Is technology appropriate?

In 1998, the Technology Unit of the Curriculum Support Directorate worked with five primary teachers and five secondary technology teachers to investigate how appropriate technology principles and strategies could improve teaching and learning in Science and Technology in primary schools and in design and technology in the secondary school.

The teachers involved in this action research project were each given a copy of the resource kit, *Appropriate Technology: Designing the Future*, five relief days and curriculum support from Julie King, Project Officer in the Curriculum Support Directorate. The teachers applied teaching strategies from the kit to an existing, planned unit of work.

The primary teachers involved were:

Greg Clarke, Ambarvale Public School

Neville Fraser, Bilgola Plateau Public School

Julie Kennelly, Thalgarrah Field Studies Centre

Kathy Lang, Granville Public School

Penny Neromiliotis, McCallums Hill Public School.

A comment from one of the teachers involved in the project sums up the value of appropriate technology in Science and Technology.

> It was enlightening to the students that there is more to technology than just computers. There is constant talk and debate in my classroom now about what may and what may not be technology … For once they did not mind getting something "wrong" and going back to "fix" it. They came to understand that it was not "wrong" but rather that refining and more thinking were necessary. My students are now asking me: "What are we doing for Science and Technology this term?".
>
> Penny Neromiliotis, McCallums Hill Public School

What is appropriate technology?

Technology is an important part of the lives of people in all societies.

The teacher reference book, *Make the future work*, provided in the kit, defines appropriate technology as "technology which, in its creation and use, meets human needs while considering the short- and long-term consequences for the society and the environment" (page 9).

Products, systems and environments are typically valued for how they work (their function) and how they look (their aesthetics). Appropriate technology also involves considering the impacts on and benefits for society and the environment of the design, production and use of the technology.

What does appropriate technology mean for teaching in Science and Technology?

In the Science and Technology K–6 syllabus, students are required to learn about and be involved in processes of designing and making and the use of technology. Technology learning experiences provide outstanding opportunities for students to develop creativity and technical competence, whilst considering and being responsive to social and environmental needs.

> It is yet another myth that it is necessary to teach students the technical skills first, and then the moral "extras" afterwards. Technology cannot be separated from the responsibility that goes with it. If technology teaching is to truly reflect our technological society, then the responsibility of the designer must be taught from an early age …
>
> The key to teaching and learning activities at the earliest levels of the curriculum is to link designing, making and living.
>
> (*Make the future work*, page 25.)

Technology experiences in schools should assist students to think about questions of appropriateness. Who has designed it and for whom? Who benefits? Why? Upon whom or what does it impact and why?

Who or what is most important and why? Is there another way it can be done better?

What teaching strategies support appropriate technology?

The kit presents ideas about a range of teaching strategies which can assist students to evaluate benefits and consider long- and short-term consequences of design and production. Some of the strategies in the kit are widely used in schools, for example brainstorming and PMI charts (see below).

Below are just some of the activities which teachers used in their action research projects.

The services and products in our community

Penny Neromiliotis, McCallums Hill Public School, developed a unit for her Year 5 class, *The services and products in our community*, which investigated gender issues.

Unit outline

Using a technology audit, students investigated what recreational facilities were available at the school. They then decided whether or not the school catered for both genders equally with regard to recreational facilities. They responded to this by designing and making a recreational centre or recreational facilities for the school. They drew a plan — their vision of the future. Finally, students evaluated and appraised their peers' constructions through a PMI.

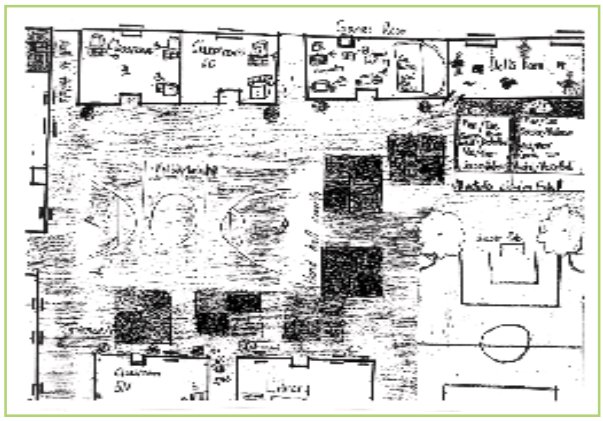
Technology audit

Photographs were taken of the recreational facilities found at school using the school's digital camera. Then, in small groups, the students completed an audit of the equipment, using the five evaluation criteria for appropriate technology identified in the kit: culture, environment, gender, energy and ethics. All groups were able to identify quite simple social and environmental impacts. They thought about and generated discussion about the ethical impact of the equipment that they were evaluating. The class really enjoyed the investigative and cooperative nature of this activity.

Vision of the future

The next stage in the unit was the design and make phase.

Vision of the future involves students imagining the future to develop descriptions, cartoons, posters, news stories, drawings or models free from the constraints of "realistic" design. They are able to develop technological solutions that incorporate considerations for society and the environment.



