthetic needs and how they are satisfied.

Creative and Practical Arts

Creating props, costumes etc as appropriate.

Using inks and oil paints on slides for visual effects.

Music

Explore the use of tone and colour to create scary, pleasant, peaceful moods/atmospheres.

Teacher notes

Students will make observations about light while exploring and manipulating materials and objects.

Advertisements and videos are useful for exploring the effects of sound and lighting.

Suggested resources

Media for Kids, Butler, M

Light and Dark, Catherall, E

Light Fantastic, Kerred, R

Tracks into Primary Science, Freer, K and O'Toole M

Lode (series), Longman Cheshire

Computer software: Energy Efficient House, Make the Connection!, Slide Show

People and places: computer education contacts, theatres, professional producers, community theatre groups, Powerhouse Museum

Materials and equipment: video cameras, video cassette recorders, audio-visual equipment, appropriate props and equipment, simple lights, sound effects, film, coloured screens

Teaching strategies

8 *Researching to explore and discover*

17 *Exploring needs*

32 *Audio-visual technologies*

35 *Telecommunications*

36 *Sound and lighting*

41 *Computer graphics*

Task

Design and make a shadow play or puppet show. [G]

Activities

Predict what 'leisure' will be like in the future. [TS11] Suggest some new activities that might exist, eg day trips to the moon, hologram shows, computer simulator dome. Select an activity to make a play or puppet show. Identify characters to be illustrated. Choose the light source, eg overhead projector, slide projector, light behind sheet. Explore materials that may be suitable. Consider the characteristics required, eg allowing no light, some light, coloured light through, and how they can be cut and joined. Select materials and make the puppets. Try them out and discuss possible improvements. Organise other aspects to enhance the performance, eg sound effects, music and voices, darkening the room. [TS32] Combine all the elements and rehearse the production. Invite friends to watch the play.

Task

Design and make a representation of a natural change in the surroundings. [W]

Activities

Choose a scenario to which 'special effects' can be added. (This could be part of a class play.) Discuss the type of effects that would complement the chosen scene.

Discuss the various lighting changes to be observed in the environment, eg sunrise, sunset, lightning, cloudy day, gathering storm. Try out various ways of representing lighting effects with various light sources.

Discuss the sounds that are often heard at special times, eg birds chirping at sunset. Try out various sounds and combinations of sounds that might represent natural occurrences, eg thunder, rain, leaves rustling. Add the 'special effects' to the scene and evaluate their success.

Add a different set of 'special effects' to the same scene and discuss the result.

Task

Investigate the effect light has on materials. [I]

Activities

Shine light from a slide projector on to the wall or onto a screen. Observe the shape of the light beam. Explore ways of affecting this beam of light. Observe light passing or not passing through several materials, eg wood, glass, woollen cloth. Collect a range of materials, eg clear plastic, cotton cloth, nylon, metal, coloured liquid, lighting gels. Predict whether the light will pass through easily (transparent), partially (translucent), or not at all (opaque). Test predictions. Record observations. Describe other characteristics of transparent materials. [TS36]

Task

Investigate sources of light. [W]

Activities

Identify light in the environment, eg light from the sun, ceiling lights, candles etc. [TS8]

List possible light sources, eg the sun, candles, stars, fire, glow worms, light globes. Group according to common characteristics, eg uses electricity, can be used outdoors, used when the sun's light is not available.

Task

Investigate how sound and lighting can be used to create 'special effects'. [G]

Activities

Collect a variety of materials, eg cellophane, cotton material, coloured overhead projector sheets, filters.

Trial these materials to see if they can change sources, eg overhead projector, torch.

Observe the effects.

Record observations of the success of various materials, eg no light passed through, the light turned purple.

Trial more than one successful material at a time. Discuss the results of combining different colours.

Effects of human activities on the environment

Content focus

Built Environments
Living Things
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- people try to control the conditions in the environments they build
- people live in communities and build environments to service their common needs
- the activities of people can change the balance of nature
- there are environmental consequences of production and consumption
- systems are designed to provide particular services
- systems are used to deliver and distribute goods
- there are many physical phenomena which change the environment
- there are various parts to the physical environment, eg stars, planets, earth, air and water
- environments on Earth have been affected by technology.

Students will:

- describe the social, environmental or economic implications of the investigation of new materials and processes
- explain the need for safe, ergonomically sound work environments
- describe the process of design and make which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments and evaluating outcomes
- explain that the future must be considered when making choices of particular technologies
- evaluate technological activity in terms of social and environmental cost and benefits
- explain that particular technologies are significant causes of change in the way people live

- describe ways in which resources can be conserved.

Skills

Students will:

- modify and apply their understandings in the light of their investigation
- use resources with consideration for the environment and adopt procedures which minimise waste
- identify and report unsafe conditions
- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions
- respect the rights and property of others
- work cooperatively in groups
- respect different viewpoints and ways of living
- show informed commitment to improving the quality of society and the environment
- be curious about and appreciate the natural and made environment
- appreciate the scientific and technological contribution made by Australians and members of other societies and cultures.

Assessment

Listed below are strategies that may be used in assessing this unit.

- Have students assess the effectiveness of the recycling system they have implemented in the school and recommend any modifications.
- See how effectively students are able to transfer their ideas for improving the environment into their lives outside school.
- What are the observable differences in students' behaviour toward their immediate environment?

Links with other Key Learning Areas

Human Society and its Environment
Developing understandings about ways major world environments are

managed and the effects of management practices on natural environments and human society.

Personal Development, Health and Physical Education

Investigating potential health hazards caused by environmental damage.

Creative and Practical Arts

Organising movement and language through simulation, addressing issues of environmental damage.

Suggested resources

The Greenhouse Effect – Exploring the Theory, Morris, B et al

The Environment and Health, Ward, B

The Ozone Crisis, Mackness, B

The Humpback Whale, Green, C

Survival (series), Watts

Protect Wildlife (series), Watts

The Battle of Billy's Pond (video),

British Children's Film Foundation

Drowned Land (video), ABC

Scars on the Landscape (video), ABC

Sands of Time (video), Yowie Films

People and places: Forestry Commission, Soil Conservation Service, Australian Conservation Service, national parks, Gould League, State Pollution Control Commission

Computer software: databases, eg Goodbye Forever? A Database of Threatened Mammals, Australian Mammals Database, SimAnt, SimCity

Teaching strategies

8 *Researching to explore and discover*

10 *Proposing explanations*

11 *Predicting outcomes*

13 *Trialling and testing ideas and concepts*

14 *Modifying understandings*

22 *Selecting solutions*

Task

Design and make a product to satisfy an identified need, taking into account environmental costs. [G]

Activities

Evaluate how selected products satisfy human needs. Outline the environmental impact of the item's production. **[TS30]** Include packaging, production methods, the product's use and eventual disposal. Design modifications to minimise the effects on the environment, eg an environmentally sound product may be poorly packaged, a simple object may be made of rare rainforest timbers. **[TS20]** Describe the design problem, including environmental requirements. **[TS10]** Generate ideas using drawings, words or both. Outline solutions or make a model of the product. Include disposal procedures. Research large-scale production methods. Analyse the design solution, identifying its strengths and weaknesses. **[TS21]** How is the item received by others? Get an expert opinion. Present your proposal/suggestion to the original producers.

Task

Design and implement/maintain a system to recycle materials within the school. [W]

Activities

Examine current waste disposal in the school. (If a recycling system already exists, evaluate its function.) Trace where waste products go. Measure the amount of rubbish thrown away in a day, a week. Evaluate the effects of this on the school and wider community. **[TS11]** Identify materials that can be recycled, eg food scraps, paper, plastic containers, glass, aluminium cans. Separate materials that can be usefully reused within the school, eg yoghurt pots. Organise recyclable materials into those to be recycled at school, eg food scraps made into compost and materials that can be sent to a recycling service, eg paper, glass. Define the purposes of recycling system, eg to gather suitable food scraps and organise compost area. Generate ideas and illustrate the steps of the system. Consider location of rubbish collection points, ways of encouraging their use, systems for separating different materials, storage, collection by outside agencies etc. Include an ongoing management plan that may allow for shared responsibility. Trial the plan over a period of time and evaluate its effectiveness. **[TS13]** Make changes as required. Compare amounts of 'rubbish' thrown away before and after implementation of the plan.

Task

Investigate the use of renewable and non-renewable resources. [I]

Activities

Research the availability of this service, such as how frequently garbage is collected, are recycled paper/plastic/bottles collected etc. **[TS8]**

Make a list of everything your family has thrown out in one day (or go through your trash can in the house — this may have taken a couple of days to accumulate). Make a second list which shows how many of these items have only been used once. Have students brainstorm/design items which do not use up our fossil fuels and other non-renewable resources. Research how some of the thrown-away material is manufactured (eg plastic detergent containers, poppers, aluminium cans). Do a flow chart showing how it goes from manufacturer to the store.

Task

Investigate the effect of human activity on environments both in Australia and the rest of the world. [I]

Activities

Identify characteristics of natural environments, include plants and animals in particular areas. **[TS8]** Visit national parks, watch videos, etc. List human activities that interact with/impact on natural environments, eg land for farming; hunting/fishing; mining; urban development; use of resources; quality of air/water; use of pesticides, cars/planes. Suggest effects of identified activities, eg farming leads to reduced natural habitats/animal food sources. **[TS10]** Directly observe and critically appraise effects of human activity, eg soil salination, air/water pollution, species endangerment. Use reference materials. Research causes of problems, identifying as many reasons as possible, eg species endangered through habitat destruction, introduced species, hunting. Present pros and cons of human activity. **[TS10]** Explore conservation in traditional Aboriginal societies. Make predictions for the future, eg forest felling causing species extinction, green house effect. **[TS11]**

Task

Investigate the ways people, world wide, are addressing the problems of environmental damage. [W]

Activities

Review the range of effects human activities have on natural environments. Evaluate the necessity of human activities, eg farming is harmful to indigenous plants/animals, but necessary to provide food. Use arguments to justify judgements. **[TS10]** Classify consequences as preventable or able to be addressed. Propose ways of preventing problems.

Research current means of addressing problems using pamphlets, organisations, references. Areas of enquiry may include:

- identify and contact concerned organisations, eg ACF, State Pollution Control Commission. Discover aims, activities, etc. Contact government agencies and explore legislation or statutory requirements/controls. Make judgements about their effectiveness.
- suggest ways of reducing use of resources and waste. Research recycling systems. Identify actions being taken in the local community, state, other countries.
- explore the roles and functions of zoos and botanical gardens in protecting animals and plants under threat.

Evaluate methods/solutions suggested. Consider their complexity, expense, applications to other situations.

Propose ways that individuals can have some effect. Assess how current activities are changing society's attitudes and actions.

[TS14]

Reflect on whether 'technology' is a destructive force or is it part of the solution to environmental survival?

Don't forget to include raw materials, energy use, paper cartons and plastics for wrapping, fuel used in transporting the raw materials and finished products to market. Find out what processes create pollution of one kind or another. What type of pollution does the power create? What type of pollution or toxic waste is created in the manufacturing of the plastic and the paper from pulp (investigate atmospheric, ground water, and surface water). What impact does logging/mining have on loss of top soil, animals losing their habitat, extinction of species, or the quality of life of future generations? Investigate what health effects are caused by these toxic chemicals entering the environment. Research some of the ways in which local councils or the State Pollution Control Commission, Water Board and Department of the Environment remove the toxic waste.

A Change for the Better

Stage 3

Inheritance and environment

Content focus

Living Things
Earth and its Surroundings

Outcomes

This unit will contribute to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- information can be represented in a number of different forms, including graphics, sounds and texts
- living things show variation within a species
- the activities of people can change the balance of nature
- groups of living things have changed over long periods of time.

Students will:

- describe the process of investigation which can involve exploring and discovering phenomena and events, proposing explanations, initiating investigations, predicting outcomes, testing, modifying and applying understandings.

Skills

Students will:

- make detailed observations using appropriate technologies
- modify and apply their understanding in the light of their investigation
- use investigation techniques to identify opportunities for design activities
- select, reject or modify as appropriate the elements of design to evaluate the procedures and outcomes of a design task
- produce a model, prototype, product or procedure to meet a specific design brief
- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions
- show flexibility and responsiveness to ideas

- show a commitment to fair treatment for all
- respect different viewpoints and ways of living
- show informed commitment to improving the quality of society and the environment
- be curious about and appreciate the natural and made environment.

Assessment

Listed below are selected examples of strategies that may be used in assessing this unit of work.

- Encourage supportive peer assessment of how well animal models are suited to the described environment.
- Conduct conferences with students to discuss information selected from different sources. Focus on the students' ability to select and evaluate available information.

Links with other Key Learning Areas

English

Discussing the purpose and audience for oral reports. Role playing a range of oral languages techniques, eg reporting to small group or whole class.

Mathematics

Developing and practising a range of measurement skills.

Human Society and its Environment

Researching the environment of particular cultural groups.

Personal Development, Health and Physical Education

Exploring growth and development – human reproduction cycle.

Creative and Practical Arts

Drawing animals and plants from direct observation at various stages of development. Developing a sequence of annotated drawings.

Teacher notes

Care and sensitivity is needed when looking at students' inherited characteristics. The creation of a family tree could be done in groups.

Teachers need to be aware that family relationships may be described differently in various cultures, eg cousins

may be called brother/sister, family may be extended, not 'nuclear'. Relationships need to be defined and language explained before commencing family trees.

Researching human alterations to plant/animal characteristics should be very simple – not an investigation of genetics.

Suggested resources

Animal Acrobatics, Nelson

Young Naturalist (series), Hodder & Stroughton

The Great Whales (video), Educational Media

Computer software: interactive story writing programs, eg Family Tree and Family History, Story Tree, Venture Writer. Graphics software, eg MacDraw, MacPaint, Mouse Paint, Deluxe Paint III, 1st Paint, Picture It. Database software, eg Appleworks, Microsoft Works, Carefile, Datasweet

People and places: Gould League, Native Plant Growers' Association, The Royal Botanic Gardens, farms, zoos, local nursery, field study centres, national parks, Australian Museum

Materials and equipment: plant and animal photographs, modelling materials, Osmiroid measuring instruments

Teaching strategies

7 *Observing to explore and discover*

8 *Researching to explore and discover*

15 *Explaining understandings*

26 *Organising tools, equipment and processes*

Task

Design and publish a way of representing a person's/ animal's place in their family group which illustrates inherited characteristics in people or other animals. [I]

Activities

Use an example of a family tree to explore its features. Refer also to computer software.

Decide how the family information is to be set out. Explore possible ideas by drawing sketches or plans. Evaluate by sharing ideas with a friend. Assess whether they can follow the relationships.

Select the information to be included in each field, eg names only, or names with descriptions.

Enter information into each section, on paper or computer. Print out the final design or publish as appropriate.

[TS38]

Report characteristics appearing regularly in the family.

Task

Design a model to illustrate how animals are suited to a particular environment. [I]

Activities

Negotiate whether models should be created individually or in groups.

Plan steps required in production of the model. **[TS26]** Include initial sketches, organisation of materials and tools, final construction and presentation.

Using information gained through investigations identify the features and behaviours of selected animal(s). List physical characteristics of their environments to be included.

Explore appropriate materials to be used for animal models and for background setting. Consider how well they can be moulded, coloured/decorated etc.

Consider how the model may be made to demonstrate the relationship between the animals and their environment, eg animals moving from one area to another to demonstrate camouflage. Present findings to class.

Task

Investigate how characteristics can be passed from one generation to the next. [I]

Activities

Identify characteristics that may be 'inherited'. **[TS8]**

Choose characteristics, eg eye colour, tongue rolling, attached or detached ear lobes. Chart results of interviewing each family member, including cousins, aunts and uncles, grandparents where possible.

Observe characteristics of animals that are passed on to each generation, eg skin/fur colour, size, features.

Research how the characteristics of domestic animals have been changed by people, eg breeding beef cattle, merino sheep to maximise wool yields, breeding dogs and cats to meet particular criteria.

Task

Investigate animals'/plants' inherited traits. [W]

Activities

Generalise about the passing on of information from parent to offspring. **[TS7]**

Predict outcomes of substitute parenting.

Discuss what will grow if a tomato seed is planted. Why?

What will hatch if a duck sits on a chicken's egg? Why?

Task

Investigate how species of plants and animals are suited to their environment. [W]

Activities

Visit a zoo. Include a lesson with the education officer. Identify the specific characteristics of given animals, eg kangaroos have large back legs, eat grass etc, possums have long claws, large eyes, dark fur, are nocturnal. Include physical features, habits, food, behaviour.

Research the characteristics of environments, eg desert, savannah, alpine, marine, jungle. Include vegetation, colours, landforms, climate, availability of water. **[TS8]**

Match animals to their native environment. Identify features that make them particularly suited to their environment, eg kangaroos' fur colour blends with soil or vegetation colour, largely inactive in heat of day etc. Note similarities and differences between species in a specific habitat. Suggest reasons for these. Research the relationship between species, eg food webs and chains, competing for similar food source etc. Case study a particular species. Prepare a report detailing how it fits into its environment and satisfies its needs.

Visit a botanic garden to observe plants growing in a specific environment. Include a lesson with an education officer. Observe plants that are found in particular areas, eg arid, mangroves, rainforest, temperate. Identify characteristics common to each habitat, include leaf type and size, fruit, seed pods, flowers, plant size etc. Research how characteristics may aid the plant's survival in that area. Make generalisations about plants from different habitats. **[TS15]**

Observe other examples and predict where the plants come from. Give reasons for predictions. Research to test predictions.

Film or video production

Content focus

Built Environments
Information and Communication
Products and Services
Earth and its Surroundings

Outcomes

This unit contributes to the following syllabus outcomes.

Knowledge and Understanding

Students will know and understand that:

- information can be represented in a number of different forms, including graphics, sounds and texts
- technologies continually offer new ways of creating and sending messages.

Students will:

- describe the social, environmental or economic implications of the investigation
- show some relationship between the process of investigation and the process of design and make
- justify the decisions made in designing and making
- identify that new technologies increase the options in designing and making
- describe the process of design and make which can involve identifying needs and wants, defining a design task, generating and selecting ideas, assembling or constructing products, systems or environments and evaluating outcomes
- explain that the future must be considered when making choices of particular technologies
- explain that particular technologies are significant causes of change in the way people live.

Skills

Students will:

- make detailed observations using appropriate technologies
- identify data which support a particular prediction
- modify and apply their understanding in the light of their investigation
- develop a design proposal by selecting and refining ideas and justifying choices
- select, reject or modify as appropriate

ate the elements of design to evaluate the procedures and outcomes of a design task

- produce a model, prototype, product or procedure to meet a specific design brief
- select appropriate tools, hardware, materials, equipment or software on the basis of their specific function and in order to gather information
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas
- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- have a positive view of themselves and their capabilities
- exhibit self direction in their own learning
- initiate and persevere with activities to their completion
- develop rational and creative thinking
- appreciate the scientific and technological contribution made by Australians and members of other societies and cultures.

Assessment

Listed below are selected example strategies that may be used in assessing the objectives of this unit of work.

- Have students present their video to another class.
- Have students use lighting and sound to create different moods.

Links with other Key Learning Areas

English

Exploring a variety of ways of conducting audience research, eg value scales, interview, sampling.

Exploring the features of shooting scripts or storyboards. Jointly constructing examples.

Mathematics

Developing strategies for recording and analysing audience research data using computer software.

Human Society and its Environment

Use skills developed in this unit to extend ways of organising and presenting work in this area.

Exploring the ways people are represented in a variety of media.

Creative and Practical Arts

Drama: developing scripts and characterisation for video.

Craft/design: designing and making props, backdrops.

Music: investigating sounds and music to complement images, exploring use of music/sound in films and video.

Teacher notes

Allow students time to gain confidence in using the video.

Suggested resources

Lights, Camera, Action, Curriculum Development Centre

Making a TV Series, Trussell-Cullen, A

Media for Kids – Film, Butler, M

Media for Kids – Television, Butler, M

Social Themes and Language (series)

Electronic (series)

The Electronic Rainbow: An Introduction to Television (video)

Computer software: graphics software, such as SuperStory Tree, HyperStudio, Deluxe Paint III, Poster; multimedia tools, eg Slide Show, Slide Shop, Hypercard, Linkway, Linkway Live; databases, eg Appleworks, Microsoft Works, Carefile, Datasweet

People and places: art galleries, Power House Museum, 'Stage Lights' Exhibition

Materials and equipment: video cameras, video cassette recorders, simple lights, sound effects, props, television programs, cameras, film, lights, coloured screens, percussion instruments, video clips, music

Teaching strategies

7 *Observing to explore and discover*

8 *Researching to explore and discover*

16 *Applying understandings*

Task

Design and make a video production presenting a story to sell a product or idea, or inform the audience. [G]

Activities

Identify potential audience and conduct audience research if applicable. Consider how this may affect the final product.

Select the subject matter of the program, eg drama, comedy, advertisement, news presentation, music video, animation, or combination of these.

Carefully plan the production using a storyboard or shooting script. Ensure details are finalised regarding:

- script—including sound effects, music, camera technique
- actors or characters
- sound recording if any
- props, costumes and make-up
- lighting.

Gather required equipment, props etc.

Test to ensure equipment is fully functional and that operators are familiar with correct and safe operation.

Shoot the film/video footage.

Evaluate results concurrently and reshoot when necessary.

Edit to eliminate errors and create the desired effects, eg changes in pace, shot sequence.

Add music or sound effects.

Screen and enjoy.

Reflect on and discuss how the production would differ if made professionally. Include consideration of costs and how the production would need to be funded.

Task

Investigate the diversity of TV programs and techniques. [I]

Activities

Identify the range of television programs presented in a week, including advertisements. Watch samples of each type of program and note similarities/differences in technique. Consider: camera, eg use of framing, angles, shot size; set, eg type of setting places, objects, decor; characters, eg type, age, appearance; editing, eg number and length of each shot, pace and effects on atmosphere; story line or type, eg drama, sport, comedy, music video.

Identify techniques typical of different program formats and use these discoveries to aid video production.

Task

Investigate how sound and lighting can be used to create moods and feelings. [G]

Activities

Observe uses of sound and light in media products. Experiment with simple light positioning, colour and strength to make people look healthy, scary, shocked.

Explore the sound effects made using everyday objects or instruments. Predict the sorts of music that might be used to create specific moods. Trial different pieces of music to test the prediction.

Task

Investigate who makes TV programs. [I]

Activities

Visit a production company or studio. Observe and record the varying roles people take. Use a flow chart to demonstrate relationships between jobs or roles.

Research the costs of production. Compare different program types. Suggest ways that funds may be raised. Test the predictions by seeking information from broadcasters, ad companies. Compare non-commercial and commercial broadcasters. Consider the implications of this for program choice.

Food production, preservation and packaging

Content focus

Information and Communication
Living Things
Products and Services

Outcomes

Knowledge and Understanding

Students will know and understand that:

- information can be represented in a number of different forms, including graphics, sounds and texts
- the activities of people can change the balance of nature
- there are environmental consequences of production and consumption
- systems are designed to provide particular services
- systems are used to deliver and distribute goods.

Students will:

- describe the social, environmental or economic implications of the investigation
- justify the combination of materials and techniques in relation to the properties required for specific end uses
- explain the need for safe, ergonomically sound work environments
- explain that the future must be considered when making choices of particular technologies
- evaluate technological activity in terms of social and environmental cost and benefits
- explain that particular technologies are significant causes of change in the way people live.

Skills

Students will:

- make detailed observations using appropriate technologies
- modify and apply their understanding in the light of their investigation
- develop a design proposal by selecting and refining ideas and justifying choices
- produce a model, prototype, product or procedure to meet a specific design brief
- use appropriate equipment and tools to carry out a particular task, and understand the technology involved to record and present ideas

- use resources with consideration for the environment and adopt procedures which minimise waste
- record the economic, moral, social and environmental consequences of technological advances.

Values and Attitudes

Students will:

- demonstrate confidence in themselves and willingness to make decisions and to take responsible actions
- work cooperatively in groups
- respect different viewpoints and ways of living
- show informed commitment to improving the quality of society and the environment
- gain satisfaction in their efforts to investigate, to design and make and to use technology.

Assessment

Listed below are selected example strategies that may be used in assessing the objectives of this unit of work.

- Observe the packaging students design for distribution of goods over long distances.
- Consider how effective the computer-controlled system designed by the student is.

Links with other Key Learning Areas

English

Designing labels for packaging of products. Investigating the details of label contents.

Mathematics

Investigating properties of 3D objects. Measuring area and volume using formal units.

Human Society and its Environment

Developing understandings about interrelationships between trade and transport systems inside and outside Australia.

Personal Development, Health and Physical Education

Developing understandings about consumer health, eg reading food labels.

Creative and Practical Arts

Craft/design: designing and making packaging for a variety of purposes.

Teacher notes

Food code books are available to indicate, by numerical code, the additives put into commercially-produced foods. These numbers are indicated on the packaging.

Case studies of food production in a variety of communities could include traditional Aboriginal food production, as well as other cultures/places in the world.

Suggested resources

Identifying Food Additives, National Health & Medical Research Council
Survival, Parbury, N

Where Food Comes From, Usborne Explainers

Feeding the City (video)

The Fisherman (video)

Computer Software: desktop publishing software, eg Multiscribe, Microsoft Works

People and places: Department of Health, Australian Institute of Food Science, Australian Nutrition Technology Foundation, UNICEF, Australian Museum, supermarkets

Materials and equipment: packaging from foods, magazines

Teaching strategies

5 *Researching to explore and discover*

7 *Proposing explanations*

8 *Trialling and testing*

13 *Clarifying a design task*

Task

Design and model a computer-controlled system to be used in a food processing operation. [I]

Activities

Select simple processes to be modelled in the classroom, eg weigh an ingredient, add one ingredient, turn on mixer, deliver to another place.

Devise a system to carry out the process automatically. Identify the steps of the process to be modelled.

Consider the elements that the system needs to contain:

- the sensors, eg light, movement, mass. Make selection according to the way it is to be triggered
- the means of processing information, eg write the appropriate computer program
- the reaction. Organise the mechanisms to carry out the selected actions.

Trial the process and evaluate its operation.

Task

Design and make packaging for local produce for long-distance distribution. [G]

Activities

Select item to be marketed.

Identify characteristics that make the product attractive to purchasers, eg effectiveness, appearance. Identify characteristics that make it difficult to transport overseas, eg short life, liquid nature, fragility.

Define the desirable qualities of the package, eg must be durable, attractive, stackable. Preserve the item if necessary.

Design the packaging, considering need to preserve the item, need to protect the item, need to contain the item, appearance, packaging costs, available materials.

Draw ideas for the package.

Make a prototype.

Test the design in terms of criteria set initially. Try devising a way to simulate the travelling conditions in order to test durability, preservation of goods.

Make necessary adjustments to the prototype.

Evaluate in terms of effectiveness, cost, environmental effect.

Reflect on how technological developments have been able to prevent food wastage.

Task

Investigate food production and processing from raw material to domestic use. [I]

Activities

Visit a food processing factory. Record as a flow chart the steps from raw ingredients to distribution.

Observe how the process is controlled. Aspects may include: ingredients weighed or combined; processes applied, eg baking, preserving; products packaged and loaded for delivery. Identify how the machines 'sense', 'decide' and 'act' automatically.

Explore how local conditions and available technologies influence food production. Identify and case study a variety of communities within and outside Australia. Clarify aspects to be researched, eg geography, lifestyles, soil quality, use of fertilizers, tools and machinery, climate, social structures.

Organise information to enable comparison, eg using a database. Compare and contrast conditions and resultant food production. Suggest explanations for differences. Assess environmental effects of different methods.

Task

Investigate how food items are preserved. [I]

Activities

Classify foods as fresh or preserved.

Visit a delicatessen and identify different ways foods have been preserved, eg salted, smoked, chemical additives, refrigerated, packaged. Compare with their fresh state and note changes, eg colour, texture, smell, flavour. Compare the effect of different preserving methods on the same item, eg peas that are frozen, tinned, dried.

Experiment using different methods to preserve foods, eg apples dried, bottled, refrigerated, stewed and frozen. Compare results of preserving various products. Suggest why some methods are more effective with different foods. Research the nature of food preservatives as indicated on packaging.

Task

Investigate where food has been produced. [I]

Activities

Visit markets, supermarkets. Identify origins of food items, eg areas of Australia, other countries.

Explore how food items can be transported from distant places. Compare packaging, whether fresh or preserved, date of manufacture. Compare costs of locally-produced items with similar imported products. Suggest reasons for differences.

Predict how items have been transported to our markets. Research to test the predictions.

Teaching Strategies

Teaching strategies

The Teaching Strategies are designed to support teachers in their implementation of *Science and Technology K-6*. In particular they will help teachers when designing their own units or when adapting the sample units of work which are provided in the syllabus. They include information which will be useful when programming and when planning class activities. These strategies also provide an explanation of particular terms used in the syllabus and support document.

The strategies are organised into five groups. The first group suggests strategies for improving the learning environment. The next three explain how teachers can plan for the development of skills related to Investigating, Designing and Making, and Using Technology. The final group supports the development of skills related to a range of specific technologies.

Group 1: Managing the learning environment

- [TS1] Cooperative learning
- [TS2] Reflecting
- [TS3] Evaluating resources
- [TS4] Students' negotiated learning
- [TS5] Language development (to be added after completion of K-6 English Syllabus)

Group 2: Investigating process

- [TS6] Fostering curiosity
- [TS7] Observing to explore and discover
- [TS8] Researching to explore and discover
- [TS9] Manipulating to explore and discover
- [TS10] Proposing explanations

- [TS11] Predicting outcomes
- [TS12] Clarifying an investigation
- [TS13] Trialling and testing ideas and concepts
- [TS14] Modifying understanding
- [TS15] Explaining understanding
- [TS16] Applying understanding

Group 3: Designing and making process

- [TS17] Exploring needs
- [TS18] Clarifying a design task
- [TS19] Exploring ideas
- [TS20] Representing ideas by modelling
- [TS21] Drawing to develop and record ideas
- [TS22] Selecting solutions
- [TS23] Considering appearance and function
- [TS24] Evaluating design

Group 4: Using technology process

- [TS25] Selecting and using materials
- [TS26] Organising tools, equipment and processes
- [TS27] Understanding materials
- [TS28] Learning safety procedures
- [TS29] Selecting appropriate technologies
- [TS30] Selecting and maintaining tools and equipment
- [TS31] Evaluating chosen technologies

Group 5: Using specific technologies

[TS32] Audio-visual technologies

[TS33] Adventure games

[TS34] Control systems

[TS35] Telecommunications

[TS36] Sound and lighting

[TS37] Animation

[TS38] Publishing

[TS39] Databases

[TS40] Video production

[TS41] Computer graphics

The strategies that follow use the following general format

- **Introduction** section describes key elements in the strategy and details essential issues that should be addressed.
- **Skill Development**, if appropriate to the particular strategy, summarises the levels through which students progress as they acquire relevant skills.
- **Managing Learning Experiences** gives teachers suggestions of activities they may use with their students. These are not exhaustive and can be modified and used as appropriate and directed to the needs and abilities of their particular students.
- **Special Considerations** provides advice on issues that may affect students with particular needs.
- **Useful Resources** provides advice on some resources that may be used when working through the strategy.

Managing the learning environment

Purpose of the management strategies

The strategies in this group are designed to assist teachers in their efforts to provide a supportive, yet challenging science and technology learning environment for their students. They are strategies which are student-centred and involve teaching practices which benefit all students. They are also the types of classroom practices which allow the teacher to be not only a facilitator but also a learner along with his/her students. These strategies can be used either alone, or in combination, to ensure the aims and objectives of this syllabus are realised by students and teachers alike.

Teaching Strategies

- [TS1]** Cooperative learning
- [TS2]** Reflecting
- [TS3]** Evaluating resources
- [TS4]** Students' negotiated learning
- [TS5]** Language development (to be added)

Introduction

Cooperative learning works for young students in pre-school as readily as for a team of scientists working on a complicated investigation. It provides continual opportunities for the development of important leadership and group skills. These skills are essential not only for learning in school but also for success in the workplace and getting on with people at home, since most human interaction requires cooperation.

When working in a cooperative environment students are more positive about school, subject areas and their teachers. Students learn more, achieve more and have more fun in cooperative learning groups. Learning to work together and solve problems in a cooperative way promotes the self esteem of everyone because all the students and their teachers have an important and valued role to play.

In cooperative learning situations the clarifying of problems, together with suggestions for their solution, provide students with opportunities to communicate their ideas. This contributes to the development of thinking skills and greater levels of understanding.

Students have to practise cooperative skills long enough to integrate these skills into their behaviour. But practising cooperative skills is not enough. Students need to discuss, describe and reflect on their use of these skills in order to improve their performance.

Students develop skills that are used when forming groups, such as managing the group's activities to complete the task and to maintain productive working relationships within the group.

Students develop the ability to take on leadership roles. They need to develop skills to enable them to manage the differences of opinion and conflicting points of view which will occur when they are working in a group.

If students' outcomes are judged by comparing one student's performance with another and rewarding the best performance, they are not going to be taught to value shared learning experiences. The only possible way to assess the ability of students to work cooperatively is to record for each student what they have achieved and where they need to go next. This can be done by observing how well students are able to put into practice the skills needed to undertake group work.

Students must be guided into this form of learning. When physically placed in a group, students do not necessarily work cooperatively. They require guidelines and structures for working. Perhaps the most important thing to ensure is that each group member has a definite role to play.

Managing learning experiences

The following recommendations provide teachers with suggestions for improving students' cooperative working ability.

- Ensure that students experience a variety of roles when working in groups, *eg recorder, questioner, organiser, time-keeper.*
- Observe how the student contributes to the group in order to maintain productive working relationships. This could be noted when students are brainstorming, clarifying ideas, organising information, finding solutions etc.
- Observe how students manage the differences of opinion and conflicting points of view. Are the students able to see the problem from another viewpoint, able to negotiate, reach a consensus etc?
- Ensure students develop skills such as: making space for people, staying with the group, using a quiet voice, taking turns, listening to what other people have to say etc.

- Assess the group as one entity instead of individually, so that students realise that success depends on the achievement of the whole group, not individuals, *eg break the task into subtasks, the successful completion of which is necessary to complete the overall task.*
- Establish activities in which the whole class is involved and where everyone has a role to play, *eg class newspapers, plays, whole class discussions.*
- Regularly change the membership of small groups to provide a variety of learning experiences for all students. Grouping can be based on gender, ability, cultural background, and student preferences.
- Groups can compete against each other, but it is important to avoid cliques that can undermine class cohesiveness and morale.
- Pit a small group against some external force, *eg gravity, to see how long they can keep a paper aeroplane suspended using design modifications.*
- Create an imaginary situation where the group has to work together within restraints established by the situation, *eg if you were designing an environment in outer space for people to live in, what things would you need to consider?*

Special considerations

Inclusive cooperative learning is especially important when students in the classroom come from different backgrounds and have a wide range of abilities. The inclusion of exceptional students into regular classes requires a collaborative effort. Cooperative learning also has important implications in the development of mutual respect and better understanding between boys and girls.

Useful resources

Hill, S&T, *The Collaborative Classroom*

Johnson, D et al, *Circles of Learning*

Sharan, S et al, *Small Group Teaching*

Edwards, A et al, *Investigating Classroom Talk*

Introduction

Reflecting is the act of thinking about what has been learnt. It often involves putting learning into a new context, looking at the experiences in a new light, interpreting what has been said or done for different applications or in novel situations.

Therefore reflecting is not only an excellent review of learning, but leads to:

- (a) the valuing of the learnings
- (b) the valuing of the learning process
- (c) encouragement of lateral thinking
- (d) transfer of learnings to alternate settings
- (e) fostering of innovative styles of thinking.

Reflecting is one strategy which allows students to become aware of the relationships between investigating, designing and making.

The encouragement of lateral thinking through reflecting upon the learnings of a unit of work is effective for all age groups and at all stages. Even very young students are capable of reflecting upon their observations and experiences. Initially students are more likely to be able think about situations which are familiar to them but later they should be able to consider the social implications of their learnings.

Managing learning experiences

To encourage reflecting, the teacher should pose a question, allow the students to explore it through introspection, question further and then discuss.

Opinions can be formed through individual introspection and/or group consensus.

The students can then be encouraged to express their conclusions individually either in writing or verbally.

Ask students to:

- reflect upon what they have learnt from an activity
- reflect upon and identify the processes they have employed
- consider how these processes may be applied in another situation
- discuss different approaches to situations by possible options.

Special considerations

Teachers must provide time both during and at the end of any learning experience for students to contemplate the content and processes in which they have engaged. This time needs to allow for individual, small group and whole-class reflection.

Reflecting is one strategy that must not be formally assessed by the teacher. There are no right or wrong answers. Indeed, any judgmental stance is sure to stultify the reflecting process and discourage students from reaching their own conclusions.

Introduction

A resource is anything which could be used to facilitate or enhance the development of skills, knowledge, understandings, values and attitudes. It is something which can contribute to the learning environment and to the interactions between learners and teachers.

A resource may be anything from a tangible object, such as a book, computer software or video recording, to something intangible, such as the viewing of a dramatic performance or the recounting of an anecdote.

Resources need to be selected for their relevance to the needs and learning experiences of each student and their applicability to the curriculum. While teachers frequently evaluate resources, students also need to develop skills in evaluating the resources they use.

While ostensibly increasing students' knowledge, materials can, either overtly or subtly, develop misunderstandings on the basis of sex, race, culture and disability. It is difficult to show that the message from any one book, kit, illustration or person has a negative effect on the attitudes of any one child. Rather it is the impact of all these on all children over a period of time which must be considered.

To remove from resource collections all materials which have elements of bias is unrealistic and unnecessary. Such materials can be used constructively to assist students in detecting and understanding this issue. It is only when such materials are the sole reference and are used uncritically that they serve to perpetuate prejudice and misunderstandings.

Often it is difficult to find materials which meet all criteria. In many instances one criterion may be sacrificed for another. The emphasis should be on providing a balance in the total collection in use.

Students are quite accepting and uncritical of materials presented to them. Social con-

ditioning often reinforces the stereotypical images of certain materials and equipment, placing limitations on student choices.

Managing learning experiences

The following ideas could be used by teachers in their classrooms.

- Supply students with a range of resources from which to choose. Through this experience they will develop the ability to make appropriate choices.
- Ask students to explain why they chose to use a particular resource. It is the appropriateness of choice that is important, *eg to record information a student may choose a video, while another may choose a still camera for the same job.*
- Provide a checklist which assists students to identify the qualities that are desirable in a resource.
- Introduce discussion of images portrayed in resource material, *eg Does the resource present positive images and role model? Which groups of people are seen as being active and/or passive? Which as being dominant/subservient? Which people as being superior/inferior? Which as having stereotyped characteristics and roles?*
- Apply specific criteria, depending on the topic, theme or area and encourage students to give their own answers and interpretations of the resource, *eg Does it present a non-violent point of view? What kind of language and/or images are used? Is the language appropriate and non-disparaging?*
- Place the material into its historical context, the attitudes and values current at the time, *eg What values and attitudes are being rewarded or reinforced? Do they inflate or deflate a self image?*

- Discuss with the class, depending on level of understanding of the students, whether the resource is unbiased, *eg Which groups of people are omitted or ignored? Is the inclusion of groups representative or stereotyped?*
- Identify areas of bias in resources, *eg values presented in newspapers or magazines.*

Special considerations

All members of the school community should understand the need to critically evaluate resources used by students.

Schools should provide opportunities for parents and teachers to discuss the types of

influences which affect students' choices of resources. Students' self concept is influenced by the nature of the material they use and the attitudes and values of others towards that material.

Teachers should ensure that the atmosphere is secure and non-threatening, as the whole area of prejudice and bias can be emotive.

Useful resources

CEU, *Handle with Care*

Tasmanian Media Centre, *Resource Management Guide for Australian Schools*

McIntosh, J, *Taking Stock*

Introduction

Negotiated learning involves the deliberate planning of the learning program with the assistance of students. This can occur from the earliest years of early childhood education.

Negotiating is a very useful device which allows students to work at their own level and pace. It caters for the individual interests of the students as well as helping them to become independent learners. It allows the teacher to individualise learning and provide opportunities for students to take more control over their learning.

In order to become successful independent learners, students need to develop a range of skills, which include planning and setting goals, making responsible choices, managing resources and time effectively and evaluating their learning.

Negotiating the learning process involves the development of the teacher's understanding of the learning process and how to provide conditions in which learning can best occur. This means a shift away from teacher-centred learning situations to one where a teacher becomes the facilitator of learning experiences. Negotiation does not mean that teachers divest themselves of power and responsibility. Teachers are, and always will be, responsible for teaching. However, negotiation does involve teachers using their power and responsibility in ways which will empower students, ie allow students to exercise their own powers and responsibilities.

What distinguishes negotiated learning from other teaching strategies is that it doesn't only call for active learning by the student but gives an emphasis on teaching students to see themselves as learners.

Negotiated learning is an on-going process which is based on the developing relationship between students and teachers. It enables the teacher to help develop students' self-

confidence and self-direction. It can lead to increased motivation which will result in more meaningful and worthwhile learning. Students are more likely to be willing learners if they can establish some sense of ownership over their own learning.

Because of the nature of this style of learning, students can talk among themselves, discuss problems, delegate tasks, make their own decisions and are free to see what other groups are doing. This provides students with the opportunity to share and clarify ideas with a wider audience. Teachers who have used negotiation techniques in classrooms find that the level of student language increases and the number of student-initiated questions increases.

Significant outcomes of negotiated learning include exploration of ideas in greater depth, increased confidence when presenting opinions and greater willingness to question.

Managing learning experiences

Listed below is a range of strategies which students can use to negotiate their learning.

They can:

- make a list of their own favourite 'finding out' activities. This can be a basis for further investigations
- initiate their own play activities with equipment that may be in the classroom, *eg students decide to make a shadow play with an overhead projector after they have seen it used*
- share their interests with others by holding a hobby day
- initiate and design explorations. They could also discuss the procedure for recording results
- determine the method of presentation of models or work which they have created

- make organisational decisions relating to equipment and materials in the classroom setting.

In many situations teachers can:

- encourage students who have particular interests and skills to share them with the whole class. This modelling of behaviour will provide a stimulus for other students and develop the self esteem of the presenter
- use observations made by students in their own time as a focus for further activities
- use something a student brings to school to initiate an investigation or as a stimulus for discussion or other activity
- establish learning centres within the classroom: students set them up, collect materials, establish routines and even plan some of the activities
- hold workshops to address particular skills or processes. Attendance should be negotiated or voluntary and students who attend can be praised for their willingness to participate
- create databases about students' areas of interest
- provide electronic information services or student newspapers for use by students. The information to be communicated can be open to negotiation.

Special considerations

All students have a right to be heard within the learning context. Teachers should avoid judgemental positions which categorise or downgrade students. The teacher has a special responsibility in a negotiated learning situation to ensure that each student receives the opportunity to participate in the process of negotiation.

Negotiated learning focuses on the individual student learning at a rate appropriate to his or her needs. The teacher must be responsive to the varying individual requirements within the class.

Students from diverse language backgrounds need to be provided with opportunities to express their areas of interest. This may involve using their first language to communicate their desires. Classroom support in the form of an interpreter may assist this process.

Investigating process

Teaching Strategies

- [TS6]** Fostering curiosity
- [TS7]** Observing to explore and discover
- [TS8]** Researching to explore and discover
- [TS9]** Manipulating to explore and discover
- [TS10]** Proposing explanations
- [TS11]** Predicting outcomes
- [TS12]** Clarifying an investigation
- [TS13]** Trialling and testing ideas and concepts
- [TS14]** Modifying understanding
- [TS15]** Explaining understanding
- [TS16]** Applying understanding

Introduction

Curiosity involves the students' intrinsic desire to learn or know about something. Investigations can be initiated as a result of a sense of curiosity. As an activity, investigating capitalises on and develops curiosity. It can be fostered in a stimulating and exciting environment and by responding positively when students demonstrate curiosity.

Most students possess curiosity about artefacts, events, phenomena, places and living things. Teachers can use strategies to build on this existing curiosity and further enhance it.

Whatever arouses curiosity will vary among students because of social, cultural, economic or physical backgrounds.

To encourage curiosity, students need to be provided with a variety of resources. These resources could be familiar things from the classroom, playground or objects with which students have had little experience.

Skill development

By the end of Stage 1, students should be able to identify areas of interest and inquiry. They should be able to recognise the purpose of an investigation and seek further information as a result of their own curiosity.

At Stage 2, they should be able to undertake an investigation as a result of something that has aroused their curiosity and also be able to clearly state the issue to be investigated.

By the end of Stage 3, students should be able to initiate investigations independently in order to satisfy their own curiosity.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences to foster curiosity.

- Capitalise on observations made in students' own time, *eg after school, on the weekend, in the holidays*. These observations could include animals seen on farms, in zoos or animal parks or in the wild, things seen at the beach such as pumice rock (porous and consequently floats on water), pieces of algae, skeletons of sea urchins, cocoon shells, astronomical observations such as an eclipse of the moon, 'falling stars', satellites passing across the sky or comets.
- Build on students' own curiosity about the world around them, *eg the variety of animals and plants, both native and introduced, how machines at home and in community work, or curiosity about their own bodies*.
- Develop interests through set activities, *eg a teacher may set up a science morning for the class with a variety of investigations on offer. They could include:*
 - *investigating transpiration with celery and coloured water. Note any changes, especially colour in the leaves*
 - *pendulum investigations — the long and the short*
 - *making a shadow measuring device to find out about the movement of the sun as it appears to move across the sky.*
- Discuss students' own interests, *eg the teacher might like to ask students to list their favourite investigative activities. From this, develop a 'plan' of the interests of the group or class. This will provide a good basis on which to plan future activities.*
- Develop new and related interests, *eg map students' interests and develop strategies related to these, to excite students' interest in other areas. This includes negotiated learning.*
- Build on incidental learning, *eg 'Why is the puddle smaller now?'*

- Encourage as learning models students who have particular interests and are willing to demonstrate them.
- Encourage students to tinker with equipment, *eg camera, magnifying glass, bug catcher, magnets, Meccano, construction blocks, straws*, and explore what can be done with the equipment. Give praise for any construction activity while encouraging further imaginative work.
- Encourage students to explore materials, *eg wood, leather, paper, rock, woollen cloth, Lego, pipe cleaners, paddle pop sticks, paper, cardboard*. When students discuss the properties of materials, this can lead them in different directions. Ask students if there is something they want to investigate that isn't available to them. Attempt to obtain these materials.
- Ask students to express their observations through drawings, talking, role play etc, by using leading questions, *eg if the unit is on small animals, ask 'What small animals have you seen in your yard?' or 'What did they look like?'*
- Use television or radio programs—documentaries, children's shows, serials, movies, soaps etc—as a stimulus, *eg if you know there was a specific program on the night before ask who saw the program and what they found interesting or exciting, or if there was something they didn't understand or want to know more about.*
- Use an excursion to stimulate curiosity. Have specific questions for the students when they go on excursions so that their observation has a direction to follow but allow them to have an interest in other aspects as well. Use this curiosity where possible to relate it to a planned investigation.
- Use items that students bring to school to initiate an investigation, *eg a small animal, items the student has found such as a rock, a strange plant or part of a plant, a toy.*

Special considerations

Special Needs

Ensure that someone describes visual changes to students with visual disabilities.