Penny's students developed a plan for a proposal for a new recreational centre at the school that catered equally for both genders. The next step involved either making a scale model of their plan or presenting it as a computer slide show.

A Year 5 student using his plan to make a model of the school recreational facilities designed to be equitable to both female and male students. Great resourcefulness and careful measurement were necessary, as students were confined to using the resources collected by the class.

Plus, minus, interesting (PMI)*

(*PMI is a technique suggested in de Bono, E (1986), *CoRT Thinking*, Pergamon Press, New York.)

In a PMI, students evaluate the idea, first giving the good points (as they see them), then the bad points, and then the points that are neither good nor bad, but are interesting.

Students evaluated the model or computer slide show of their peers using a PMI. Groups focused on whether or not the goal, to cater for both genders equally, had been accomplished. Getting the students to evaluate their peers' work gave them a sense of commitment.

The activity acted as a form of evaluation. The children were given the opportunity to reflect on the process they had undertaken and the concept of gender.

Plus	Minus	Interesting
• The high fences keep strangers away. • It's fair because boys have the karate area and the girls have the dancing room. • The roster is fair. • The basketball and netball courts are big.	• There are no fire doors. • There are no rails on the jungle gym. • There is no sound base in the dancing room. • There are no chairs for the computers. • There is no nature, for example, trees, plants, flowers. • The basketball poles are made of wood. • There is no office or canteen.	• The building is interesting because the building is triangular. • The handball courts are colourful. • Their karate room has circle windows. • There is a pink floor. • They have blue classrooms.

Student work sample, showing the use of a PMI for peer evaluation of plans for the school recreational facility.

Clean-up of neighbouring gully

Greg Clarke, Ambarvale Public School, developed a unit for his Year 5 class, *Clean-up of neighbouring gully*, which focused on the environment.

Unit outline

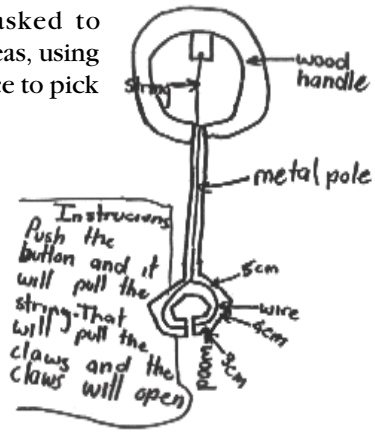
The class was involved in a clean-up exercise in the gully area adjacent to the school premises. In this gully there is a public path, frequently used by the general public, which leads to the local shops and hotel. The gully was very heavily polluted by a variety of rubbish.

The class decided to clean up the area and design and make devices so they would not have to directly handle any forms of rubbish. The class discussed particularly dangerous items, such as glass and syringes, and developed strategies to manage the clean-up process safely.

Brainstorming

Brainstorming involves generating and recording ideas without discussion and is a particularly valuable teaching strategy in technology activities. It builds confidence and encourages open-mindedness, imagination and risk-taking, because its rules protect individuals from criticism or ridicule. Brainstorming promotes a lively, cooperative class climate and brings to light a wide range of perspectives and attitudes.

Each group was asked to brainstorm their ideas, using drawings, for a device to pick up rubbish.



Initial design ideas for a rubbish collector.

Greg found brainstorming a very rewarding activity, as it encouraged all class members to have some input. When many of the groups realised that their initial brainstormed ideas could be achieved, their confidence and self-esteem soared.

Evaluating design solutions

A follow-up activity to the development activity was to evaluate the potential effectiveness of the devices before they went to the gully to test them.

Students were asked to:

- describe the device they had designed
- design a simple chart for making predictions about what they thought they would see in the gully and the rubbish they were going to target
- assess whether the device would collect all the rubbish or only specific rubbish
- evaluate the device, using a table, and give reasons.

Greg felt this lesson was very successful, commenting that the students were very keen to experiment with their devices. In many cases, the students were so engrossed in using the device, they weren't keen to record their findings and complete their worksheets.

Recreational technology

Neville Fraser of Bilgola Plateau Public School developed a unit for his Year 5 class on *Recreational technology*, which focused on culture.

Unit outline

The students established businesses to invent their own recreational technology to fill an identified niche. The activities selected from the kit were brainstorming, role-play, PMI, technology collage and technology audit.

Technology collage

A technology collage, or collection of images, encourages students to express their perceptions of technology. It may provide startling evidence of the social conventions and attitudes that surround a given technology. In this way, the strategy can bring to light appropriate and inappropriate technological practices.

Students created a technology collage by cutting out examples of different recreational technologies from magazines. The examples were fixed to a display panel around the caption, *recreational technologies*. Examples of their prototypes were added to the display panel too.