Students with special needs may require specialised or modified equipment when tinkering. Some students with gross or fine motor coordination disabilities may need extra assistance or specialised equipment, for observation or manipulation. This may influence the range of activities.

Aboriginal students, if they have not attended pre-school, may lack experience. They may also have deficits in standard English.

ESL/NESB

Students with English language and experiential deficits may need more structure — questioning and prompting.

Useful resources

Anderson et al, *Investigate* (series)

Balding, J, *Springboards*

Stacey, D, *Nifty and Thrifty Science Activities*

Fredericks, A, *Think About It – Science Problems of the Day*

Simple Science (series), Hodder and Stoughton

Observing to explore and discover

[TS7]

Introduction

An observation is data acquired through the senses. Through observation, students are able to obtain direct information related to their environment. Accurate observation requires checking each observation against others. It does not involve an interpretation of what is observed. For example, students are investigating the distances they are able to push a toy vehicle. They could observe and measure the actual distances that the vehicle moved. Interpretation of the information could be that one student is the strongest because that vehicle travelled the greatest distance and this would not be included as an observation.

Students should appreciate that the term 'observing' is not restricted merely to the operation of seeing. It refers equally to using any of the five senses: sight, taste, smell, hearing and touch. When making observations, students should be encouraged to use all relevant senses to discover information. Experiences should include observations of a quantitative nature concerning, for instance, number, size and mass. Students should also include observation of changes occurring over time. Competence should be developed in the use of devices to assist observation such as rulers, lenses and scales, since this permits a refinement of observation. To obtain accurate data students should record more than one set of observations, eg in an activity where the students are measuring the distance they are able to push the toy vehicle each distance should be measured and recorded twice. The importance of accuracy of record keeping is particularly relevant.

Skill development

At Stage 1, students need to develop skills in identifying. This should involve observing using one or several senses to readily identify

similarities and differences (eg touching, smelling, seeing different types of plants). They should be able to make progressively more detailed records as observing skills are refined.

By Stage 3, as students mature, they should be able to use diagrams and interpret data. They should be able to identify trends as they emerge in the data. They should also begin to use a wide range of increasingly complex tools and equipment to assist with observations.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop skills in observing when planning and managing learning experiences.

- Play games to identify objects by touch, taste, smell, sight, sound.
- Isolate one sense and use the other senses to identify objects, *eg blindfolding, blocking nose.*
- Compare how the senses influence each other, *eg while blindfolded, listen to someone whispering, smell and taste an onion while the nose is blocked.*
- Explore sense thresholds, *eg getting closer to a warm object.*
- Use devices to aid observation, *eg binoculars, magnifying glass.*
- Discover changes in objects or events, *eg by sketching and labelling, explore how plants grow from seeds, describe observations using all the senses.*
- Make qualitative observations and record them in verbal or written form, *eg record on tape a description of the behaviour of a specific animal.*
- Make tables which classify objects on the basis of the senses, *eg sweet smells, loud noises etc.*

- Record observations that can be quantitatively measured and compared, *eg how high students in the class can jump.*
- Record observations in graphic and/or numerical form.
- Make a graph which demonstrates a phenomenon over a period of time, *eg record the noon temperature over a month.*
- Use various tools to measure observations, *eg stopwatch, tape measure, thermometer.*

Special considerations

Research shows that Aboriginal students tend to have well developed and high-order spatial and observation skills. These skills could be catered for and utilised in these teaching strategies.

Useful resources

Skills Guide for Teachers, Addison-Wesley
 Chapman, P et al, *Introduction to Science*
 Gould League, *The Urban Book*
 Gould League, *Urban Survival*
 Hope, C, *Seasons Themes Through the Year*
 Stokes, D, *Monsters and More Mini beasts II*
 Ward, D, *Streets*
What is the Difference (series), Hodder & Stoughton
The Know How Book of (series), Usborne
The Young Scientist Investigates (series), Oxford

Researching to explore and discover

[TS8]

Introduction

When researching, students are concerned with finding information that is relevant, understandable and useful. Students need to recognise that information can come from a variety of sources, including other people, places, equipment and machines.

The amount of technological and scientific information is increasing at a rapid rate with the result that students cannot 'learn' all the information available to them. Students need to develop skills in accessing and using information as an important aspect of investigating.

People within the community can play an important part in supporting students' understanding by providing information. Libraries can be a source of information in a wide variety of forms: audio cassettes, computer software, pictures and video tapes.

Skill development

When students arrive at school the range of knowledge about the gaining of information is wide and varied. All students, however, will have drawn on the information in their environment in some way and have begun to develop skills in using that information. The school builds on the students' present abilities and aims to further develop those skills.

The school has the responsibility to determine the needs of students and teachers in providing access to resources.

The school also has the responsibility to provide adequate procedures for teachers and students to approach people and other resources in the community.

At Stage 1, students should gather information, eg survey, interview, listen and recall.

At Stage 2, students should research familiar environments in a number of ways, eg books,

databases or people. They should also select and devise ways of gathering information.

By Stage 3, students should be involved in researching and deciding about issues which arise at school. They should become competent in the gaining of information from a variety of sources and be able to experiment with new techniques and skills as technologies change.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop research skills when planning and managing learning experiences.

- Evaluate resources on the basis of suitability, information offered, credibility and relevance to students' needs, and select the most appropriate of these sources accordingly. Resources made available to students must be non-sexist in language and should not contain stereotyped roles. It should be appropriate to the development of the students, be accessible to the students, have instructions that can be understood and describe clearly activities that can be done.
- Provide opportunities to access a variety of resources. There is a need to ensure that all such resources are suited to the particular developmental level of the students, *eg books, pictures or magazines in the classroom, school library, community library or the home; data on disks; information available through keylink; other students or teachers; guest speakers; radio or television; other resources in the classroom or playground.*
- Define exactly what it is the student needs to find out, and whether it is applicable to the exercise or purpose of the activity.

- Make decisions about selection from information obtained. Students should decide whether information is closer to fact or opinion and assess the credibility of sources which express opinion. Teachers should encourage the critical discussion of information encountered in terms of credibility, bias and other characteristics, *eg if information has come from a particular company the instructions may be biased towards using apparatus that is made by that company.*
- Make decisions about the relevance of information students obtain to the original task, *eg when students gather information on how cities are planned they may gather a whole range of information on things such as the site for a city, the type of rock it should be built on, the maximum population suitable for its facilities, the maximum height for buildings and where green areas should be located. The students may then decide that setting a maximum size for the population and specifying the type of rock may not be appropriate to the task.*
- Organise and present the information that students obtain through a variety of methods, *eg posters, reports, tapes, video tapes.* Students need to consider the nature of the audience for the presentation and the type of information being gathered. They would need to select a form of technology appropriate to the audience and the content of the material, *eg when visiting a science and technology museum to gather information about machines, students would need to take notes and draw diagrams. They could give an oral and visual presentation to other class members.*
- Assess the information students obtain and set goals for further development, *eg students who were researching how people in various cultures or places use their leisure time would need to assess if they have included different groups of people such as children, families and young adults. They may then decide to examine leisure activities within one particular sub-culture by comparing the amount of time each group has for leisure.*

Manipulating to explore and discover

[TS9]

Introduction

Manipulation involves purposeful handling of materials and objects to explore and discover various phenomena. Through manipulation students can better develop important skills such as observing and classifying and gain a better understanding of their environment.

Manipulation can involve playing or tinkering with equipment. The teacher can set up guided play activities, catering for the needs and interests of both boys and girls, and can guide the explorations and discoveries required from students. Outcomes may be planned or unplanned.

Students may be organised into investigations that may be less directed, or involve more negotiation or group work. Where investigations are less formally structured, students are able to negotiate the direction of their learning.

Students should be encouraged to use all their senses to observe what occurs as a result of their manipulation. Students should be encouraged to discuss explanations offered by others.

Skill development

When students begin school they will have already explored many objects and environments. It must be remembered that their experiences will be extremely varied and some students will have had limited opportunities for manipulatory play.

In general, many boys will have had greater access to, and experience with, equipment which can be assembled and pulled apart. Opportunities for 'catch up' experience should be provided whenever the need arises.

In the first few years of formal education, the school builds on these experiences by exposing students to a wide and varied range of materials and tools. Teachers should develop the skill of

manipulating by providing opportunities for the students to share experiences.

By continuing to manipulate materials and objects students should develop further understandings of properties, capabilities and characteristics of a wide range of natural and made materials.

By Stage 3, students should be able to manipulate a wide range of objects, materials and processes, including making models and using equipment such as cameras, tape recorders, thermometers, electrical equipment and kitchen utensils.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop skills in manipulation when planning and managing learning experiences.

- Students need to play and work together and at the same time be given equal access to equipment. This equipment needs to cater for the needs and experiences of all students in developing their abilities. Special consideration will need to be given to the grouping of students and choice of objects or equipment for students with physical disabilities.
- Manipulate material to make a model or model system, *eg make a model aeroplane, manipulate water and sand to simulate erosion.*
- Pool discoveries with the class using a variety of media for expression. Ensure that all students are able to contribute, using both qualitative and quantitative descriptions.
- Manipulate to explore the function or condition of an object that might have changed, *eg placing the two north ends of magnets together or moving an ice cube from the shade to a sunny position.*

- Handle living things with care to find more about their characteristics, *eg care for animals in the classroom to observe their behaviour, needs and characteristics.*
- Use tools to investigate a range of articles, how they are assembled and how they work, *eg use tools to disassemble an unwanted clock.*
- Use specific materials to explore specific technologies, *eg dressmaking, knitting, miniature furniture making, leatherwork.*
- Discover the scientific principles behind toys by playing with them, taking them apart and putting them back together again and make discoveries which are incidental or intended.
- Explore ways of repairing toys or equipment.
- Use measuring instruments and devices that are extensions of the senses, *eg balances, stop watch, measuring jugs, hand lenses.*

Special considerations

Research shows that Aboriginal students have well-developed high-order spatial and observational skills. In managing learning experiences in manipulating to explore and discover these skills could be catered for and utilised.

Useful resources

Dalton, J, *Adventures in Thinking*

Vickery et al, *The Process Way to Science*

Investigating (series), Harcourt Brace Jovanovich

Make and Discover (series), Collins

Dunn, S, *Design Technology, Children's Engineering*

Introduction

Proposing an explanation, or inferring, involves providing a tentative explanation for an observation. Students constantly propose such explanations as they strive to make sense of their environment. This should be actively encouraged by the teacher. Students attempt to fit explanations of observations related to their environment into a framework of prior experiences. The environments and past experiences that students have are often varied and must be taken into consideration when providing educational experiences for students.

Proposing explanations will involve making one or more observations during an investigation. Students should draw one or more inferences from an observation or set of observations. It is essential that the student is able to distinguish between an observation and an inference.

Students should engage in formal and informal activities which will develop their understanding of cause and effect relationships.

Testing of the proposed explanation may: (a) support this explanation, (b) prove it to be false or (c) indicate that a revision of the original statement is warranted.

Skill development

Initially students should be provided with activities where they may form explanations using only one factor (variable). This is based upon only simple observation and one inference. To form explanations, data must be interpreted.

By the end of Stage 3, it should be possible for them to distinguish between results which support and do not support a particular explanation, and to formulate an explanation of these results. At this stage, too, students should be able to use more complex methods of observation and identify the variable.

Managing learning experiences

Listed below is a range of strategies to involve students in proposing explanations which teachers can use when planning and managing learning experiences.

- Form explanations based on observations, *eg students propose an explanation for the cause of an inland midden (a pile of material, usually sea shells, produced by people).*
- Model an event to illustrate the cause and effect process, *eg a student could use the effect of heat from the sun on an ice cube to simulate molten rock causing a lava flow, or explain why a building falls when a base block is removed.*
- Discuss the adequacy of test results, *eg whether the test provided clear results, whether the results of an investigation support an explanation, whether the results prompt other questions, and whether new explanations are needed.*
- Discuss reasons for changing a design in a specific way, *eg students improve the design of a shopping trolley by discussing and testing effective designs and subsequent redesigning of the trolley.*

Special considerations

ESL/NESB

Provide ESL students with suitable language experiences to assist them in making explanations, *eg through group work, using matrices, vocabulary activities or problem solving strategies.*

Aboriginal students may also need language experiences.

Useful resources

National Parks and Wildlife (kit)

Harlen, W, Primary Science – Taking the Plunge

Introduction

When students predict, they attempt to forecast outcomes based on selected information. Predictions are the foundation for forming hypotheses. An hypothesis is a general statement that attempts to provide an explanation based on previous experience.

Predicting can be viewed as a way of applying information which has been gathered and organised. Predictions can be made even if they are not correct, but they must be accompanied by information which supports the prediction. Once predictions have been made they can be tested for their validity.

Practice should be given in forecasting consequences, with students recognising cause as well as effect. Students should develop skills in designing objective procedures and a language competency which will allow them to justify their predictions clearly.

Skill development

At Stage 1, students should be encouraged to interpret information and make predictions based on their own observations. They will be able to justify these by using appropriate arguments. Predictions should be based on direct relationships, eg 'If this... then...'

By Stage 2, they should be able to make a prediction using the data collected by other students.

At Stage 3, students should be able to identify and use specific data which will support a particular prediction. These students will be able to place greater emphasis on accuracy. At this stage students should be introduced to the word hypothesis. Students should be provided with opportunities to develop skills in formulating hypotheses.

Managing learning experiences

Listed below is a range of strategies for predicting outcomes which teachers can use in planning and managing learning experiences.

- Gather information using one or more of the five senses, and organise the information to determine similarities, differences or patterns in order to make a prediction, *eg record observations over a period of time comparing 'dry' and 'wet' potted plants in order to predict the water requirements of plants.*
- Recognise patterns in phenomena in order to make a prediction, *eg explore the playground for examples of plants which reach toward the sun.*
- Record findings in an appropriate medium so that a prediction can be made, *eg pictographs of foods eaten for lunch to predict the most popular lunch bought from the school canteen.*
- Analyse observations and discuss whether a complete prediction can be made or whether more data need to be investigated.
- Share predictions with small groups or the class. Predictions can be made even if they are not correct, but they must be accompanied by observations made which support the prediction. All predictions must be tested and results used to substantiate or disprove the prediction, *eg predict whether plants to be grown in a red pot grow better; predict whether a plastic or metal spoon will heat up first when placed in hot water, predict whether wet or dry sand will build the sturdiest castle.*
- Control variables and forecast their effect upon investigations. A control must be set up when a factor is being tested, *eg put one plant in a cupboard and one in sunlight to*

test a prediction that the sun has an effect on plant growth.

- Design tests which challenge predictions associated with selected variables, *eg teacher gives a reference pitch while students investigate by blowing glass bottles with different levels of water to match that pitch.*
- Design tests in order to disprove predictions, *eg devise a way to compare the view of a tree from a low angle with a drawing which has been made to predict how it might appear.*
- Make an alternative prediction when testing disproves a previous prediction.
- Work with students to develop the idea that predictions are 'educated guesses' based on observations, ideas and their previous experiences. Provide opportunities/experiences for the students to make predictions from their observations or past experiences with similar situations, *eg large ice blocks take longer to melt than others because they are the biggest.*
- Use specific predictions made from their observation to form a general statement (hypothesis), *eg large ice blocks take longer to melt than small ones.*
- Suggest the different facilities that could be available in the future, *eg make drawings or models of different forms of transport (On the Move 3).*
- Use survey results to discuss how lifestyles may be affected by a particular building design, *eg how a building may be better insulated (Hot or Cold).*

Special considerations

Special Needs

Predicting outcomes is difficult for students with learning difficulties. Many concrete examples are required in practising these skills. To predict may be an unrealistic outcome for some students and the students' needs should be evaluated accordingly before practising skills in specific areas.

In predicting outcomes Aboriginal students may need to use their own language, Aboriginal English. Aboriginal students may perform better using diagrams.

ESL/NESB

Allow the students to record their predictions in their own language.

Show students how to record their predictions using diagrams, to cater for students who do not have the language to express their ideas.

Use the students to translate predictions to the class so that NESB students feel included in the class discussions.

Useful resources

Markle, S, *Science Sampler*

Introduction

It is only through regular and frequent opportunities to investigate that students will be able to clarify investigations.

Providing students with non-threatening activities using materials and objects with which they are familiar encourages them to experiment. These investigations can verge on active play. Investigation arises naturally out of curiosity, so it must be encouraged.

Students should be encouraged to state what they intend to do and suggest reasons for their proposed course of action. Teachers need to offer guidance at this stage and help students develop the ability to determine what action may cause a particular result and the procedures that will achieve this result.

Students should develop the ability to see that an investigation is a series of orderly steps undertaken to acquire knowledge.

Students need to be able to analyse the steps in an investigation and decide how they are going to contribute to the intent of the investigation.

Skill development

By Stage 2, students should be able to clarify a problem by asking questions of others.

At Stage 3, students should be able to discuss factors that might influence an investigation and be able to recognise the limitations that may be placed on the investigation process. They should also be able to discuss issues, phenomena or events that have led other people to investigate.

Managing learning experiences

Teachers can develop student skills in clarifying an investigation when planning and

managing Science and Technology learning experiences by the following.

- Discuss and make decisions concerning what, why and how about the investigation.
- Identify any steps that need to be taken in order that an investigation can take place. Isolate particular steps, identify why they are important and consequently how they will be approached.
- Devise a plan for carrying out the investigation. This might include forming questions to be answered, where or how the answers will be found or how the particular findings may be presented.
- Define terms by drawing answers from students, *eg concerning transport: 'How do you travel to and from school?' 'How is using a car or a bus different from walking?'* Use pictures or other prompts to assist responses.
- Practise identification of all the variables associated with a particular activity.
- Further clarify the task before, during and after an investigation to eliminate extraneous variables.
- Allow the use of a variety of materials in all activities. It may involve the exploration of media, *eg a student constructing a bridge from paper may not know of the strengthening effects of rolled paper. This exploration may improve the quality of the result. Students could substitute cardboard for paper.*
- Record activities in a variety of ways so that students can make sense of their results, *eg make a video, keeping a diary on a daily basis of the activities carried out for one or two weeks.* It allows the student to keep on task by continually clarifying their task. This can also be useful to students who can compare their activities with those of others.

- Record activities in a variety of ways, *eg photographs, comic strips*, so that the investigation or design and make activity becomes clearer in the mind of the students. By recording, students can see the direction and will discover if a clear trend is emerging, *eg make a checklist of characteristics of living and non-living things. Look for any overlap. Does this seem feasible?* By testing it will be seen that certain characteristics belong only to living things while others belong to non-living things.
- Reflect on the initial clarification by ascertaining whether the results of an investigation answer a problem or support an explanation.
- Apply a newly-discovered understanding to other uses.

Special considerations

Aboriginal Students

Aboriginal students learn well through demonstration and imitation and these processes are important for this strategy. However these processes should be balanced with others. Aboriginal students may have deficits in standard English.

Girls

Use a range of students to demonstrate to the class.

Special Needs

The use of specialised equipment might be necessary for students with physical disabilities.

Pictorial/diagrammatic recording could be incorporated for visually impaired students. Consider a cassette recorder.

ESL/NESB

Students with language deficits will need a much more structured approach with liberal use of prompts and cues.

Group work for these students may be more appropriate than individual work. Careful consideration of the group composition would be necessary to provide unobtrusive peer support.

Useful resources

Barman et al, *Science Skills Guide for Teachers*

Ainley, D, *Science Problems to Investigate*

Mills, G, *Scientific Problems Solving – An Introduction to Technology*

Carin, A et al, *Teaching Science Through Discovery*

Trialling and testing ideas and concepts

[TS13]

Introduction

Testing involves devising, designing and carrying out activities to determine whether a proposed explanation can be supported or a prediction verified. Testing can be carried out in a variety of ways, including experimentation, researching an idea or conducting interviews.

For students to be able to design their own tests, they should be encouraged to be systematic without losing the curiosity, imagination and creativity embodied in the day-to-day testing of ideas.

In teaching students how to select appropriate methods of devising tests, teachers should encourage students to try different test designs.

Experiments try to establish cause and effect relationships by manipulating variables to determine their influence on the outcome of the experiment.

Providing students with familiar materials and objects encourages them to experiment with confidence in a non-threatening environment.

Students should be encouraged to state what they intend to do and give reasons for their suggested course of action. By stating their intended course of action they will in fact predict an outcome. Once a problem or task has been stated, the students should begin to predict possible results of their experimental activity.

Students should be able to identify all the factors in their experiment. They need to realise that all factors, except the one they are testing, should be held constant. They need to set up two situations for comparison, one with the variable, one without (this is the control), *eg the problem might be to find out if water evaporates faster if there is a wind. The constant factors may be two glasses containing the same amount of water (one experiment, one control). This involves placing*

one in the wind and one out of the wind. To discover the result the amount of water left in each glass would be measured after a similar period of time.

Skill development

By Stage 2, students should engage in informal activities which develop their understandings of cause and effect relationships in developing their own 'experiments'. They should predict outcomes by proposing explanations and test to see if their predicted outcomes eventuate. As students develop skills in predicting and testing they are encouraged to design more formal experiments which will facilitate the manipulation of a variable. Students should become competent at using instruments which record information precisely. Analysis of data associated with experiments should be expressed both orally and in writing. With guidance, students should devise activities which seek to verify previous results. Some may use the predictions of others for these activities.

At the end of Stage 3, students should be able to question their own explanations, formulate hypotheses and devise ways of testing, depending on whether the explanation is supported, or the test was inconclusive. Finally students should become competent in designing their own experiments and trials where they control variables to clarify the best possible scientific outcome. In doing this, students are setting their own agenda; using language they need to explain their work, building into their work an open-endedness that could be developed as far as time/teaching/learning constraints allow.

Managing learning experiences

Listed below is a range of strategies for trialling and testing ideas and concepts which teachers

can use to develop these skills when planning and managing learning experiences.

- Observe the relationship between cause and effect, *eg students devise a test to discover the outcome of placing an iceblock on hot cement as against cold cement.*
- Predict expected outcomes of a particular investigation, *eg removal of any block from a tower.*
- Select or devise an appropriate method to test an expected outcome, *eg plants die if we don't water them.*
- Conduct the investigation using the chosen test and record results, *eg try picking up different materials with a magnet to find out what is common to materials attracted by magnets.*
- Manipulate a variable in an experimental situation, *eg use materials with different properties when investigating insulating ability.*
- Evaluate the effectiveness of the chosen test, *eg did the investigation support or disprove the original explanation?*
- Test a prediction by designing and making, *eg students design and make a container to cover seeds so that they can be tested in total darkness.*
- Trial a design, device or idea.
- Before, during and after an investigation, discuss in groups, testing alternatives.

Special considerations

Aboriginal Students

Aboriginal students may need to be encouraged to trial and test ideas because they may not be interested in this strategy to explain things which are fixed in their culture.

If students are doing this the teacher must start with the students' interests.

Aboriginal students may know their environment and therefore may not need to test or trial.

Be careful not to stereotype individuals or groups when testing socio-cultural backgrounds or concepts.

Testing/experimentation is a feature of Western science. Many cultures do not use this.

If testing is based on socio-cultural factors, *eg eye colour*, be sensitive to Aboriginal people.

ESL/NESB

Allow for group work and translators.

Labels need to be made for language development.

Allow for individual testing of different investigations as the student must see the need to test predictions in order for them to be meaningful.

Useful resources

Ward, A, *1000 Ideas for Primary Science*

Carin, A, *Teaching Science Through Discovery*

Introduction

Modifying understandings concerns the ability to change one's preconceived ideas to accommodate the new understandings arrived at through trialling and testing. Students need to appreciate the value of testing preconceived notions to arrive at a change in outcome. In doing this, students are being encouraged to assess their ideas critically and then substantiate them using arguments developed from their testing. This process will encourage the development of trialling and testing to explore other variables. This in turn will lead to new testing to substantiate the outcomes.

Initially the teacher will spend much time guiding the student towards improving those particular skills to promote clearer understanding, at times directing the student in the kind of thing to look for.

Students tend to be more able to modify understandings when the classroom is supportive and open to the discussion of ideas. Once a student is able to verbalise an understanding it can be more easily recognised and therefore questioned. Students need the opportunity to trial ideas before they are finalised or made public. In a positive and encouraging environment students can take risks and move from subjective evaluation to demonstrating confidence in testing their understandings. The encouragement of this skill development has a compounding effect as students become better 'functional learners'.

Skill development

At Stage 1, students should be able to accept that the result of a test may be different from what was originally expected. As skills in verbalising develop, students should be encouraged to question their own understandings as well as those of others.

At Stage 2, they should be able to suggest appropriate ways to test an explanation for some event.

By Stage 3, students should be able to compare the outcomes of tests with predicted outcomes and so be able to modify their understandings.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop skills to modify understandings when planning and managing learning experiences.

- Verbalise predictions about certain phenomena, *eg students say they think that earthworms are random in their responses to environmental change or that there will be no difference in pendulum arcs between two tyres on different lengths of rope.*
- Compare the outcomes of the test with the predicted outcome so that understandings can be modified, *eg in studying pendulum arcs, the students may discover that the rope length actually affects the time of the swing.*
- Choose an appropriate test for the explanation that has been proposed, *eg in seeking to explain the behaviour of earthworms, the test may involve the observation over a day of worms placed on wet and dry surfaces.*
- Propose an explanation by clarifying the variable(s), *eg the only difference in our investigation of the growth of two plants is the colour of the containers we used.*

Introduction

Explaining understandings is the interpretation of observations to establish relationships and patterns between them. Because of their natural curiosity, students appreciate understanding and knowing how things work, or what has happened. In explaining understandings, students are involved in talking about, drawing or writing about an observation, an activity or an outcome. Students can report what they have discovered by using various media. This can take several forms: written reports, talks, demonstrations, drawings, working models etc.

In developing understandings through investigations, students can be actively challenged because they are highly motivated to explain the results or understandings to others and to demonstrate their new-found discoveries.

Within the framework of explaining understandings, appreciation by others must always be encouraged. An emphasis on the part of the investigator to explain the understandings in an acceptable manner should also be encouraged. While explaining, students should also identify the processes that helped them arrive at their understandings.

Skill development

At Stage 1, students should explore informal situations and could also explain their understandings to others. They should then be engaged in a directed activity where they have the opportunity to explain their understandings.

By Stage 2, students should be able to design an investigation to verify understandings and will then subsequently contrast these understandings with past experiences.

Students should examine proposed explanations and data accurately so that they will be able to explain new understandings.

At the end of Stage 3, they should then be able to verbalise, demonstrate, illustrate, report etc the understandings acquired through investigation and apply these by predicting the proposed explanations of a similar investigation.

Managing learning experiences

Listed below is a range of strategies involving explaining understanding which teachers can use when planning and managing learning experiences.

- Explain understandings in an informal setting, *eg free access to a variety of play equipment. Through group negotiation students determine the use of the equipment, then explain how they arrived at those decisions.*
- Explain understandings in a formal setting, *eg groups of students may be asked to explain what happens in a presentation to their peers.*
- Explain understandings, *eg ask students to explain to the class a new discovery they have just made.*
- Explain by comparing and contrasting new and previous understandings.
- Engage in group discussion within the class.
- Challenge students' findings and encourage them to argue their explanations logically.
- Investigate based on certain explained understandings, *eg icebergs float in the ocean just as ice cubes float in a glass of water.*
- Challenge understandings through investigations, *eg students find that by rubbing sandstone, one can get sand, but*

when presented with a piece of granite etc, wonder why it can't be rubbed to get soil.

- Predict, using understandings, other investigations or situations, *eg students could predict the resulting landform from the weathering of a rock outcrop. Possible changes could be holes formed in sandstone by wind carrying sand particles, or holes formed in watercourses by pebbles being swirled around in rock. Another result could be the effects of soil being deposited on the bed of an inner curve of a slowly-flowing river.*

- Create a reference group, *eg consult experts from the local community such as parents, business people, scientists etc.*
- Prepare presentations in the form of models, videos or talks for a variety of audiences, *eg to parents or community members to explain discoveries or other understandings.*
- Publish findings, perhaps writing for a 'discovery' column in the school newspaper, or writing to a local newspaper.

Introduction

In applying the understandings that have been discovered, students will develop appropriate problem solving strategies and work on using these to solve increasingly more sophisticated problems.

It is vital that all students are encouraged to apply their understandings, because by doing so, they are being engaged in thinking and developing strategies, ideas and empathising within a total life and social plan.

Teachers are in the business of developing 'functional learners'— students who are encouraged to develop ideas, investigate and take risks. Students will have the confidence to apply their understandings so that they are actively thinking through problems by themselves or with the help of a teacher or their peers.

In engaging students in using understandings generated through investigations they can be encouraged to apply these to other situations so that there is lateral thinking, open-endedness and incidental learning.

Skill development

At Stage 1, students should be able to relate their knowledge and understandings to particular domestic, environmental or industrial situations and as time passes should be able to interpret their observations accurately and use these to better understand their world.

By Stage 3 they should be able to identify and give accurate explanations for some natural phenomena that have been given by people living in other times or in other places of the world.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop skills in applying understandings when planning and managing learning experiences.

- Apply students' understandings by encouraging investigations which develop lateral thinking, open-endedness and incidental learnings. Interaction, questioning and reflection are essential elements of this learning situation.
- Seek and understand how alternative explanations to natural phenomena have been applied by other people living in other places and/or other times, *eg Dreamtime explanations of Aboriginal people*.
- Manipulate investigations so that understandings will be developed which can then be applied to solve problems and make products.

Special considerations

Aboriginal Students

For Aboriginal students with a language deficit or disability in standard English there may be a need to make more use of concrete examples and directions.

ESL/NESB

This strategy may be difficult for students with a language deficit so there is a need to use concrete examples and directions.

Designing and making skills

Teaching Strategies

- [TS17]** Exploring needs
- [TS18]** Clarifying a design task
- [TS19]** Exploring ideas
- [TS20]** Representing ideas by modelling
- [TS21]** Drawing to develop and record ideas
- [TS22]** Selecting solutions
- [TS23]** Considering appearance and function
- [TS24]** Evaluating design

Introduction

Exploring and identifying needs and wants precedes designing and making activities.

It involves the examination of social or environmental issues and an exploration of needs in the students' living environment as well as within other cultures and times. The exploration of needs should relate directly to the student so that relevance will aid understanding.

When considering needs, students should be aware that conflicting needs may exist. Personal needs might contradict community needs. Students must practise establishing priorities in order to identify the benefits and disadvantages to various interest groups.

The needs of people from a diverse range of cultures and from other times should also be considered in addition to the needs of individuals within the immediate environment. A comparison of the needs of groups within cultures should also be included.

The opportunity should also be provided for students to explore and discuss needs and 'wants' and the relationship that exists between them.

Students, will then develop skills to explore and identify the needs of people and other living things.

Skill development

By Stage 2, students should be able to employ a variety of methods of research and investigation to identify the needs of other people and living things.

At the end of Stage 3, students should be able to use questions and research the results of their investigations to identify needs and to suggest how new technologies can meet their needs in improved ways.

Managing learning experiences

Listed below is a range of strategies which teachers can use in exploring needs when planning and managing learning experiences.

- Interview people, *eg family, peers, people with special needs, to find out their needs. The needs of food, transport/mobility could be considered.*
- Observe the needs of living things in a particular environment, *eg plants in the classroom.*
- Select a need and expand on it, *eg the need for food in a variety of situations, the needs of a baby compared with the needs of an adult and the needs of a very elderly person, the needs of people on a special diet such as a diabetic or an athlete on a high carbohydrate diet before an event.*
- Identify present technology and suggest improvements to better satisfy needs, *eg look at past/present/future ideas. In transport consider the technologies involved in the buggy pulled by a horse, the bicycle, the motor car, the Very Fast Train, aeroplanes, spaceships. Investigate technological developments for the wheelchair, eg manually operated by someone else, manually operated by the person in the wheelchair, electronically operated, wheelchairs that can go up and down stairs.*
- Investigate a product that has been reported to have problems and try to improve the design, *eg a pencil sharpener that continues to break the lead when it sharpens.*
- Research the needs of people from a variety of cultures, *eg look at the needs of people in a hot climate (cool clothing, air conditioning, cool leisure activities) compared with those in a cold climate (warm clothing, central heating, hot and more fatty meals, indoor sport).*

- Research how people's needs have changed over time with changing technologies, eg entertainment one hundred years ago could have been singing around the piano or going to a dance. With the invention of the radio and movies, entertainment would have included listening to radio plays and/or music on the radio and going to the movies occasionally. When television was introduced to Australia, this largely took over from listening to the radio as family entertainment and the movies became less

popular. Recent changes in entertainment include VCRs to give people more choice of TV programs and compact discs(CDs) to improve the quality of music and the longevity of discs.

- Identify, verbalise and list needs associated with a particular group, eg what are the requirements for a school bag for preschool/secondary students?
- Analyse the needs of a target group, eg what are the needs of a rheumatic person?

Introduction

It is important for the student to have a clear statement of the problem or task he or she has to solve or address. This statement is called a design brief or task.

It is equally important that students are given sufficient opportunity to develop an understanding of the nature of the task or brief. In clarifying the task students will:

- establish the objectives that are to be satisfied or the needs that are to be addressed, *eg transmit a message from one classroom to other classrooms; lift a load from the floor to the tabletop*
- identify the restrictions or limitations that might be applied to the design process, *eg the design must: use only electricity stored in a battery; use equipment available from the resource room; be completed in three weeks; cost less than five dollars*
- state the criteria to be used when assessing the design, *eg the vehicle will carry the load from one side of the room to the other; the advertisement should attract a further 10% of customers.*

Skill development

At Stage 1, students should be encouraged to state clearly what they are designing, *eg 'I am making a bridge out of straws'.*

By Stage 2, students should be able to identify some limitations which may exist in carrying out a design task, *eg 'I cannot use a drill because I haven't learnt how to use it yet'.*

At Stage 3, students should be able to further clarify their design tasks by questioning or other research methods. They should also be able to identify cultural, social or legal influences on design activities.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop skills in clarifying a design task when planning and managing learning experiences.

- Use observation, analysis, interviews, research and/or discussion to clarify a design task, *eg when designing improvements to the school playground, identify problem locations within the school environment, discuss 'black spot' accident areas in the playground. Analyse the characteristics of these areas to determine why accidents occur there.*
- Discuss the nature of a problem with the target group, *eg discuss with mothers who bring their babies to school how they negotiate flights of stairs with their prams.*
- In small groups discuss a problem in order to clarify the task, *eg produce several solutions to the problem. Through group negotiation select one solution and devise one list of procedures to complete the task.*
- Explain the objectives of the task to another student or to a teacher.
- Observe how an inexperienced person copes with a problem, *eg discuss how they cope with an 'out of reach' shelf.*
- Analyse the target objectives associated with everyday items, *eg a pencil case is able to be locked, is light weight and is easy to open.*
- Write design briefs, then swap briefs so that peers have the opportunity to write the target objectives associated with the briefs.

Useful resources

Williams, P et al, *Design and Technology 5-12*
Dunn, S, *Design Technology – Children's Engineering*

Introduction

It is important that all students are provided with frequent opportunities to explore and develop their own ideas for designs. The successful generation of ideas will often depend upon the students' modelling, drawing and other communicating skills. However it is important that teachers distinguish between the actual value of a student's ideas and how successfully they have been interpreted.

Students should be encouraged to:

- think laterally
- explore how other people have solved similar problems
- work collaboratively to develop ideas
- explore made and natural forms
- research, using a wide range of materials.

It is essential that students appreciate the value of exploring a range of ideas and of re-developing particular ideas that are considered to have merit.

The success of particular ideas should be assessed in terms of the intent of the task. Through their exploration of the task, students will gain an appreciation of the range of acceptable solutions. The explorations will inevitably lead students to ideas that can be developed further.

Skill development

At Stage 1, students should be able to suggest opportunities for investigations and design activities and suggest practical changes that could be made.

At Stage 2, they should be able to explore ideas for investigations and their design proposals in order to identify where decisions still need to be made, and suggest possible courses of action, including modifications to improve their original proposals. They should also be

able to estimate resource requirements (time, materials, tools, skills) and check on their availability.

At Stage 3, they should be able to develop and justify their ideas and design proposals by selecting and refining ideas by using models and drawings. If necessary, they should be able to develop and present these ideas and make modifications where appropriate. Students should also be able to reflect on and evaluate the elements and assess the implications of the availability of the resources required to carry out their tasks.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

- Brainstorm to generate ideas. Brainstorming is a popular creative technique which, when correctly executed, will facilitate the generation of ideas. It is useful for developing creative thinking processes and promoting discussion. Students' language development is enhanced since clarity and brevity of statements is encouraged. All students need to experience a diversity of roles in group work; one being the recorder of brainstormed ideas.
- Discuss what is involved in brainstorming before practising a brainstorming situation. In brainstorming, students should appreciate that quantity is not a goal, that judgement is deferred, that developing another's ideas is permitted and that novel ideas are acceptable. Brainstorming is a structured activity which progresses through established stages and must not be confused with discussion groups.
- Investigate a stimulus to generate ideas, *eg hermit crabs' 'homes' leading to a study of 'homes' of different animals.*

- Analyse features of a stimulus which generates ideas for solving specific problems, *eg visit an exhibition home to examine how specific problems have been solved by the architect.*
- Document different suggestions to solve a problem. Evaluate the good and not so good points of all the suggestions – select the most appropriate suggestion.
- Develop and revise a range of ideas. Discuss and develop these ideas with another student or expert. Modify and further develop the ideas.
- Practise lateral thinking after experiencing role modelling situations by teachers or experts.
- Research previous attempts at solving similar design tasks.

Representing ideas by modelling

[TS20]

Introduction

In science and technology, models can be regarded as two- and three-dimensional representations of forms, environments, images and systems. Modelling is an important means by which students can develop, express, record and communicate their ideas.

Modelling is done to model key features; after this students can be creative. Modelling is intended to preserve a key feature of what's being modelled. It encourages group work and expression. The process of modelling can assist students to develop an understanding of function, form, visual and tactile characteristics.

Students should be encouraged to examine and explore different types of models and understand how and why they have been made, eg 'visual' models of aeroplanes can be constructed from commercial kits. It is also possible to make 'working' models of kitchen appliances to show how they might work or function.

In many instances computers can be used to model by means of graphic programs.

Students should be encouraged to interpret and discuss their modelling and their models. This provides a useful way of clarifying understanding and developing vocabulary.

Skill development

At Stage 1, students should make three-dimensional models from materials that can be moulded. As students develop manipulative skills they should be encouraged to expand the range of materials with which they work. They should also be challenged to produce different types of models, eg working models from construction blocks etc.

In Stage 2, students should explore the properties, capabilities and working

characteristics of both natural and manufactured materials and components. They should safely manipulate a range of appropriate hand tools and equipment. Current research indicates that primary school students are capable of developing quite complex models that 'work' and can be controlled by computer languages such as 'Logo'.

By Stage 3, students should be provided with opportunities to **choose** appropriate means of modelling their ideas. They should be provided with learning experiences that will encourage them to develop fluency in expressing their ideas through modelling.

Managing learning experiences

Listed below are a range of strategies which teachers can use when planning and managing learning experiences.

- Make models from plastic materials, *eg 'playdough', plasticine, clay.*
- Make working models using construction blocks and modelling systems, *eg Lego, Mobilo.*
- Make model structures using strip timber and cardboard triangular corner gussets.
- Make working models and 'mock up' a housing or body for an appliance or machine.
- Use computers to model ideas using graphics, *eg Logo.*
- Have children bring their own models from home to represent an idea.
- Enlist local cultural community involvement where appropriate, *eg visitors explain methods and materials used: architectural models, clothes designs.*
- Form a human model of a graph, *eg students line up to indicate likes/dislikes.*

Special considerations

Aboriginal Students

Incorporate group work and movement in the lesson which is suitable for Aboriginal students. Ensure not all directions come from the teacher so that students may also direct activities.

Girls

Ensure suggestions for models meet the interests of both girls and boys. Allow girls to work together until they gain confidence.

ESL/NESB

Students should be encouraged to interpret and discuss models in their first language. This may involve translation and could involve peers and parents in assisting the explanation process.

Useful resources

Aitken, J, *Creative Technology*

Dunn, *An Introduction to Craft, Design and Technology*

Drawing to develop and record ideas

[TS21]

Introduction

In science and technology, drawing is an important means of expressing, recording and communicating ideas. A drawing can be a product in its own right, eg a poster, an illustration or a sign. More importantly the process of drawing can be used to explore ideas and solve problems.

Learning activities in this Key Learning Area will require students to use a range of technologies and methods to produce drawings. Freehand drawing will enhance the students' ability to manipulate ideas. More formal drawings will enable students to communicate, present and evaluate information, ideas and proposals. Computer technology will extend the range of images that a student can create. It provides a means of storing information and images for further use.

The process of drawing will lead students to a clearer understanding of form, shape, colour, texture and symbols and will enable them to appreciate the images in their environment. Accuracy in drawing is dependent on, and can lead to, the development of observation skills.

Fluency in drawing is developed through practice. Frequent opportunities should be provided for students to express themselves graphically by sketching and freehand drawing. The computer should be used extensively as a graphics tool.

Students should be encouraged to interpret and discuss drawings and illustrations. This provides a useful way of clarifying understandings and developing vocabulary. It is a particularly important strategy to be used with students of non-English speaking background.

It is not recommended that in developing and recording ideas, students construct formal drawings using geometrical instruments. However, students should be introduced to the notion that codes, symbols and drawing systems are a part of graphical language.

Skill development

At Stage 1, it is important that students should be provided with opportunities to express themselves freely by drawing. They should use their own schema, codes or symbols when creating images.

At Stage 2, in order to develop drawing skills, they should be encouraged to observe carefully the form and detail of the objects they draw. This will be reflected in the images they create and record. They also should be encouraged to add notes to their drawings when details are difficult to clarify graphically, eg *'This has hairs on it', 'The handle turns'*.

By Stage 3, as students need to use more complex scientific and technological concepts, they should also develop a need to record and express their ideas using the codes, symbols and systems that are part of graphical language. These codes, symbols and systems should be introduced only in response to the student's need to record and express ideas.

At all stages it is important that students are provided with experiences that will promote fluency in expressing ideas through freehand drawing.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

Drawing from One's Imagination

- Visualise an animal or machine of the future. Make a model of it, using any model-making materials, eg *clay, card, wax, plasticine*. Make a drawing of the animal or machine in its possible surroundings.
- Model a design from construction blocks. Draw the model. Redraw the model from different positions. Use the drawings to tell the class about the design.

- Make a drawing of a design. Make a model from the drawing. Modify the model. Make a drawing to present to the class or group.
- Redesign an existing object, product or environment. Draw it from observation. Change the drawing to reflect the changes that could be made to the design.

Drawing from Observation

- Model a design from construction blocks. Cover the model. Attempt to draw it from memory. Uncover the model. Redraw it from direct observation. Compare the drawings. Describe the differences.
- Use rubbings to record details of natural or made objects. Draw the object, including all details included in the rubbing.
- Make a drawing to represent an idea that is expressed in another form, *eg in writing*.
- Use sequenced sketches to record phenomena and events observed in an investigation, *eg growth of a plant, movement of a machine*. Use the drawings when discussing the observations and proposing explanations.
- Explain how a product, appliance, tool or piece of equipment functions. Make drawings to illustrate the explanation.

Learning from Other Peoples' Images

- Explore how, over time, societies and cultures have used images to record ideas, *eg Aboriginal art, images carved on rock, images on the walls of the pyramids*. Discuss the drawing techniques used.
- Use X-ray technique to show details inside something students have designed. Use the drawing to explain how the design works.
- Cut out and collect drawings and images that have been created for magazines.

Using Codes, Symbols and Systems

- Read and interpret drawings that use common symbols or codes.
- Use drawings that include symbols or codes to make a model. Discuss the meanings of the drawing with an expert.
- Use symbols or codes when making a drawing of a design. Use the drawing to explain the design, *eg develop an electrical circuit for a torch. Discuss how the torch operates*.
- Use simple line diagrams to demonstrate such things as electrical circuits, travel directions, how to thread sewing machines. Research the symbols that are commonly used in such diagrams.
- Use a computer to create, manipulate, alter and place images and illustrations.

Useful resources

Design World journal

Visual Arts Syllabus K-6

Introduction

Selecting the appropriate solution involves constantly referring back to the task identified in the design brief. The selected solution should satisfy the identified need and address all the limitations, restrictions and *latitudes* identified.

In the process of exploring ideas, students should be encouraged to make several attempts at solving a problem and each of these attempts should view the problem from a different perspective. There is little value in producing several solutions using the same approach. Any idea generated, no matter how insignificant, should be preserved. From these isolated ideas can come a combination of interesting or inspiring innovations that may provide a solution. With all the information at hand it is possible to select the most efficient way of addressing the problem.

In selecting the final solution all attempts should be looked at, whether they are in the form of brief notes, sketches, models, drawings, even recordings. This collection of possible solutions should be regarded as an 'ideas box' from which a solution might immediately present itself or, from the variety of isolated concepts, a combination of ideas may form one suitable outcome.

When selecting the appropriate solution it is important to consider some of the following questions.

Time

- How much time is available to complete the task?
- Is the design too elaborate or too basic?

Materials

- What materials are available?
- How much would they cost?
- Are the facilities available to work with the particular material?

Function

- Would it perform the identified task?

Ergonomics

- How big?
- What shape?
- Can it be used/applied without discomfort?
- Is it easy and efficient to use?

Appearance

- What will it look like?

Technology

- Can it be made to work?
- Do you have the technology to make it?

Safety

- Is it safe to make?
- Will it be safe to use?

Society

- What will be the consequence of making it?

The important aspects of selecting the appropriate approach are that:

- it should satisfy the design brief
- the student should feel satisfied that the outcome can be achieved.

Skill development

By Stage 1, students should be able to identify the basic requirements of a design brief and select a solution that addresses the expressed need for the design.

At Stage 2, the students should be able to explore different solutions and select features from different solutions to come up with a single, more suitable, outcome.

At Stage 3, students should be able to select solutions having considered the societal and environmental consequences of their selection. This will allow them to make modifications to their design to satisfy these concerns.

Managing learning experiences

Listed below are a range of strategies which teachers can use when planning and managing learning experiences.

- Provide a range of design briefs and get students to brainstorm a list of aspects they will look for when selecting a suitable outcome.
- Display/provide a range of containers. Describe what the content of the container will be and how it will be dispensed. The class can select an appropriate container and explain the reasons for their choice of this container.
- Select from a variety of transport systems how to get from one place to another. Why

were these identified? How did the one selected satisfy the need of the person or group?

- Select from a variety of venues a suitable place to have a school function, *eg sports, picnic etc.* Describe why this venue was selected.
- Draw up a grid. On one axis show the criteria to be considered for a particular design brief, on the other axis the possible solutions. For each solution place a tick in the box to establish the criteria that the particular solution satisfies. Compare the boxes for each solution to determine which one best satisfied the criteria of the design brief.

Considering appearance and function

[TS23]

Introduction

In the design process, consideration must be given to functional, material and visual requirements. The aim of the process is to produce not only something that works, but something that is pleasing to the senses.

Appearance is a result of deliberate attention to construction, shape, form, colour combinations, texture and how well it will complement its final environment.

The arrangement of components also influences an object's appearance. Designs characterised by unified appearance facilitate the eyes taking in and giving a pattern to these objects. In turn, the brain can better process the information it receives about the object. Three means of promoting unified appearance in designs are rhythm, symmetry and proportion.

Function is the job something has to do. Some articles are designed to perform more than one function. That means one has to look at several different aspects of function. Function includes **size**: *eg will the dog fit into its new kennel?*; **strength**: *eg will the garden seat hold the weight of three people*; **adaptability**: *eg will the article be used by more than one person for more than one purpose?*. Another important aspect of function is 'life' or **durability**, *eg how long is the item to remain in service? Compare the function of a milk bottle with that of a milk carton.*

Function and appearance must always complement one another, although different cultures have different ways of interpreting these qualities. There are times, however, when one aspect might dominate the outcome, depending on the design task.

Students should be provided with the resources and opportunities to produce different results. A wide range of resources is necessary from which to produce these different results. Such

stimuli might include different natural resources. Nature provides the students with millions of different forms even though they all perform similar functions. The advantage of natural over made resources is that the ideas have to be actively transferred from one medium to another to meet the design task.

Skill development

At Stage 1, students should generate and select ideas to best meet the design task objectives by using pictures, drawings and models, and give simple reasons why they have chosen a certain idea. They should be able to combine materials and demonstrate that these are appropriate for the task in hand.

By Stage 3, they should go a step further by using graphical and written data to record their exploration of different ideas for their design proposals. Students should be able to use and manipulate a wide variety of materials and tools. They should also have the knowledge of a wide range of the working characteristics of materials and techniques so that they can improvise when faced with unforeseen difficulties.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

- State and explain likes and dislikes, *eg survey likes and dislikes of others, carry out market surveys to determine which designs are most 'saleable'.*
- Compare proposed designs with the requirements of the brief; does it fulfil requirements?
- Analyse existing products in terms of their effectiveness, appearance and value.

- Decorate an object, *eg decorate a glass jar with paint, pasted pictures, fabric or any other accoutrements to improve its appearance as a flower vase.*
- Display and arrange research materials, *eg on mobiles, walls, windows and display boards related to a theme under discussion. Pay particular attention to appearance, layout, positioning and function.*
- Make a model or representation, *eg cut and paste pictures from furniture magazines, brochures and leaflets to arrange the furniture and fittings. This is done on a prepared and selected background to represent the carpet.*
- Bring in a variety of objects from home to discuss appearance and function.
- Redesign existing products to improve their function/appearance.
- Devise means of testing designs for strength and endurance.
- Identify service conditions and discuss how a design might be affected by such conditions.
- Identify the market for the design and discuss how to design for particular markets, *eg the young, the aged.*
- Arrange lengths of timber on blocks, bricks or boxes for class seating at an outdoor activity. Remember to investigate the length of the spans between the supports, how easily seating can be adapted, how strong the seats would have to be and for how long the arrangement is needed.

Special considerations

Aboriginal Students

When there are Aboriginal students in the class, students should be encouraged to look at artefacts from Aboriginal cultures. Aboriginal students should not be placed in the position of being required to be experts on all aspects of all Aboriginal cultures.

Aboriginal students with Standard English deficit or disability will need to be allowed to use their language, Aboriginal English.

ESL/NESB

Encourage students to look at objects from different cultures. Appreciate that some objects will not be familiar to everyone, so an opportunity should be provided for explanation and use of students' first language.

Take care not to promote a particular culture. Accept different opinions of appearance and the need for function in different cultures.

Useful resources

Choice magazine

Royal Australian Institute of Architects, *The Source Book*

Introduction

Evaluating designs occurs throughout the design process and not just as a final step. During the design process students evaluate how a design is developing in relation to the final product, whether materials are suitable and whether alterations are needed before proceeding.

Students should be critical of their own work. They need to appreciate that an important part of the designing and making process is to look at something they have designed and made and decide if it fulfils the original design brief. The brief may be to design and make a gift for someone. Students need to decide if the gift they have made is appropriate to the person they made it for and if they are happy with the quality of the gift. Students should develop proficiency in evaluating not only the outcomes of their own designing and making activities, but also the products of their peers and commercial designers. By evaluating the varied designs of others, students not only become more informed consumers, but also acquire ideas for their own solutions to problems.

Students should develop skills in using the design objectives when evaluating outcomes. Firstly, the designer should talk about and try out their solution or watch a peer try it. This aspect of evaluation is essentially objective in nature. Students should develop skills in systematically measuring whether performance satisfies the perceived needs. This facilitates more accurate observation and appraisal than mere guesswork.

Secondly, judgement of a solution is influenced by personal opinion. This aspect of evaluation is unavoidably subjective in nature.

The information gleaned from evaluations should be recorded in formats which allow reference to the original design and specifications. By analysing evaluations

relating to their own designs, students are better equipped to alter defects which have come to light.

Skill development

In Stage 1, students should recognise and discuss with others the strengths and limitations of what they have done and make comparisons about what they like and dislike about familiar products, systems or environments.

By Stage 2, they should be able to make adjustments to their original intention when designing as a result of problems or improvements that occur to them.

At the end of Stage 3, they should be able to critically evaluate the materials, components, procedures, techniques and processes used and suggest possible improvements where necessary. They should also be able to evaluate the form and function of existing products, systems or environments and those from other times and/or cultures. Students should be able to make comparisons and make some simple value judgements about the social and economic implications of these products, systems or environments. They should be able to evaluate the ways in which their designs have developed, justifying their decisions and evaluating outcomes in terms of original intentions. They should then draw conclusions about the outcome of design tasks in meeting users' needs and how they might be improved.

Managing learning experiences

Listed below is a range of strategies which teachers can use to develop skills in evaluating designs when planning and managing learning experiences.

- Explain what they like and dislike, *eg bring a few toys to school. Show all the toys to a*

small group. Select your favourite toy and explain why you prefer it to the other toys.

- Identify a number of environments in the school and discuss why students prefer certain areas. Make a painting of a favourite environment. Label the aspects underlying students' subjective evaluations, *eg the sand pit area, the grassed area under the trees, the sick bay.*
- Analyse pictures of contrasting environments and explain why students prefer certain environments and which is their favourite, *eg sea shore, shopping centre, resort.*
- Objectively evaluate outcomes against design objectives, *eg students display their designs and talk about what they have done. Analyse whether or not the electrical circuits of a scary creature should light up. See if the pulley system which operates the creature's tongue produces the desired effect. Have a number of other students operate the design. See if they can work it, observe any difficulties they had and attempt to rectify these.*
- Make adjustments as a result of evaluation that occurs during the design process, *eg 'I could see that paper wouldn't be strong enough to hold my model steady so I decided to use cardboard instead.'*

- Make comparisons about the social and economic environment in analysing and identifying target objectives associated with a design, *eg what needs would be associated with a picnic storage container? List these in terms of standards which can be assessed objectively: does it leak? is it lightweight? Use the container to determine the degree to which the target objectives have been met. Students devise a recording format and indicate ratings for each inferred design specification. Discuss the picnic storage container with peers and explain subjective assessments to each other.*
- Evaluate ideas at the start of the design process, *eg 'I thought of two ways to use the sun's energy and I decided to make something that would cook an egg.'*

Useful resources

Williams, P et al, *Design and Technology 5-12*

Dunn, S, *Design Technology – Children's Engineering*

Using technology process

Teaching Strategies

- [TS25]** Selecting and using materials
- [TS26]** Organising tools, equipment and processes
- [TS27]** Understanding materials
- [TS28]** Learning safety procedures
- [TS29]** Selecting appropriate technologies
- [TS30]** Selecting and maintaining tools and equipment
- [TS31]** Evaluating chosen technologies

Selecting and using materials

[TS25]

Introduction

Whenever we make an object or formulate an idea, some kind of material is generally used. Materials must be organised in such a way as to assist the activity.

To select appropriate materials students must have experiences that encourage the use of a variety of materials in a wide range of applications. Several factors will influence the choice.

Students need to:

- develop understandings related to the properties of materials which are transformed from a raw state by the primary processes of cutting, forming, fastening and finishing
- consider the appropriateness of materials for the task at hand
- develop understandings about selecting and using appropriate materials. Students must have experiences that encourage the use of a variety of materials in a wide range of applications.

Organising material for a project is done in conjunction with the design brief. The organisation, supply and preparation of appropriate materials involves noting design developments and the needs of students. Some materials need preparation before they can be used. Preparation might be as simple as mixing paints.

Skill development

At Stage 1, students should:

- gain expertise in manipulating materials that are available in the classroom environment
- become aware that materials have different properties

- become aware that these properties affect how the material is used.

By the end of Stage 2, students should be aware that:

- there is a greater variety of materials
- materials have different properties
- properties affect the use to which materials are put.

In Stage 3, students should understand that:

- the properties of materials can be investigated by testing or trialling
- the uses of materials for specific applications are based on the properties of the materials.

Managing learning experiences

To develop these skills when planning and managing learning experiences, teachers could provide the following activities for students.

- Classify materials according to use, *eg visit a building site and observe the materials used in the construction of houses and buildings. List the observable properties of some of the materials used in construction. Discuss how the properties of these materials, such as glass, have been used.*
- Investigate the different types of containers that the children can find and identify what they are made from, *eg why have the materials been used? Which materials are waterproof? Which materials are strong? Compare different containers such as egg cartons, milk cartons, and soft drink cans or pet food cans. Identify the materials from which they have been made and discuss how each suits its purpose.*
- Test materials for water absorbency. Make a list of materials, showing comparisons of how well they absorb water. Identify the materials from which they are made.

- Test a variety of materials to identify their ability to conduct electricity. Use a variety of materials to complete an electric circuit powered by a battery. Can a bulb light up when it is used in a circuit?
- Investigate how materials are joined together. Observe materials in the environment. Test a variety of ways of joining materials and decide if some ways are better than others.

Special considerations

Special Needs

Good hands-on material should be provided for students with special needs. There should be direction and good structure for these activities.

Useful resources

Good, K, *Starting Craft, Design and Technology*

Organising tools, equipment and processes

[TS26]

Introduction

'Tools and equipment' refers to collections of hand and mechanical implements that are used daily, *eg overhead projector, transparencies and marker pens, computers, disks and printers, hammers or scissors.*

When investigating:

- students need to have access to tools and equipment which have been systematically organised
- it is essential that teachers do not assume prime responsibility for organising tools and equipment
- teachers should identify and organise resources according to the needs of their students, for example:-
 - storing the scissors out of the reach of the kindergarten students reflects lack of appreciation of user needs
 - in preparing to make a design or set up an experiment, it is important that students are able to identify and select the most appropriate equipment and tools for the tasks at hand.

'Processes' describes the path from an idea to an outcome, taking into account the various inputs and constraints which impinge on the outcome.

Teachers should aim to develop in their students:

- positive attitudes towards safety and resource maintenance
- skills which will allow them to organise tools and equipment both in the classroom and in relevant out-of-school activities
- a realisation of the importance of striving for an ordered, safe and functional set of tools and equipment
- a vigilance in identifying faulty equipment
- a commitment to the appropriate storage,

handling and maintenance of expensive equipment, so that unnecessary expenses are not incurred.

Skill development

At Stage 1, students should be able to combine a variety of appropriate materials, images, components and elements to make simple models, drawings and structures.

By the end of Stage 2, they should be able to:

- make choices as to what they construct
- assess the properties, capabilities and working characteristics of both natural and manufactured materials and components
- improvise, within limits, when confronted by unforeseen difficulties
- use their knowledge of the working characteristics of a range of readily-available tools and equipment to assess the most suitable for the task in hand
- use processes safely, accurately and with respect for future use.

In Stage 3, they should be able to identify, organise and use the tools, equipment, materials, workspaces, people and other resources that are most suitable for their designs.

Managing learning experiences

To develop these skills, when planning and managing learning experiences, teachers could provide the following activities for students.

- Identify and define the properties and capacities of available tools, processes and equipment.
- Identify safety factors of tools and equipment.

- Identify and define the organisational needs of a target audience, *eg survey peers to determine how and where they would like their sports equipment stored for easy access.*
- Develop ideas relating to organisation and display of tools and equipment, *eg brainstorm ideas to generate an array of solutions to ways of organising the distribution of tools for a science lesson.*
- Identify and select appropriate tools and equipment for an identified task, *eg select tools and equipment according to the ways they are used; make a display of tools giving reasons for their particular categorising.*
- Manipulate tools and equipment with care, *eg teacher or peers act as role models and/or students explain a system of resource maintenance that works for them.*

Special considerations

Aboriginal Students

Look at materials used by Aboriginal cultures.

Special Needs

Good hands-on material should be provided here for students with special needs. There should be a definite direction and structure for these activities.

ESL/NSB

Look at how different cultures organise tools, equipment and processes, *eg cooking utensils, multi-purpose tools.*

Useful resources

Pluckrose, H, *Cut it!*

Pluckrose, H, *Join it!*

Introduction

Students should develop understandings related to the properties of materials. Knowledge relating to such properties best stems from investigations. Students' natural curiosity precipitates informal discoveries. These provide a framework for more formal investigations which teachers can stimulate. Experiences with a wide variety of materials in a diversity of situations will maximise the development of understandings. Materials can be classified in terms of their basic composition and the manner in which they are used. Students' understandings can be maximised by observing where and how materials are used in the environment. They should develop skills in evaluating the effectiveness of materials in both familiar and unfamiliar contexts.

Skill development

At Stage 1, students should explore the characteristics of various types of materials. They should recognise that some materials occur naturally, while others are made.

By Stage 2, they should recognise the important similarities and differences between the characteristics of a range of materials.

At the end of Stage 3, students should investigate the properties and uses of a wider range of natural and made materials. They should use a variety of materials so that comparisons can be made regarding properties such as strength, hardness, flexibility and solubility.

Managing learning experiences

To develop these skills when planning and managing learning experiences, teachers could provide the following activities for students.

- Consider the knowledge Aboriginal people have of all types of timber, *eg for bark painting, boomerangs, digging sticks, spears, fire.*
- Classify materials according to their composition, *eg investigate the school playground to develop understandings*

which facilitate classification of objects into made and natural categories. Classify natural materials as 'once living' and 'never living'. Identify made materials in familiar and broader contexts.

- Identify readily-available materials in terms of their composition, *eg draw a picture of your house or classroom. Design symbolic indicators for materials used in these contexts which were: (a) once alive, (b) non-living materials but never living, (c) made. Research objects according to their composition by talking to adults, reading literature etc. Label them with symbols appearing in a key.*
- Explore the properties of materials, *eg collect a number of wooden, plastic and metal rulers. Test them for hardness, weight, durability, strength and thermal properties (heat retention).*
- Classify a range of materials with different attributes, *eg hardness.*
- Explore and manipulate materials by designing and making a product, *eg try making 'solid' shapes using 'soft' materials to make them look 'like the real thing', eg a soft drink can formed in sponge rubber, a biscuit in plastic, a piece of cheese in wood, a golf club in rubber. Design ways of tricking people by using an inappropriate material.*
- Evaluate a classification of materials and have students develop their own way of organising materials of their environment.

Special considerations

ESL/NESB

Look at materials from other countries which students may not have seen, *eg fabrics, earthenware bowls, tools.*

Look at machines from other countries and the materials from which they are made.

Useful resources

Yarwood, A et al, *Design and Technology*

Whyman, K, *Structure Materials*

Burt, E, *Natural Materials*

UNICEF, *Appropriate Technology*

Introduction

Attention to safety in the design process can prevent accidents. Accidents can often be attributed to inadequate attention to safety instructions or factors in the design process. Many accidents could be prevented by obeying safety instructions and anticipating problems which arise from slippery floor surfaces, trailing wires, fragile toys and incorrectly positioned shelves. The likelihood of accidents happening can be reduced by paying attention to the strength, durability, wear, balance, moving parts, surface finish, combustibility and toxicity of materials, electricity, sharp edges and corners, and hot surfaces. The best example of this safety in design would be the latest control box on pedestrian crossings. The design features for safety include a variable sound for the blind, a pulsating arrow for the deaf and blind, a robust structure, a practically indestructible button mechanism, a smooth finish with no sharp corners and a completely weather-resistant casing.

Learning safety procedures should be an integral part of the processes and practices undertaken in the curriculum. This includes the activities, attitudes and organisational aspects which are relevant to teachers and students in schools, in homes or the wider community. Instruction in safety procedures should take two forms:

- i) a formal aspect of a safety program where regulations and procedures are emphasised. Individuals and group roles are identified and safety drills performed
- ii) an informal and pervasive part of the processes and practices in class. This includes not only safe behaviour patterns, but also the establishment of routines in cleaning work areas and safely storing materials, tools and equipment.

Various technologies and design features have been incorporated in the manufacture of most items at home, at school and in the community

to make them safe for use by all. When designing for safety, it is important to first analyse the needs and the people who will use the item.

Skill development

Students will aim at caring for equipment as well as the safety, health and well-being of everyone and the environment.

At Stage 1, students should be able to identify, choose and operate appropriate classroom tools with safety and to care for the equipment in their immediate surroundings.

By Stage 2, students should be able to maintain basic tools and equipment used during class activities and to recognise the appropriate use of tools, equipment, hardware and software. They should also be able to use the technologies which are available in the school environment, including basic constructional and design tools.

At the end of Stage 3, students should be able to identify and report unsafe conditions and use basic machines and equipment safely and correctly. They should also be able to improve the efficiency of machines and be able to identify and select the most appropriate tool, equipment, material, hardware or software for a particular task.

Managing learning experiences

To develop these skills when planning and managing learning experiences, teachers could provide the following activities for students.

- Identify 'high risk' items and locations in the classroom and in the playground.
- Collect pictures of warning symbols used in our society. Discuss the colours used to warn of danger. Design safety logos which

could be stuck or painted onto danger areas at school.

- Discuss, and record pictorially, the nature of injuries that people sustain as a result of using made items, *eg burning yourself on the iron*.
- Discuss layout of classroom furniture. Identify congested areas where collisions are possible. Brainstorm needs and solutions to the problem. Discuss and select criteria by which to evaluate a modified layout. Build a classroom model layout and evaluate it. Trial improved use of space designed by pupils, *eg model in blocks, match boxes to determine safer classroom movement*.
- Collect a range of examples and pictures of everyday products that pose a danger to people. Classify these according to which can cause, for example, bruises, burns, collisions, cuts, electric shocks, falls, poisoning, skin irritation, slipping, suffocation, swallowing, trapping.
- Collect and investigate a range of toys for safety and potentially dangerous features. Display the toys and record observations on accompanying card, or similar.
- Identify factors necessary to be kept in mind when designing and display findings, *eg surface finish, electricity, durability, strength, sharp edges*.
- Publish pupils' accounts of accidents which have happened to them when using everyday products. Create a data bank of brainstormed safety measures which could be incorporated into the designs. Draw suggestions or make prototypes of some of these.
- Design and make a container with a 'child proof' locking device that would be suitable for storing small, dangerous items.
- Make a list of possible dangers associated with the following examples and suggest ways of reducing the risks. Prepare lecturettes on students' findings. Make use of sketches to explain suggestions, *eg roads, trucks, bicycles, fixed playground equipment, chair lift, extension cord, frayed electrical cord, skateboards, stairs, frypans, hair dryers*.
- Research play patterns in the school playground. Design a playground which accommodates the identified play preferences of all groups, facilitates safety in terms of providing unrestricted traffic routes to the wash area and makes use of grassed spaces for games in which children might often fall. Trial and evaluate. Present findings at an assembly, in the library or in some format that will reach the school community.
- Interview a range of pupils about the type and location of playground accidents. Record data on a graph. Observe the students' play practices during breaks. Design a playground, and construct a model, which accommodates the safety and recreation needs of the pupils.
- Design an interview and then question parents and other adults regarding the accident patterns which occur in, for example, the kitchen. Determine the precise nature of the safety problem. Is it, for example, a floor surface, hot surface or a balance problem? Identify user needs and then design and, if practical, make the solution.
- Visit a park. Study the equipment to determine items which put the safety of young children at risk. Incorporate design modifications into models built from different materials.
- Research the physical attributes of young children. Design and make a model of a safe piece of play equipment for a park. Design and draw a scale model of a balcony railing suitable for a house where toddlers live.
- Observe the traffic outside the school. Observe the school bus areas, parents' parking area and their practices. Observe good and potentially dangerous safety situations. On a plan or model display proposed design improvements.

Useful resources

Toft, P, *Craft, Design and Technology for GCSE*

Selecting appropriate technologies

[TS29]

Introduction

Technology in the classroom includes, but extends beyond, the tools and technical items available to students. It must be remembered that technology also includes materials, processes, products and information. As well as being anything that you use to help you meet a goal, technology also involves the application of knowledge and resources to make things work. Technology is precipitated by human needs. It involves meeting those needs or solving identifiable problems.

Selecting appropriate tools and technologies not only has safety connotations but also requires the mental process of visualising the design and how the tools will be manipulated to produce the result. It involves consideration of the relationship between the task to be completed, the tools available and the abilities and skills of the potential user.

Students have already had much first hand experience with forms of technology before they came to school. In many instances the tools and technologies selected might not have been appropriate and the result obtained less than favourable. Selecting the appropriate technology is important to maximise the level of success. Young children frequently make selections regarding the most appropriate form of technology to accomplish certain goals. A child typically selects a clear, secure container for pet beetle storage as opposed to an opaque, less secure vessel. Teachers should provide opportunities for students to develop skills in identifying and exploring the capabilities of technologies and using these in the classroom.

In practising classroom decision-making related to which form of technology is most appropriate for a task at hand, students develop technology-related analytical skills. These will serve them in all aspects of their lives, since there is a pervasive spread of sophisticated technologies in our world today. By giving the students opportunities to handle and use a

range of technologies, teachers can assist them to gain a greater control of their lives and be aware that ultimate decision-making related to technology usage rests with each one of us. It is the teacher's responsibility to ensure that the range of technologies and tools available to the students is appropriate, having regard to safety and the skills to be developed by the students. Students will appreciate that by the purposeful and creative use of resources, their task is simplified, the outcomes are enhanced and the range of their endeavour is broadened.

Skill development

At Stage 1, students should be able to identify the different forms of technology in their immediate environments and explain how they help us.

By Stage 2, they should be able to choose those tools, equipment and processes suitable for making their designs and to use and store these safely and accurately so that they will be readily available at a future time.

At the end of Stage 3, students should be able to evaluate technologies so that they can change and adapt processes and procedures when they encounter obstacles and/or seek help if necessary. They will be able to adopt procedures which will minimise waste and pay regard to cost, accuracy and finish.

Managing learning experiences

To develop these skills when planning and managing learning experiences, teachers could provide the following activities for students.

- Identify forms and purposes of pieces of equipment.
- Discuss the equipment involved in an activity and identify how it was used.

- Discuss the forms of equipment and how students enhanced the product. Discuss the skills needed to operate the forms of technology.
- Explain to peers how to go about using a form of technology to produce the best effects.
- Select an activity and identify forms of equipment or processes which can be used to satisfy identified needs, *eg pencil and paper were used to keep the score; a bucket was used to carry the balls; label a collage according to the technologies which contributed to its production and design and make mini posters to highlight safety precautions associated with classroom technologies; use the equipment focused on by someone else and share perceptions about how/when safety precautions were taken while using the particular technology; create a data bank of forms of technology used for making linear measurements; use the equipment; share the categorised list with peers and provide insight into how they can operate the equipment.*
- Manipulate in order to fully control equipment.
- Explore the variety of ways in which a tool or piece of equipment can be used, *eg pencils used on the side produce a shading effect. Apply this knowledge gained through peer tutoring. Teacher or a peer can model the use of an overhead projector, the basic processes involved in using databases, word processing programs, video cameras.*
- Select and use appropriate tools and equipment, processes and resources.
- Trial the appropriateness of a selected technology by making models. Skill deficits can be remedied by the teacher, peers or a community resource person, *eg present the students with a design brief, eg to advertise the forthcoming fete within the local community. Discuss methods of advertising: pamphlets, posters, talks at assemblies using various aids. Students decide on the medium of communication which appeals to them and form groups within these frameworks. Group members discuss the creation and organisation of*

their advertisement using specific technologies: on masonite, letters and graphics in black on a white background, lights (powered by simple circuits) appearing at 10 cm intervals. Design and make a cost-effective game for a young child. Students list target objectives. They explore materials which will stand up to the handling of the target group. Use community resource people to broaden skills associated with designing and making.

- Evaluate outcomes in terms of strengths and limitations of the technologies used.
- Analyse the technologies used to create a product. Survey target audiences, *eg students evaluate advertisements they have designed and made. Discuss the pamphlets produced with the aid of Print Shop (computer software); was it cost/time-effective, did it make best use of scarce resources from a conservationist's perspective, was it eye-catching, was the layout balanced? Were the materials selected resistant to dampness? Students suggest more appropriate technologies for future use. Were skill deficits apparent? Students suggest ways of improving these so materials can be used more effectively. Question which features of an advertisement appealed to them/caused them concern. Analyse survey data to determine if a more appropriate technology could have been chosen or if a refinement of the same process would enhance the product.*

Useful resources

UNICEF, *Village Technology*

Selecting and maintaining tools and equipment

[TS30]

Introduction

Selecting involves purpose. In order to operate the correct tool, the task must be considered.

At various times throughout history, processes for developing tools for specific tasks were worked out, eg for cultivating soil. Selecting the appropriate material and shape for the tools changed, as the different tasks and possibilities of designing improved. With the growing trend towards mechanisation, more power tools and more sophisticated equipment were available.

Most tasks prove to be simple when the most appropriate tool or equipment is selected and used. No matter how appropriate the selected tool or piece of equipment might be, if its condition is poor the quality of the work will be equally bad. As part of skill development, students need to be aware of the value of maintaining basic tools and equipment. This involves storing, lubricating, cleaning and, in some instances, repairing. It is emphasised that attempting to repair electrical or other sophisticated equipment is discouraged for safety reasons. Nevertheless, reporting on malfunctions or potential danger, eg frayed electrical leads, is regarded as an aspect of maintenance.

During the early years of their schooling when students are acquiring a degree of independence and self-sufficiency, teachers should encourage students to select tools and equipment from a central distribution point, eg teacher's desk, cupboard, store. This encourages them to evaluate selected tools with regard to size, weight, usefulness, appropriateness and whether it works or not.

Selecting and maintaining tools and equipment is a process that accompanies most practical classroom activities and is basic to all good housekeeping.

Skill development

At Stage 1, students should be able to select simple materials and tools that are appropriate for a specific task. They should be able to operate basic tools with safety, eg scissors, stapler, camera, tape recorder. Students should also be able to maintain and care for equipment in the immediate surroundings, eg chairs in class, seating and play equipment in the playground. They should be able to store tools carefully and properly to avoid damage to the tools and possible injury to people.

By Stage 2, students should be able to select software and hardware appropriate to a specific activity and explain the reason for their selection. They should be able to use more complex tools or equipment to aid their investigations, eg use a stopwatch, video camera. Students should be able to maintain basic tools and equipment used during a class activity, eg brushes, hot plate, magnifying cube, camera. The tools and equipment should be kept clean and stored correctly to ensure continued good function.

At the end of Stage 3, students should be able to select appropriate tools, hardware, and equipment. They should be able to select software and materials on the basis of what the software and materials are supposed to do. Students should be able to evaluate the use of materials and equipment in order to understand their function.

Managing learning experiences

To develop these skills when planning and managing learning experiences, teachers could provide the following activities for students.

- Select tools and equipment needed for all designing and making activities, eg cutting and shaping tools for making shadow puppets.

- Before commencing a class project, students list the tools and equipment needed. One student may act as stores controller. After the activity, and on returning the tools and equipment to the stores controller, students should evaluate whether the tools are in good condition or in need of repair.
- Select the appropriate tools and equipment needed for an excursion. Check to see whether the tools and equipment need maintenance, repair, or replacement.
- Discuss the brief of an outdoor activity. List the tools and equipment needed for the activity. Assess how well tools and equipment are organised and stored and how easily they can be located and obtained.

Evaluating chosen technologies

[TS31]

Introduction

Technology can be regarded as a creative human activity. It is therefore essential that the chosen technology brings about the desired change through design and the application of knowledge. It is the responsibility of teachers and students to ensure that the technology chosen will not lead to the detriment of the individual, society or the environment. Choosing an appropriate technology can be as simple as the selection of the correct adhesive or as complex as the particular paper milling process.

The successful outcome of a process can sometimes be directly related to the technology chosen. In model making, the card trimming process can be achieved by using different technologies, such as scissors, Stanley knives or a guillotine. Each technology has its own specific advantage, such as cutting internal or external curves or angles or trimming straight lines. The success of the process depends on the technology selected for a specific task.

There are many different ways of obtaining similar results using different technologies. Similarly there are many instances where the same technology can obtain a totally different result under a different set of circumstances. Using the Stanley knife to cut cloth might not have the same result as using it to cut through leather. Students are encouraged to access, organise, use and evaluate information relevant to the chosen technology.

In evaluating the chosen technology it is important to consider whether the technology selected would provide students with the opportunity to gain experience in identifying, selecting and using the appropriate hardware and to evaluate, design and use appropriate software and kits.

Skill development

At Stage 1, most use of technologies by students in class is teacher-directed, however students should be encouraged to evaluate whether the choice of tools, equipment and software was appropriate to perform the given task. The students should be made aware of technologies that can perform similar tasks but achieve different results.

At Stage 2, students would be expected to select different technologies and explore alternatives as part of this skills development.

By Stage 3, students would have acquired a variety of technological skills and should be able to evaluate a chosen skill in terms of its social and environmental implications. Students should be able to choose and modify existing technologies to suit and satisfy their immediate needs.

Managing learning experiences

To develop these skills when planning and managing learning experiences, teachers could provide the following activities for students.

- Evaluate a project completed by the class. Examine whether the success/failure was a direct result of having used the correct or incorrect technology. Suggest alternatives. List the technologies involved from the planning stage to the final product.
- Display and examine a range of artefacts such as clothes pegs, bottle openers, spoons, bottle tops, corks, lids, milk carton, plastic cups, glasses, cooking pots etc. Identify which can be used for the same purpose, which can be used for more than one purpose and which, during or after manufacture, can be environmentally unfriendly. Under what conditions would a particular technology not be regarded as the correct one, *eg using a plastic cup as a container for a solvent.*

- Compile cards with images of various technologies, such as a telephone, television set, video camera, typewriter, computer, pencil, drawing board, eraser, paint brush, cloth, chalkboard duster, bicycle, motor cycle, car, bus, truck, train etc. Students respond to various briefs by choosing the appropriate technologies. At times there might be only one appropriate technology while at other times there might be several.
- If one had the task of selecting and introducing appropriate technologies for a poor, traditionally rural community in the

outback of Australia, which technologies would be introduced first and why?

- Students imagine they are taken back in time. They suggest or adapt technologies that they would introduce, considering the resources available at that time.

Useful resources

Macaulay, D, *The Way Things Work*

UNICEF, *Appropriate Technology and Children*

Using specific technologies

Teaching Strategies

- [TS32]** Audio-visual technologies
- [TS33]** Adventure games
- [TS34]** Control systems
- [TS35]** Telecommunications
- [TS36]** Sound and lighting
- [TS37]** Animation
- [TS38]** Publishing
- [TS39]** Databases
- [TS40]** Video production
- [TS41]** Computer graphics

Introduction

The syllabus recognises the need for technology education to embrace the technology of computers and communications. In so doing, students will appreciate that these technologies influence almost every facet of all our lives and are some of the most significant causes of change for people in the latter half of the twentieth century.

Computer technology

Computer technology is in our homes, our shopping centres, our schools and our entertainment venues. Students should be aware of a wide range of applications of computer technology. They should appreciate that computers influence the way we travel, the games we play, the way we learn and work, what happens to us when we are ill, how we handle money, how we communicate and how we get information. They should recognise that the food we eat and the merchandise we buy have more than likely been processed, packed and priced using computer technology.

This Key Learning Area is concerned with providing experiences which allow students to understand computers by using them. Students will be provided with opportunities to use computers to learn new things and to learn traditional things in new ways. Computer education assists students to meet new challenges and to make appropriate decisions concerning the use of computers now and in the future.

Communication technology

Communication technology is constantly changing, increasing the options available to communicators. The design and production of communication products involve a variety of technological processes and equipment. All communication products are the results of many decisions made by different people at each stage of the production process.

This Key Learning Area is concerned with the technology that creates and delivers communication products. Students will be involved in creating communication products as well as using a variety of communication technology. Communication technologies include telecommunications, video, television, radio and print media (including magazines, billboards, leaflets). Students should be aware of the wide variety of communication technologies that exist and become competent users of these technologies.

Introduction

Audio-visual technologies involve creating and reading messages using sound (audio) and pictures (visuals), either separately or in combination.

Students interact with a vast range of information sources every day. These range from simple visual images and sounds, through more structured examples, to those involving conventions of written language. Often school activities concentrate on the written language aspects, forgetting the frequency of use and effectiveness of other forms. If students are to become fully proficient members of a technological society, they need to be able to use a wide range of tools and techniques to acquire and communicate meaning.

Audio-visual technologies should be used by teachers for the benefit of students in motivating activity, clarifying concepts, processes and purposes and providing experiences or information beyond the scope of the school or community.

A wide range of technologies should also be used by students themselves. This may be in gathering and recording information, clarifying, organising and illustrating ideas, and communicating their thoughts.

The range of technologies used should be as broad as those available: overhead projectors; still pictures in the form of photographs, slides, magazine pictures, cartoons, posters etc; tape recordings; video and film; computer software; diagrams; music; spoken word; CD; microfiche and video discs, as they become part of everyday life.

Students need to have a very clear purpose in using any method of gathering, organising or presenting information. This is particularly so in using audio-visual media. Selection of the medium and techniques used should be made because they fulfil particular requirements, rather than for their own sake.

Students need to develop skills in evaluating the appropriateness of a technique to the task.

Skill development

At Stage 1, as students may use simple, single-medium forms such as taking photographs, recording sounds or voices, or creating simple combinations, *eg captioned pictures*.

By Stage 2, as students increase in familiarity with a range of techniques and tools, they may combine media to create more complex products. This may include manipulation of audio-visuals to change their form, *eg cropping photos, editing sounds, matching sounds and images*.

By the end of Stage 3, students should exhibit greater proficiency that may lead to sophisticated manipulation of processes and equipment, and creation of new applications for chosen techniques.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences that use audio-visual technologies.

Stimulating Activity

- Use stimulus pictures or sounds to arouse curiosity and stimulate investigation.
- Motivate students by using and creating personalised materials, *eg reports, pamphlets, using photos of students or photos taken by students*.
- Extend students' experiences by observing activities that cannot be seen first hand, *eg video material of a volcano, audio recording of a symphony orchestra*.
- Provide audio-visual records of working models or machinery as a source of ideas for designing and making.

Gathering Information

- Record excursions or school events, *eg using photos of places, people and events, audio recordings of sounds of the bush or factory.*
- Take photos of animals, structures, plants, physical features to enable more detailed observation and analysis.
- Record change through a sequence of images, *eg photos over a period of time, stop-motion or time lapse video.*
- Make selective tape recordings of particular sounds, *eg warning signals, transport sounds.*
- Interview other people using audio or video tape.
- Explore phenomena, *eg use overhead projector (OHP) to investigate light and shadow, shape and size; dismantle a speaker to observe vibrations caused by sounds.*
- Record steps or stages of a process, *eg photos used to recall and summarise.*
- Make a record of work, *eg products such as puppets, posters, experiments, dramatised activities or steps taken in investigating or designing and making.*

Organising or Illustrating Information

- Make comparisons between sets of images or sounds, *eg discriminating between sounds, identifying differences/similarities.*
- Explore abstract concepts through annotated pictures, *eg strength, stability, change.*
- Develop language skills using photos, sound effects or moving images to support written language.
- Illustrate relationships, *eg use OHP to create flow charts of steps in a process or people involved in a production.*
- Provide directions for non-readers.
- Sequence events.
- Record activities to assess performance, *eg video tape a play rehearsal.*

Communicating

- Use a range of images to create a powerful message, *eg using photomontage, photo stories, sound sequences.*
- Create moods or atmosphere, *eg sound effects, project slides in a darkened room to accompany stories/reports, continuous projection of images behind dramatised action.*
- Present information to group or class, *eg using OHP, slide projections.*
- Document processes, *eg using comic strips, photo sequences.*
- Use images and sounds to complement or contradict text messages, *eg advertisements, posters, exploring irony.*
- Provide visual or aural evidence in support of an argument.
- Record live performances to share with others, *eg video or photos for visual performance or sporting events, audio tape for music performances.*

Useful resources

Curriculum Development Centre, Canberra, 1980, *Classroom Photography, Learning by Making Photographs*

NSW Dept of School Education, *Photos in Print*

NSW Dept of School Education, *Photo Sequences*

Butler, M, *Media for Kids: Print, Television, Film*

Gross, Y et al, *Film Animation for Schools*

Introduction

Computerised adventure games create a fantasy world in the real classroom. They provide a problem-solving environment. Adventure games vary from being structured, where there is only one correct path to follow, through to the totally open-ended game, where there are many different paths. In all adventure games there are set goals to achieve. The achievement of these goals involves the students in making decisions in order to solve puzzles and problems along the way.

The value of adventure games lies not so much in the games themselves but rather in the experiences they provide and generate for students. A well-chosen adventure game provides students with a relevant context for the development of problem-solving skills in an interactive learning environment.

Students will be involved in many stages of the investigation process. They will predict what might happen in the game and they will propose explanations and test them. Because an adventure game can be replayed, students will have opportunities to test new predictions that they may have developed. Students will use strategies and understandings to solve problems in the game. As they become better problem solvers, they will be able to apply these strategies and understandings to solve different problems. The concepts introduced by an adventure game can motivate the student to explore new areas of interest and study.

Some adventure games require students to create their own adventures, thus involving students in the designing and making process. For example, some games allow students to use an adventure shell in which they set the scene themselves and define their goals. There are also interactive story-writing programs which allow students to design and write stories with many different paths. These adventure stories can be printed in book form.

Adventure games are truly cross-curricular in nature. Good adventure game software provides a natural springboard for a variety of activities that give the students many opportunities to develop skills in logical and deductive thinking, problem solving, decision making and cooperating. These skills are in addition to those relating more specifically to the individual broad learning areas.

The effective use of adventure games requires skill and planning on the part of the teacher. Software must be selected carefully and examined thoroughly to ensure the suitability of the content. Activities need to be planned but should allow for flexibility. One of the greatest difficulties for most teachers is to minimise their intervention in the game itself. There will be times when students need assistance in achieving goals set in the game and times when they are best left alone. Teachers must try to limit themselves to providing help by asking questions, encouraging students to review what they have done and what they know, using a variety of resources and thinking logically and laterally.

Skill development

At Stage 1, students should begin working with adventure games and will be developing their skills in cooperating. They should begin to develop some problem-solving skills, such as recording their progress through the adventure, making decisions, taking risks and formulating their own solutions to problems.

By Stage 2, as students gain experience and develop a wider range of problem-solving strategies, they should begin particularising strategies to specific instances arising within the adventure game situation. Their writing skills should be developed as adventure games encourage students to record their progress as well as to motivate them to write in different genres.

At the end of Stage 3, students should have progressed from the ability to use basic thinking strategies, *eg simple deductions*, to the ability to apply sophisticated problem solving skills, such as building models to explain how something works.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

- Simulate reality by using an appropriate adventure game. Some adventure games often include a simulation. For example, the students might transform into the skipper of a racing yacht or become a seismologist endeavouring to predict the exact time and destruction force of an imminent earthquake.
- Discuss proposed explanations and other specific strategies that students are using in any part of the adventure game. Students verbalise about proposed explanations and other specific strategies used so that they become aware that they are using a specific strategy.
- Make analogies to other situations. The teacher's role is important in pointing out specific strategies that the students are using to help solve a problem in the adventure game. The teacher should help the student make an analogy to another remote situation where the same specific strategy or understanding might be used. When students begin making their own analogies, they are on the way to becoming good problem solvers.
- Be stimulated to take part in a unit of work. Develop a unit of work around an adventure game by negotiation or incorporate an adventure game into a unit of work to stimulate the students.
- Review what students have done and what they know, use a variety of resources and think logically and laterally. Teachers should limit their involvement to asking questions, providing analogies, suggesting strategies and encouraging risk-taking, but they should never give answers.

- Keep an accurate record of an adventure in the form of a journal. All adventure games require students to keep notes of some kind. Notes should reflect decisions made and places 'visited' within the game.
- Record movements on a map or diagram. Have students discuss the more successful ways of recording their journey. Discuss the need for accuracy and the possible consequences of errors. Relate this activity to map-making techniques in a commercial sense.
- Read 'twist-a-plot' stories and decide on the path to be followed. This will ensure the students understand the concept of multiple paths or options that are presented in adventure games. Students should then have opportunities to use an adventure shell to write their own adventure or use interactive story-writing programs.

Special considerations

ESL/NESB/Aboriginal Students

Some adventure games can reflect a multiplicity of cultural names because they allow users to put their own name into the game.

If an adventure game reflects a Western consciousness, then discuss this with the students rather than not using the game at all and hence, perhaps, denying the students a good learning experience.

Girls

Adventure games with violence in them are not attractive to girls. Violence is unacceptable in adventure games for boys and girls. Some games create unacceptable stereotypes for males and females. Some games are aimed at male players, *eg when the goal is to rescue the princess*, or the player must take on a pre-defined male role. Such games are unacceptable.

Useful resources

CEU productions:
Adventure games... A stimulus for creative minds
Using Adventure Games
Primary Guidelines
Software Evaluations

Introduction

Technology is used to control many of the electronic and mechanical machines and devices which people in a modern society have to deal with every day. These range from toys, watches, traffic lights and microwave ovens, through to a car wash and car manufacturing production lines. This strategy introduces students to some of the elementary concepts and processes used in control. To assist students in gaining an understanding of these concepts and processes, they should investigate real-life control systems and build one of their own.

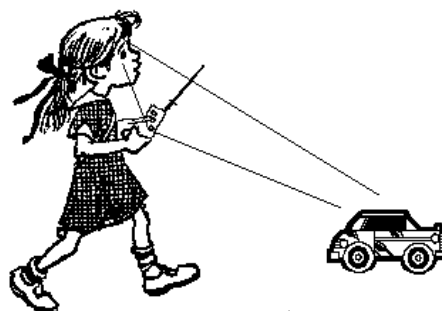
Students should understand that control systems are made up of two systems, one of which affects the behaviour of the other. One system contains **power** which drives a **mechanism** (eg *gravity enables the wheels on a billycart to move down a hill*) and the other system called the controller governs the first system (ie the person steering the billycart).

A **mechanism** consists of moving parts that perform some function, eg *the arms moving on a toy drummer*. **Power** is the energy that it gives to the mechanism, eg *the motor driving the arms to move*. **Control** is the governing of the power, eg *the cam in a toy drummer which controls how the arms will move*.

There are two types of control: **open loop** control (or feed forward) and **closed loop** (or feedback) control.

A **closed loop control system** uses some sort of **feedback** to control it. In the illustration the controller (the girl) is controlling the mechanism (toy car) that is powered by batteries. The **feedback** in this case is provided by the girl's eyes which constantly compare the actual state (position, course, speed) with the desired state (the place to which she wants the car to go). She will control the car according to the feedback she gets.

Other examples of closed loop control systems would be a microwave with a temperature probe. In this case the **power** comes from the electrical generator of microwaves. The **mechanism** is the device used for generating the microwaves and the **controller** is a



computer chip which records time, counts down and receives the signal from the temperature probe. The **feedback** comes from the sensor which is the temperature probe. Programmable toys are normally open loop control systems but sometimes they have a sensor on them that reacts when the toy hits an object and this sensor sends a signal to the controller to adjust its course. So in this case the feedback is provided or initiated by the sensor.

An **open loop system** has no feedback and is not fully automatic. A washing machine, a microwave without a temperature probe and a light that switches on at a certain time are all examples of open loop systems. These machines run through their programs without any variation and then stop. There is no feedback to the controller to change the course that the machine is going through. For example, a microwave will continue to cook something for as long as it has been timed even though the food may be cooked. However this microwave would be a closed loop system if a temperature probe was attached to the food to send feedback to the controller indicating when the food is cooked.

Skill development

By the end of Stage 1, students should be able to manoeuvre floor robots. They should be able to move the robot around obstacles and through a simple maze. Students should be able to understand what makes certain toys move, eg sound, winding mechanism, batteries etc.

By Stage 2, students should experience working with simple motors to power models that they have made from construction sets (including Lego Technics, Fischertechnics, etc) or other building materials. Students should begin to look at everyday objects, eg traffic lights, washing machines, elevators, etc and discuss the sensors that are controlling them, eg pushing the button (sensor) at the traffic lights causes the lights to change.

By Stage 3, students should have an opportunity to work with sophisticated components, such as motors and gears, to construct models and use computers to control them. They should be able to discuss the different parts of a control system (mechanism, power source and controller).

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

- Students use their senses as sensors. Students participate in activities that demonstrate that their senses act like sensors. When controlling a remote control toy, students use their sight as a sensor to give feedback to their brain which determines the desired place to which the toy should move. Students could be blindfolded and then asked to pick up a particular object. They would use their nerves as sensors to give feedback to their brain about position, shape and size of the object that they were asked to pick up.
- Investigate how traffic lights work. Students could observe the traffic lights at an intersection and discuss the sensors and the controller that are part of the traffic system.

- Learn about control technology and control systems by building and experimenting with different projects. Students design and build their own projects which can be controlled, eg a robot, traffic system, a floor buggy. Construction kits such as Lego Technics, Fischertechnics and Capsella supply a good range of sophisticated components, eg motors and gears. If students are familiar with using wood, plastics and sheet metal this could be a less expensive alternative. A floor buggy would be a simple robot device to design, build and control. The buggy is linked to a computer by a cable through which the motors receive their instructions and power. The buggy could have sensors on it so that when it bumps into obstacles, signals are sent back to the controller to change the direction of the buggy.
- Visit a factory or workshop where machines in use are controlled in some way. Students could observe machines at a factory, car wash etc and seek the controlling device and the different sensors used to send messages back to the controller.
- Create a database on controlled systems. The fields for the database could include open or closed loop, power, mechanism, controller, sensors, special features such as safety, efficiency, reliability etc.
- List the control systems in which computers are used, eg traffic lights, printers, disk drives etc.

Useful resources

Heinz Kurth, *Robots*

Richard Pawson, *The Robot Book*

Lego Technics, Fischertechnics, Capsella construction kits

Introduction

Telecommunication systems allow signals to be transmitted and received over long distances. They exist because people have a need to communicate with each other. To communicate there must be a message, the need to send that message, a means by which the message is transmitted, a medium through which the message is carried and a means by which the message is received and decoded.

Great advances have been made in telecommunications technology over the past decade. Australia, by virtue of its large internal distances and relative isolation from the rest of the world is, by necessity, at the forefront of telecommunications technology. Australia has several domestic satellites that service both Australia and the near Pacific countries. The telephone network in Australia is one of the largest in the world and Australia has the world's largest optical fibre communications network.

An example of telecommunications technology which is used extensively in schools is an Electronic Information Service. This involves sending of information between one computer and another, often by way of telephone lines. In this way, schools can use the computer in their school and their telephone line to send information quickly and efficiently to each other. They can also gain access to very large amounts of information stored on remote mainframe computers. Schools can use any computer, communications software, a modem and a telephone line to access this data.

There are many electronic information services available in Australia, including electronic mail, electronic bulletin boards and online databases. The electronic information service used by many schools in NSW is called Keylink.

Keylink allows users to communicate to other students in two ways: from mailbox

to mailbox and by accessing electronic bulletin boards. By placing one message on a bulletin board, any user can read and respond to the message. In this way, a group of students can request information from their peers without necessarily knowing beforehand to whom they are addressing their request. Information can come from any user who reads the message on the board.

Using the bulletin board allows students to collect information as a prelude to an investigation. For example, students who have an investigation in mind, such as how people spend their leisure time, could specifically post a notice on a bulletin board requesting this information, thus collecting information from a wider audience (including students from interstate and overseas).

Skill development

At Stage 1, students should understand that there is a need for appropriate telecommunications systems and that people use these systems to send and receive messages over distances. They will begin to understand aspects of electronic communications such as speed of delivery, time and distance.

By the end of Stage 2, students should begin to understand that one type of electronic information service is a mail system that can store and retrieve information (*eg their letters*).

By Stage 3, students should develop an understanding that people in our technological community rely on effective telecommunications systems. They should understand that Australia needs an effective telecommunications network because of its size and relative isolation. They should be able to use a range of telecommunications technologies for specific purposes, *eg using a bulletin board from an electronic information service as an avenue for reaching a wide and previously unknown audience*.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

General

- Explore the purposes of communication.
- Conduct a survey to find out how many students have relatives interstate or overseas. Find out how and why they communicate.
- Discuss the need to send emergency messages, what people use to call the emergency services and how they are used.
- Visit an emergency service establishment. Observe the operation of the communications systems.
- Role play an emergency situation where students make the calls, receive the message and contact the appropriate emergency service.
- Make a device that will send messages in code such as a morse code telegraph.
- Explore and experiment with sending messages to a person in another room and to other places around the school.
- Set up 'relay stations' so that the messages can be sent around corners or up stairs. What is the role of the relay station?
- Research the history of telecommunications and the various technologies that have been used. Create a database of the main discoveries in telecommunications.

Electronic Information Services

- Develop students' understanding of electronic communications by using off-computer activities.
 - Students could use a fuzzy felt board and cut-outs of a modem, micro computer, mainframe computer, satellite and cables etc. Students create different scenarios of sending information electronically, *eg two computers with two modems where the two modems are hooked together and one is put into answer mode and one put into send mode.*

- Students set up a class mail box and write and post letters to their classmates.
- Students could visit the post office and investigate private post boxes as being a good analogy with the Keylink mail box. The address on the letter is like the username, the key to open the mail box is like the password. The post office itself can be compared to the storage of information on a mainframe computer.

- Develop reading, writing and publishing skills whilst communicating with a large audience.

Students use an electronic mail service (Keylink) to communicate. When students write, their audience is usually limited to their classmates or perhaps their schoolmates, however, electronic mail offers a far wider audience — that of all registered users. Access to this large audience is possible without leaving the classroom.

- Collect information from a wide audience in order to carry out an investigation.

Students may have an investigation in mind, eg what hobbies do people have. They could specifically post a notice on a bulletin board to collect information about this.

- Send and receive responses instantaneously.

Electronic communication is very fast. Using more traditional forms of communication such as the postal service, students must wait a considerable amount of time for a response to their letter. The time needed to complete a project involving postal communication must, therefore, be quite lengthy. This often means that enthusiasm is lost by the time the response has been received. Using electronic communication, responses can be sent and received instantaneously.

- Use an electronic bulletin board as a wire service in order to simulate the publication of a commercial newspaper.

Primary students prepare articles for their school newspaper, using word processing packages on their computers. On a predetermined day they select two or three articles which would be of interest to a

wider audience and send these to the bulletin board. Any school can then read the articles on the board and select items to include in their own school newspapers. The paper is then published and distributed around the school and to other schools whose news has been used, *eg Newsday*.

- Survey the school and the local community to determine who has a FAX machine and who uses them. Locate public FAX machines and investigate how they operate.

Radio Services

- Investigate Citizens' Band (CB) radios, who uses them, why they use them and how far they can transmit and receive messages.
- Locate and question any HAM radio operators about the HAM network and possibly establish links with international HAM operators and students in other countries.

Special considerations

NESB/Aboriginal Students

When using an electronic information service students will:

- communicate with people in a variety of different communities
- write for a wider audience
- have a real purpose for writing, *eg swapping recipes, making a newspaper, making and investigating*
- have opportunities to further enhance their self-esteem and promote a positive image, especially in their ethnic identity, through such bulletin board projects as The Festival Recipe Book.

Special Education

Using electronic information services:

- allows the physically disabled to 'explore' and interact with their environment, *eg using remote electronic databases that allow them to do their shopping, banking etc, enabling them to function more easily*

- provides 'visible' language/communication for the deaf: they can have experiences with natural language patterns, including colloquial language, as they communicate with people from a wide range of locations
- gives students who are 'reading/writing reluctant' reasons to write and read. The motivation and ownership is high because the purpose and contents relate to their needs
- allows students to participate in Deaf Awareness Week (DAW), which is a bulletin board set up during this week for people to communicate their ideas, thoughts etc, while developing their computer technology skills
- complements other modes of communications such as letters, disks, photos etc
- allows participation in National Aborigines Week, which is a bulletin board set up during the week which celebrates NAW. This board gives Aboriginal students opportunities to communicate across Australia to one another. It gives Aboriginal students an opportunity to present their culture and ideas to all.

Introduction

Sound and lighting play important roles in many forms of presentation. Often the emphasis is on one element in isolation, *eg sound in radio/audio presentations, gathering information on tape or to accompany singing or musical items, lighting in still photography, for mime performances or in silent films/video*. Just as frequently we use a combination of sound and lighting to create desired effect: as in live performances, film and video production, or computer presentations.

Sound helps to create atmosphere and heightens dramatic action. Through the use of skilled lighting practices, moods, atmospheres and characters may be altered or strengthened as required.

For each application, particular techniques may be used. However the strategies listed can be applied equally to many of the suggested situations. It is important to remember that while the two elements are treated separately, they are often used in combination and have a degree of effect on each other.

Skill development

At Stage 1, students may begin identifying simple effects of sounds and lighting (including colour) in creating moods and feelings.

By Stage 3, students should be able to manipulate equipment and other resources to create both sound and lighting effects appropriate to a range of situations.

Managing learning experiences

Sound

- View a short dramatic film or video sequence without any sound. Watch the same sequence again with the sound turned on.

Discuss how sounds enhance the overall film effect. How do the sounds help build up the story, add atmosphere, mood and character?

- Discuss which sounds are natural and which sounds are added effects. Categorise those created using electronics, natural sounds, human voices etc.
- Collect a range of sounds from home and school using cassette recorder and microphone. Listen to sound effects records/tapes. Identify the sounds.
- Listen to an electronic keyboard's sound effects, a music computer or a sampling keyboard. Identify the sounds being re-created. Compare with recordings of the actual sound. Suggest advantages and disadvantages of synthesised sounds.
- Investigate the effects that can be created using musical instruments.
- Investigate how many useful sound effects students can create using their voices.
- Experiment making noises with every day objects, *eg cellophane screwed up in the palm of your hand sounds like a fire crackling*. Sound effects studios have trays of sand, water and twigs used to create sound effects after the pictures have been shot (*eg a person walking on a particular type of surface*).
- Collect a number of items from a 'Sound Effects Kit'.
- Catalogue sound effects collected from a variety of sources using an index system or computer.
- Investigate natural environmental sound distortions, including wind, echo and vibration.
- Investigate ways of manipulating or interfering with recorded sounds, *eg experimenting with bass and treble controls, speed controls, reverb and echo units, sampling keyboards*. Suggest ways these effects may be used.

- Select a scene from a film or video. Compose a short sound effects sequence to be performed to the image as it is viewed.
- Try using inappropriate sounds with particular actions. Discuss the effect.
- Listen to the music from a film sound track or piece of orchestral music.
- Identify and explore the use of specialised sound recording equipment, *eg 'boom poles' (long rods with the microphone attached to the end used for recording sound so that the microphone can't be seen), headphones.*
- Explore the differences between microphones, *eg directional, omni-directional, and radio microphones.*
- Identify any background noise that might interfere with recording your soundtrack, *eg planes, cars.*
- Visit a film/sound studio.
- Invite a sound engineer or Foley artist (someone who creates sound to be added to films or video after they've been shot) to visit your school.
- Produce a radio play.

Lighting

- Explore the effect of various lighting positions on a person's face or whole body or on a group of people. Positions may include lighting from the rear/back, side, above, below.
- Explore the effect of different types of light source, *eg reflected light (using white card or mirrors), candle light, torch light, fluorescent tubes, lamp light, moving light sources.*
- Compile a lighting resource book where students draw/record the effect that different techniques have on the 'look' of the subject. Use brief descriptions to record the way each technique creates mood, tension, atmosphere, *eg back lighting can create mystery by silhouetting a character or be used to disguise models, low front lighting can be used to create a horror effect.*
- Explore how light can be used to change the look of a scene or character.
- Examine photographs and how light is used to create particular moods and effects.
- Examine films that use lighting for strong dramatic effect. Most television and film studios try to use natural-looking lighting. Compare this with the use of light in horror sequences, advertisements etc.
- Record a series of brief sequences that use lighting to create given moods and atmospheres, *eg create a feeling of loneliness, horror, celebration, early morning, mystery etc.* Students may work as members of a small group or video unit.
- Experiment with placing plastics, fabrics and other materials in front of a light source. Observe how this changes the light. Coloured plastic sheets placed in front of a light source are called 'gels'.
- Evaluate which particular video exercises worked the best and why. Suggest ways the film exercises may be improved. Add suggestions to the resource book.
- When preparing film or video scripts, plan how the production should be lit. Consider natural, as well as artificial, lighting, positioning of light sources, use of gels or filters.
- Investigate how lights can be best hidden from view (on stage or when shooting film/video). Cords must also be hidden.
- Get to know the lighting requirements of cameras and film used, *eg cameras requiring a large amount of light because of low film speed, variation between video camera use inside and outdoors.*
- Investigate the requirements of different film type. (Film distributors will supply information sheets.)
- Complete a non-dialogue film which relies heavily on light to tell its story.
- Learn how to use a light meter.
- Invite a 'lighting person' to visit the class.
- Discuss the special lighting problems that may exist in outer space, under the water, in caves, in moving vehicles etc.
- Investigate the use of 'shadow' in film.

Useful resources

A cassette player or reel-to-reel recorder. Microphones (with windsocks if possible). 'Red head' lighting kit

Sound effects records/tapes (for use as example)

Film Data sheets are available free from the head offices of Kodak, Fuji (Hanimex) and Agfa Australian Film, Television and Radio School, *Teaching Resources Catalogue*

Introduction

Animating people, objects and images involves making them move or seem to move. This relies on 'persistence of vision', the ability of the eye to retain an image for a fraction of a second. A sequence of slightly different images appears without interruption if projected at a speed of more than approximately ten per second.

As the basis of all moving pictures, animation can be used to demonstrate how movement is recorded on film and video. Movies comprise a series of 'captured moments' or still pictures (24 or 25 frames per second) projected at a speed that makes it impossible for the eye to discern each image. An illusion of smooth, continuous movement is created. (Some 8mm film is projected at 18 frames per second.)

Although the computer is a different medium to film, computer animators use the same techniques of breaking a movement down into separate poses, each one like a still photograph. Computer animation is different to film animation in some ways. It is fast, and the ability to save and replay what has been animated makes editing easier. Many of the titles, station identifications, music videos and commercials seen on television have been created using computerised animation systems. Some animators draw by hand their characters and then use computer technology for highlighting as well as for registering the position and movement of the character. Refer to the strategy on Computer Generated Graphics for specific information on using computer graphics.

The intrinsic fascination of animated images lies in the ability to make the impossible happen. Students' ideas, experiences, toys, artwork can be brought to life and shared. There is almost no limit to the creative possibilities available to even the youngest of students.

As a classroom activity, animation is immediately accessible to all students once the basic principles are understood. The materials required for many varieties of animation are readily available in any classroom and simple film/video or computer equipment is all that is needed for more elaborate projects. Because animation relies on thorough preproduction planning, there should be little need for editing.

Students have the opportunity to work in a highly motivated, creative and cooperative class situation, where they develop skills in organisation, sequencing ideas and events, patience and working with others.

Animated film-making has an enormous range of applications. Films/videos can be made relating to work being done in any learning area or activity. It is a particularly useful method of students recording or demonstrating change over time, movement or a sequence of events.

Skill development

Beginning with simple optical 'toys' or devices, students can explore persistence of vision, how pictures appear to move and the variations needed in each image.

The simplest forms of animation include stop motion, pixillation and the use of 3D objects or single-piece cutouts.

As skills develop these techniques can be employed with greater sophistication. More complex techniques, such as jointed cutouts, progressive drawings and cell animation, can also be developed.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

Animation Without a Camera

- Make simple devices to explore persistence of vision, *eg thaumotropes or rolled paper flips*.
- Use or make optical toys, *eg phenakistoscopes — large discs containing a cycle of images, rotated and viewed in a mirror; flip books — a series of pictures quickly flipped to simulate movement; zoetropes — a cycle of images attached to a rotating cylinder and viewed through a series of slits between each image*.
- Identify the differences between each frame of 35mm or 16mm film, *eg examine pieces or project on OHP, act out the movement/changes*.
- Draw or scratch on 16mm film. Bleach used film to remove emulsion and use OHP pens to create sequences of images. Scratch patterns into the emulsion of used or black film, then colour. Screen using a 16mm projector.

Animation Using Film or Video

- Visit animation studios or artists.
- View a variety of animation films/videos using different techniques, *eg Captain Pugwash* stories use cutouts, *The Red and the Blue* uses animated plasticine. Identify the ways techniques are used, any special effects etc.
- Explore a wide range of animation techniques and combinations of different styles.

Cut outs — 2D objects drawn, decorated and cut out. Sections such as limbs can be hinged at the joints to enable movement. Various materials can be used to create different textures and effects.

Overhead projections — either coloured transparencies or opaque objects used to create silhouettes. Animation is achieved

by shooting the projected image in real time (as objects are moved out of shot) or frame by frame.

Progressive drawings — pictures drawn by adding a line or stroke between each 2/3 frames shot. Pens, pencils, paints, chalk and a variety of other media produce easy and effective results.

Time lapse or stop motion — condensing hours of action into seconds of film/video by shooting only a small amount of action at given periods, *eg* to record the growth of a seedling, building a house, the setting sun. The camera is set in a fixed position, *eg* on a tripod, and a few frames are shot each hour, every ten minutes, daily or as appropriate. On playback the change or movement is accelerated.

3D objects — toys, blocks, buttons, pencils, string and other everyday objects can be animated to do anything students can imagine. Each figure or object is moved slightly between shots.

Modelling materials — any materials that are easily moulded bit by bit make excellent and available subjects. Characters can be built up, made to change shape, move etc.

Pixillation — real people, animated to do the impossible, create interesting effects. Climb stairs without moving your feet, travel the playground sitting down, pop in and out of the picture etc. Between each shot the subject moves to a new position. Both camera and subject are still when the image is recorded.

Cell drawings — individual drawings, each slightly different, are shot in sequence. If using transparent cells, several layers can be employed, *eg* for backgrounds, character outlines, facial features. The cells need to be 'registered' to ensure they are each shot in the same position.

- Explore different types of animated movement, *eg changes made to the actual object/picture, changes in their position*.
- Test ideas for film/video/computer animation by trialling sequences using flipbooks or other simple devices.

- Examine commercial cartoon characters and identify how they are drawn. Generally they are simple enough to be drawn many times, *eg study a drawing of 'Mickey Mouse' and note how his head is composed of easily repeatable circles.*
- Divide the class into 'art teams', each responsible for one aspect/character of a more elaborate class production. This may include creating and controlling a character during shooting.
- Practise the movements of subjects (real or models) before the shoot, rehearsing both where and how far to move with each shot.
- Create cycles of movements for often repeated actions, *eg walking legs, waving.*
- Experiment by varying the number of shots used, to change the speed of action. The greater the number of moves between two points, the slower the movement appears.
- Compare shooting the same sequence on film and video. Identify the disadvantages and advantages of each.
- Use different backgrounds to create desired moods, stories etc. Experiment with moving the background while keeping the characters still.
- Plan an animated story using similar procedures to other video/film production, *eg storyboard, shooting script.* Details of each moving character need to be recorded.
- Add a sound track incorporating voice-over narration, sound effects, music and even character dialogue. In animated films, sound for any spoken dialogue must be recorded first and then mouth movements animated to match the appropriate length of time.
- Research the history of film animation.

Useful resources

Halas, J et al, *The Technique of Film Animation*

Focal Press, *Shooting Animation*

Wilson, S et al, *Puppets and People*

Da Silvy, R, *The World of Animation*

Solomon, C, *The Complete Kodak Animation Book*

Laybourne, K, *The Animation Book*

Australian Film, Television and Radio School, *Teaching Resources Catalogue*

Video camera, tripod, copy stand lights, monitors, video recorder, Super-8 camera, copy stand, Super-8 and 16mm projectors, screen.

Introduction

Student publishing activities should include both studying and making publications.

By studying publications, students can investigate:

- the variety of publications and their purposes (*eg picture books, novels, magazines, newspapers, manuals, textbooks, brochures*)
- how publications are developed for different audiences (*eg appropriate content, reading level, visual style*)
- the techniques and technologies that are used in publications (*eg photojournalism, fashion photography, factual reporting, commentary, word processing, typesetting, illustration, computer generation and transfer of material, printing and binding*)
- who makes publications (including production, marketing and distribution) and why they do it.

By designing and making publications, students learn ways to record, develop and share their observations, ideas, beliefs and feelings. For example, to record their perceptions of the world, students may need to engage in discussion, planning, drawing, interviewing, making annotated sketches, keeping diaries and taking photographs. Focus questions at an appropriate level for the students can be particularly useful for students to clarify the ways they record their observations.

While engaging in the processes of making these personal records, students will begin to develop judgements about those things they are observing. These interpretations can form the basis of a critical appraisal whereby students give their opinions about the things they are viewing, justify these opinions in their own words and decide whether they need to undertake further investigations.

Techniques for critical appraisal appropriate to primary students include:

- annotating sketches and photographs, and
- filling in sheets with columns in which students record their observations (either visually or verbally) in one column, make judgements about these observations in the next and explain and support these judgements in a third column.

The work that students do in planning, observing, discussing, recording and appraising will generate material that will allow students to engage in purposeful publishing activities. These publishing activities require students to determine:

- their intended audience
- how they wish to address this audience (*eg to persuade, inform, amuse, entertain*)
- criteria for selecting appropriate material for the publishing activity
- how they will use this material to produce a print media product for a particular audience (*eg a school newspaper, a class book or a poster*).

For some publishing activities handwriting and drawing will be appropriate, but others will require or benefit from more sophisticated production which could include the use of photographs and typed material and the assembling of many materials into a layout.

Computer technologies can be useful in publishing activities, particularly when more sophisticated production is required. At the simplest level, text, including titles and captions, can be developed on a word processor. This not only allows students to revise their writing as they proceed from recording to appraising and then to using this material to develop a publication, it also allows them to adjust the way this text is presented (*eg changing the width of the text so that it can*

be pasted onto a sheet in more than one column, or so that images can be incorporated with the text). More specialised computer software can allow students to assemble a greater part of their publication on a computer (*eg combining text in multiple columns with computer graphics—preferably graphics produced by the students—and possibly incorporating students’ illustrations and photographs through scanning and digitising*). If appropriate desktop publishing software is available to students, it will allow them to more easily investigate alternatives in layout and to continue to process text during the layout stage.

Skill development

Stage 1

Students should recognise that there are many types of publications and these are often produced for different audiences. They should also realise that publications are prepared by assembling many elements (words, images, graphics, paper, inks, binding and covering materials).

Students should be able to combine images and text to communicate ideas.

Students should be able to use a simple word processor to enter and edit text.

Stage 2

Students should recognise how publications are made to suit different audiences (*eg content, visual and verbal style, marketing*).

Students should be able to use computer software both to write and edit text and to

manipulate text into an appropriate format for a publication (*eg use of bold, italic and underline; sizes for text, captions and headings; appropriate width of text for intended publication*).

Stage 3

Students should be able to predict and/or select the elements that will make a publication suit a particular audience.

Students should be able to select appropriate computer software to process words and images for a publication.

Managing learning experiences

Although in publishing activities students should engage in exploring, preparing, recording, interpreting and communicating, many of these processes will occur concurrently. Managing learning experiences in publishing activities requires teachers to be aware of the different elements that are required and ensuring that each of these elements is present. Publishing activities will be most valuable to students when they are directed at allowing students to represent and communicate their world of experiences, beliefs and understandings.

Useful resources

Adams, E and Ward, C, *Art and the Built Environment*

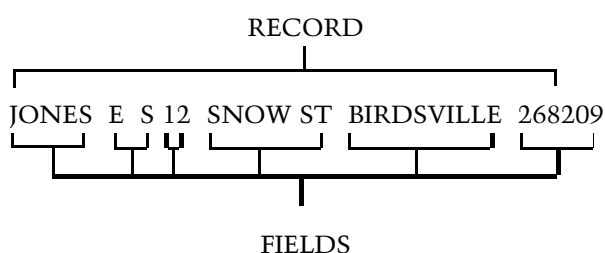
Introduction

A database is a collection of information which is related and which can be organised and manipulated.

The information in databases is organised in a particular way. **Records** are a collection of information related to a person, object or animal. Each record is divided into **fields** which contain particular information about that person, object or animal. The content of each field is **data**.

A recipe file, a telephone directory and a library catalogue are databases. It does not matter if the data are stored on cards, in a book or as a computer file: the concept remains the same.

When using the example of the telephone directory, the information about each person is the record. Each record is divided into the fields of surname, initials, address, and phone number, eg



When students are investigating databases they will be provided with many opportunities to develop these skills.

Students will be engaged in the process of designing and making when they are constructing a database. They will need to make decisions about the most appropriate field names, about consistency of data and exactly what data go into the database.

By computerising databases, more information can be stored and it can be handled more quickly. Also the user can manipulate the data in more ways. For example, assuming a

school has a database on Australian birds and a student requires information about birds that eat meat and are found along the eastern coast of Australia, a database containing this information would quickly yield a list of birds meeting the criteria.

Skill development

At Stage 1, students begin to learn that databases, like books and matrices, are a means of storing information. Students need to develop specific skills that relate to the retrieval of material stored in this way.

By Stage 2, students would be able to add data to a teacher prepared database and begin to understand terms such as 'field', 'data', 'record' and 'sort'. They will begin to select and sort data according to a single criterion search, eg *what do kookaburras eat!* At this stage they will be able to design a simple search strategy for a specific purpose. They will be able to interpret data.

By Stage 3, students should be encouraged to design databases and design a search strategy based on at least two criteria, eg *birds that eat meat and live on the east coast of Australia*. They should have opportunities to interact with a remote/online database. Students should be encouraged to question the accuracy of data. Advanced students will use databases to test proposed explanations, eg *all birds eat meat*. They should interpret graphs that have been generated by a database.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

- Sort data into fields and use data to form hypotheses.

- Design personal profile cards on cardboard and make decisions about the fields that need to be included in each profile card (record), *eg name, sex, hair colour, favourite food etc.*
- Read profile cards and discuss the information to decide to whom the card belongs.
- Form and test hypotheses using the data, *eg all students with blond hair have blue eyes.*
- Demonstrate the function of a computerised database file and the need for consistency when entering data.
- Demonstrate a prepared database to students so that they are aware of what a computerised database looks like, *eg The Solar System, Australian Lizards Database.*
- Use a database program to prepare a blank record card using the fields suggested by the students (name, sex, age etc).
- Discuss the need for consistency when determining the rules for data entry. The computer is unable to interpret the students' meaning. Students must say exactly what they mean, *eg some students' entries in the field of sex may vary from female, girl, w, f, g etc, so that when a search is made for female, the computer will only find those entries which actually say the word female when, in fact, the student requires the other entries as well.*
- Students record their own information into the blank database record.
- Sort and search the records in the database, *eg age equals seven and hair equals brown. If there is a paper copy of the information, demonstrate the speed of sorting by having a race against the computer.*
- Use a database to write a report.
- Prepare a set of questions that could be answered from their personal profile database such as 'How many girls have brown hair and brown eyes?'
- Students estimate the answer to each question then check their estimate against a database search.
- Students prepare a text-based response to their questions. A prompt sheet might be helpful, eg:
Our question was...
We thought the answer might be...
We tested our guess by...
and we found that...
- Use a prepared database as a research tool, *eg students use prepared databases such as The Solar System, Weather Patterns, Volcanoes, Census Information, to gain access to an extra resource for their units of work or own topics of interest.*
- Prepare activities for students that involve them in interrogating those databases to gather data.

Useful resources

Databases CEU, *Finding Out*

CEU, *Using Educational Databases*

DISCUSSION CEU, *Information Handling...Skills for a New Age*

Introduction

Film or video production can take many forms and be used for many purposes, *eg making advertisements to sell a product or idea, recording events, aiding observations, expressing ideas, entertaining people, communicating information.*

Throughout production activities students will gain skills in organising images, sound and language. This involves making decisions about what to include in their images, how pictures and sounds can be created and how these relate to selected forms and conventions of language.

All activities rely on investigating the methods of creating images and sounds, and on a firm knowledge of the capabilities and limitations of equipment and software.

A good source of ideas to motivate and inform students is their own observation of and interaction with mass media products, from cartoons and ads to news and drama. Each type of program is characterised by a range of techniques which can be used as a stimulus and model for students' own work.

Video or film production involves the combination of several crucial aspects, *eg story or ideas, camera and sound techniques, props, setting and costumes, planning and editing.*

Skill development

At Stage 1, students should investigate and create 'still' pictures, selecting their content and exploring the effects of colour, texture, arrangement of people etc. Early use of video, with teacher assistance and direction, enables familiarisation with equipment, safety rules and maintenance.

By Stage 3, students should be able to participate in a group production, undertaking a variety of different roles in the process and

have a working knowledge of the function of equipment and the skills of designing, making and selecting images, sounds and language.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experience.

Story, Scripting and Planning

- Explore a wide variety of program types, from advertisements, music clips, or news to suspense thrillers, comedy or animation. All involve similar basic processes, with variation in specific applications of techniques.
- Prepare a plan, treatment or description of ideas.
- Collect a variety of video/TV/film scripts and explore their features, *eg directions written in, information regarding sound effects, voice tone etc.*
- Develop a script that includes dialogue (if needed), details of setting and action.
- Create a storyboard to organise the pictures and how they fit the script. Use simple drawings (even stick figures) to indicate the size, angle and content of the shot planned.
- Match dialogue and any sound effects or music to the pictures and write details alongside.
- Ensure that sound requirements are planned as carefully as the script and pictures.
- Encourage students to try out a range of techniques before making too many decisions.
- Have students shoot some ideas and play them back, trying to be critical in order to discover what 'works' to achieve the effect wanted.

Camera Features and Techniques

- Students should make the video or film productions short, maintaining the interest of both producers and audiences.
- Students should familiarise themselves with the camera features and operations, *eg set up a video camera, with a monitor, in the classroom and have pairs of students explore and experiment with the camera during other class activities.* This also provides opportunities for students to become used to seeing themselves on screen.
- Use the focus to avoid fuzzy images when zooming. Automatic focus should be avoided, if possible, as it takes a disconcerting few seconds to respond to a change in framing.
- Introduce standard shot sizes, ie close up (cu), mid shot (ms), long shot (ls), very long shot (vls), and find examples in magazines etc.
- Investigate the amount and type of information in pictures of different shot size or framing, eg a close up (cu) gives you facial expression and detail. To 'set the scene' longer shots (ls or vls) are needed to provide background and information about the setting.
- Explore the effect of changing the shot size or creating differently framed images, *eg using simple framing devices or the zoom ring on the camera.*
- Explore the use of the zoom and encourage practice of slow, smooth movement.
- Explore ways of moving from one shot to another, *eg the zoom allows you to move from one shot size to another but overuse is irritating and slows down the action.* A cut between shots gives you more control over the pace of the video as well as being easier to watch.
- Investigate the ways the camera can be moved, *eg hand-held, on a tripod or stand.*
- Demonstrate panning (moving the camera from side to side) and tilting (moving up and down).
- Discover the most pleasing ways of effecting camera movements, *eg slowly and smoothly.*

- Explore, by observing video products and experimenting with framing devices, how objects and people can be made to look taller or smaller.
- Identify low angles (used to make people or things look taller and menacing!), high angle (for the reverse), shots taken from the side and the back, as well as from the front, and explore their effect.
- Watch videos of different types and identify the camera movements, angle and shot sizes used, *eg mystery or thriller will use longer, slower shots to build up suspense; a music clip might have lots of fast, zappy images taken from all sorts of unusual positions or angles.*
- Complete short exercises in creating a required mood using various camera techniques.

Sound Techniques

(Refer to Teaching Strategy on Sound and Lighting)

- Listen to video programs and identify the sounds used, in addition to dialogue and music.
- Suggest places where sound effects could be used to add to the production.
- Explore ways of creating or obtaining sound effects, *eg recording real sounds, using sound effects tapes/records, creating the effects using instruments or everyday objects.*
- Refer to instructions to find out how the microphone system works and practise using it properly.
- Explore the features of sound recording software, *eg video tapes have two sound tracks—one for dialogue and sound recorded at the same time as the pictures, another used to add special effects or music after editing the images.*
- Listen to different types of music and explore the ways they are used to create atmosphere, build tension etc.
- Select pieces of music to complement the action of the film/video.
- Investigate the legalities of using recorded music and consider this in students' choices.

Props, Costumes, Sets

- Observe how props and settings are used to create different characters or images of people, places and events, *eg laboratory setting, people in white coats, test tubes etc, all convey a sense of objectivity, credibility etc.*
- Decide on the sets, costumes and props that are appropriate for the desired effect and collect or create them using appropriate and available materials.
- Experiment with lighting to create a variety of effects, *eg spot lights, flood lights, coloured cellophane, overhead projector.*
- Explore natural lighting available at different times of day and reflect upon the effects created.

Editing

- Explore how editing can be used to get rid of any mistakes or alter the pace or tension of the plot, *eg count the number of 'cuts' in a film or video program and compare different types of program.* (A lot of short shots gives a sense of fast-paced action. Lengthy shots, where the camera moves around in a scene, slow things down and build up tension.)
- Ensure students are proficient in the use of editing systems, *eg VCR to VCR for simple editing, editing suites, if available.*
- Visit professional editing facilities and discover methods used.
- Add additional sound tracks, if appropriate.

Introduction

A **computer-generated graphic** is a representation of an idea in a pictorial form. It can be edited and customised and stored for later use. Computer-generated graphics come in many forms. There is a wide range of applications of computers to graphics. Some software allows the use of more than one application.

Poster and Sign Creation

These allow the creation of posters, signs, cartoons etc from a bank of prepared graphics already stored on the disc. They may be altered within the package. The package usually allows for some sort of layout of components. The graphics may be used within the package or it may be possible to use them in other packages. Other uses of this application include the creation of cards, signs, labels and resource materials. Some software packages enable whole documents to be published by combining text, cartoons, graphics etc. More detail about desktop publishing is located in the strategy on publishing.

Draw and Paint Packages

These allow users to draw or paint their own graphics using a mouse, graphics tablet or joystick. Draw packages usually offer more precise/technical drawing facilities than paint packages. There are a variety of tools for drawing available. The draw and paint applications can be combined with prepared graphics, thus allowing the user to customise graphics.

Digitising

Video digitisers attached to a computer allow video (TV) pictures to be captured as computer graphics. The resulting computer image can then be modified by using computer graphics software, particularly painting software. The video picture could be from a VCR, directly from television or from a camera, and can be

used to obtain computer images of real world objects.

Programming Languages

The most basic way of creating a picture with a computer is to write a computer program. The computer programming languages BASIC, Logo and Pascal all provide graphic functions. Being able to create pleasing images through the use of a few powerful yet simple commands is highly motivating for all students.

Graphs

Software is available that allows the user to create different types of graphs, eg column, bar, line and pie graphs from tables of numbers. This software is usually integrated with spreadsheet or database software.

Animation

Animation software assists the user in the creation of image sequences. The image is animated on the computer screen. These animated sequences can be stored and shown on the computer or on video tape, where they can be mixed with video images. By using an animation program many of the normally tedious and repetitive tasks can be accomplished easily and quickly.

Skill development

At Stage 1, students should be able to create signs, posters and construct monsters, masks, faces etc using *graphics packages*. They should have opportunities to manipulate (moving and placing graphics to desired position) and modify stored graphics. Also, from an early age, students will be able to combine graphics with word processing by using appropriate software packages.

By Stage 2, students should have opportunities to use a variety of graphics creation tools when using draw and paint software. They should be able to modify stored graphics and

be able to use appropriate graphics for a given theme.

At the end of Stage 3, students should be able to import graphics between software packages. They will be able to use appropriate software to make slide show and animation presentations.

Managing learning experiences

Listed below is a range of strategies which teachers can use when planning and managing learning experiences.

- Provide opportunities to develop an understanding about manipulating graphics. Students can use graphics construction software to design and make a mask. They can construct masks that demonstrate expressions of different emotions. Students select face shape, nose, mouth, eyes and so on from a graphics bank and move these features to the most suitable position on the mask. The masks can be printed and used for a variety of purposes.
- Create resource materials using graphic packages. Students could use packages that contain a large bank of pictures or use packages that allow them to add text to graphics before printing them. Printed pictures could be used to decorate future work, to make badges or they could be used in sorting, classifying or pictograph activities.
- Use cartoon software to express a point of view or to illustrate depth of knowledge and understanding of a particular topic. Students may design and create a cartoon strip or single frame cartoon, using appropriate software, to promote a topic, eg a healthy lifestyle. Students can select the character they need, add a background and selected 'props'. Headings and speech bubbles can also be added and the finished cartoon printed out.
- Use software packages that allow graphics to be incorporated into written work for the production of material in a newspaper. By using this type of software students can enhance the appearance of published work.

The students will be able to edit and resize the graphics to meet the particular need or the format of the newspaper. Students manipulating graphics in this way develop a clear understanding of the inter-relationship between the software packages and the hardware as well as of the actual mechanics of the publication process.

- Use draw and paint programs to make a graphic representation or map. Students prepare a graphic representation of a particular area such as their classroom, or school environment, using a paint or draw program. Students still practise and develop the fundamental skills involved in carrying out this activity manually, but by using computer software they are able to make changes to their work and correct errors without destroying the whole work or spoiling its appearance with visible remnants of corrections.
- Modify commercial graphics. There are graphics packages that allow students to select a standard picture or graphic and edit it to meet their own needs. The edited or customised graphic can be saved and further edited at a later date, thus increasing the resource bank and the usefulness of the original package. Customised graphics can be useful in illustration reports or any writing or research task.
- Design a slide-show presentation on the computer to illustrate a design proposal. Students create a storyboard to demonstrate their ideas for the sequence of pictures. The script and description of sound effects are included on the storyboard. Students use a paint or draw program to produce 'slides' on the computer, modifying and manipulating the graphics to suit the needs of the presentation. Use a slideshow program to sequence and time the slides. The slides will automatically flip to the next slide. Record the script and the sound effects in time with the slideshow on the computer. The computer and audio can be combined and recorded onto video.
- Manipulate, modify and copy graphics to create a 'flip book' cartoon. Students create the basic 'slide' that they want for the background and print it. Copy this graphic,

enlarging or moving it slightly to create the second slide and print it also. Continue to copy the graphic, moving, enlarging or shrinking it slightly each time. Print out each new slide. When 10-20 slides have been created students hold them together, in order, by the bottom edge and quickly flip through the stack. This will give the effect of movement. This activity is well suited to computer technology because it eliminates the need to redraw the basic graphic for each slide.

- Use an animation or paint program to demonstrate a life cycle. Students will create a storyboard about the sequence of events. They will make decisions about what the graphics will look like and whether they

will use commercial graphics and modify them or draw their own graphics. As with the activity of the 'flip book' students will be able to create a background slide and repeat it for each sequence. Students can eliminate the tedious duplication of images by copying and pasting pictures. If they are using some paint programs they could select an image and create a brush and thus produce multiple copies of that image. The students then animate their sequence of events using the facilities of the program and show them on the computer or on a video. Sound and text could be added using a presentation program or the facilities within the package itself.

Suggested resources

Books

- Adams E et al *Art and the Built Environment* Harlow: Longman Group Ltd, 1982
- Adams, V et al *Skateboarding is Not a Book* Ringwood: Penguin Book Ltd, 1989
- Addison Wesley *Skills Guide for Teachers* USA: Addison Wesley, 1989
- Ainley, D *Science Problems to Investigate* Cambridge: Cambridge University Press, 1987
- Aitken, J *Creative Technology* Melbourne: Brooks Waterloo, 1988
- Amery, H et al *Batteries and Magnets*
- Anderson, H et al *Keeping Small Animals* Gosford: Ashton Scholastic Pty Ltd, 1988
- Anderson, J *Spare Parts for People* Melbourne: Thomas Nelson, 1989
- Australian Broadcasting Commission *Buildings* Australian Broadcasting Commission, 1989
- Australian Institute of Aboriginal Studies *40,000 Years of Technology* Canberra: Australian Institute of Aboriginal Studies, 1982
- Balding, J *Springboards* Melbourne: Thomas Nelson, 1980
- Barman, et al *Science Skills Guide to Teachers* Menol Park: Addison Wesley Pub Co, 1989
- Bassett, A *Making a Record* Auckland: Shortland Publications Ltd, 1988
- Bolton, F et al *Animal Shelters* Gosford: Ashton Scholastic Pty Ltd, 1989
- Braithwaite, A *Five Senses* London: Dinosaur Publications, 1985
- Brown, R *The World that Jack Built* Fitzroy: ACF Books
- Burt, E *Natural Materials* Hove: Wayland Ltd, 1989
- Butler, M *Media for Kids: Film* Gosford: Ashton Scholastic Pty Ltd 1989
- Butler, M *Media for Kids: Television* Gosford: Ashton Scholastic Pty Ltd 1989
- Butler, M *Media For Kids: Print* Gosford: Ashton Scholastic Pty Ltd 1989
- Carin, A et al *Teaching Science Through Discovery*, 1985
- Catherall, E *Light and Dark Hove*: Wayland Ltd, 1985
- Chapman, P et al *Introduction to Science* Melbourne: Brooks Waterloo, 1983
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- Cobb, V *Science Experiments You Can Eat* Harmondsworth: Penguin Education, 1974
- Cole, J *The Magic School Bus Inside the Earth* New York: Scholastic Pty Ltd, 1987
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- Computer Education Unit *Finding Out About Databases* Computer Education Unit
- Computer Education Unit, *Information Handling Skills for a New Age*, DISCUSSION CEU, 1989
- Computer Education Unit *Using Adventure Games* Computer Education Unit, 1985
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- Curriculum Development Centre *Classroom Photography* Canberra: Curriculum Development Centre, 1980
- Curriculum Development Centre *Learning by Making Photographs* Canberra: Curriculum Development Centre, 1980
- Curriculum Development Centre *What Picture* Canberra: Curriculum Development Centre, 1980
- Cooper, D *Domestic Electricity* Oxford: University Press, 1988
- Cox, D et al *Grounds for Learning* Surrey Hills: Dellasta Pty Ltd, 1990
- Dalton, J *Adventures in Thinking* Melbourne: Thomas Nelson, 1985
- Drew, D *Tadpole Diary* Sydney: Methuen Pty Ltd, 1987
- Duffy, H et al *Greenhouse Alert* Surrey Hills: Dellasta Pty Ltd, 1990
- Dunn, S *An Introduction to Craft, Design and Technology* London: Unwin Hyman, 1988
- Dunn, S *Design Technology – Children's Engineering* London: The Falmer Press, 1990
- Edwards, A et al *Investigating Classroom Talk* London: The Falmer Press, 1987
- Erickson, A *Students, Structures and Spaces* USA: Addison Wesley, 1983
- Fagan, M (edit) *Magnets to Dynamos* London: Franklin Watts, 1989
- Fairely, A *Australian Seasons* Sydney: Methuen Co, 1981
- Feely, M *Science at Play* Surrey Hills: Dellasta Pty Ltd, 1990
- Freer, K et al *Tracks in Primary Science* Melbourne: Cambridge University Press, 1990
- Focal Press *Shooting Animation* London: Focal Press, 1978
- Forman-Anderson, M *One World* Fitzroy: ACF Books
- Fredericks, A *Think About It: Science Problems of the Day* Cheltenham: Hawker Brownlow Education, 1989
- Friends of the Earth *Hazardous Chemicals* Sydney: Friends of the Earth
- Friends of the Earth *Household Ecology* Sydney: Friends of the Earth, 1990
- Galletly, M *Faces* London: Franklin Watts, 1987
- Good, K *Starting Craft, Design and Technology* Oxford: Heinemann Educational, 1989
- Gould League *Environmental Explorer*
- Gould League *The Urban Book* NSW: Gould League, 1981
- Gould League *Urban Survival* NSW: Gould League, 1981
- Graham, A *Let's Go to a TV Studio* Bath: Cherrytree, 1990
- Graham, R *Bridges* Hove: Wayland Ltd, 1986
- Green, C *The Humpback Whale* London: Macmillan Co, 1989
- Gross, Y et al *Film Animation for Schools*
- Halas, J et al *The Technique of Film Animation* London: Focal Press, 1976

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- Hammond, T *Sport* Sydney: Collins Australia, 1990
- Harris, G *Hunter of All Seasons*
- Haslen, W *Primary Science: Taking the Plunge* Oxford: Heinemann Educational, 1985
- Heinze, K *How Does Your Garden Grow* Hawthorn: The Five Mile Press, 1985
- Hill, S & T *The Collaborative Classroom* Melbourne: Eleanor Curtin, 1990
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- Hope, C *Themes from the Playground* Melbourne: Thomas Nelson
- Houghton, G et al *Cities and Industries* Melbourne: Macmillan Co, 1990
- Houghton, G et al *Energy and Natural Resources* Melbourne: Macmillan Co, 1990
- Houghton, G et al *Water, Soil and Air* Melbourne: Macmillan Co, 1990
- Hunt, H *The Puffin Book of Australian Insects* Ringwood: Penguin, 1990
- Industry Council for Packaging and the Environment *Packaging* London: Franklin Watts, 1990
- Isaacs, J *Australian Dreaming: 40 000 Years of Aboriginal Dreaming* Sydney: Landsdowne Press, 1980
- Isaacs, J *Bush Foods: Aboriginal Food and Herbal Medicine* Sydney: Weldon Press, 1987
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- Markle, S *Science Sampler* Cheltenham: Hawker Brownlow Education, 1989
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