Students were then asked if the activities could be grouped by culture. This activity was effective, as the children identified that different cultural groups developed recreational activities and devices suited to their needs and situation. Neville reported that there was some good discussion about inappropriate technologies intruding on other cultures. One of the students from Africa brought in some African wire toys, which were very well received. Several children observed that novelty also makes a difference to the acceptance of a technology.

PMI

PMI was used to assess the prototypes that students presented to the class. It gave them valuable feedback for modifying their designs. The children adopted the PMI approach readily. They were often quite perceptive about the environmental considerations of different inventions. They were less certain about the gender and cultural aspects.

At the end of the unit, PMI was used to evaluate the final designs. Each child was given PMI voting cards and instructed how to use them. The teacher hosted the award ceremony, introducing each product and its design team. The various teams described the product and its purpose. As each product was presented, the rest of the class voted, based on an agreed set of criteria. The voting scale was as follows:

P: up to 5 points added

M: up to 5 points subtracted (i.e. negative points given)

I: up to 5 points bonus for an interesting fact.

The five recreational inventions the children developed were:

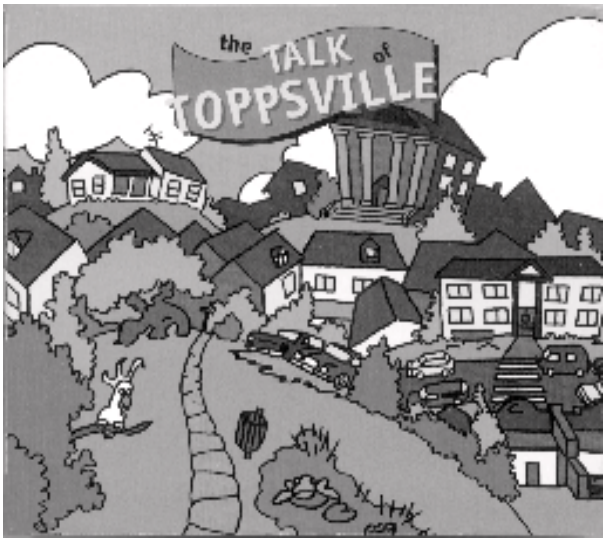
- Quick Cossie: to help girls who need the toilet at the beach
- A Nice Belt (an ice belt): for runners, hikers, outdoor workers and injured people
- The Sponge Ball: for cleaning hard-to-get-at spots, and just for fun
- The Poo Shoo: makes stepping in dog poo less of a trauma
- The Dog Walker's Harness: a dog harness with reflectors so the animal can be seen at night.

The winner of the *Bilgola Small Business Award for Appropriate Technology (Recreational Technology Section)* was A Nice Belt. It was highly evaluated by students because it used recycled materials, could itself be recycled, was not gender or culturally biased, and filled a real niche.

The Talk of Toppsville

Kathy Lang from Granville Public School developed a unit for her Year 5 class based on the Independent Commission Against Corruption's CD-ROM, *The Talk of Toppsville*. It focused on ethics. Kathy collaborated with two other teachers, Marion Round and Louise Imseih.

The CD-ROM, *The Talk of Toppsville*, presents a story about a community of residents confronted with the dilemma of how to best use its last remaining free block of land for future community needs.



A copy of the CD-ROM, The Talk of Toppsville, is available, free of charge, to each primary school from the Independent Commission Against Corruption. If your school does not have a copy of this CD-ROM, contact ICAC Education Section, (02) 9318 5999, or free call 1800 463 909.

Unit outline

The Talk of Toppsville provides an animated storyline which was the basis for discussion, investigation, planning and implementation of the technology learning activities within the context of real-life issues and ethical considerations.

- The students investigated the issues and ethical concerns as they were presented in *The Talk of Toppsville*.
- They generated and explored the pros and cons of options considered viable for the Toppsville dilemma, using the teaching strategies described in the kit, *Appropriate Technology: Designing the Future.*
- They designed and made a model car park based on a design brief developed to suit the needs of Toppsville residents.

Futures wheel

The students brainstormed possible solutions for the design brief. As a class, directed by the teachers, the students constructed a futures or cause and effect wheel for each of the possible solutions.

Students began by making a circle in the centre of a large sheet of paper and writing in the main issue to be explored. They proceeded by making further circles containing the effects of the issue and connecting these to the main idea or to each other. Students extended the wheel to include further levels of impact.

This strategy allowed the students to address the implications of their possible solutions with greater clarity, stringing consequences together and investigating the way in which one outcome led to another, then another, and so on.

Kathy reported that the futures wheel was an invaluable tool for considering how each of the solutions met the specific needs of the design brief. She felt that the futures wheel would be a useful strategy in other decision making situations.

A Year 5 student with her completed model car park for residents of Toppsville. The design brief provided a very challenging set of competing community needs and wants for the students to attempt to resolve.

Green auction

This strategy promotes student exploration of personal values and priorities as they relate to technology. Its title suggests a specifically environmental focus; however, it is suitable for application to a wide range of issues.

Students were given a catalogue of items which were available for a mock auction, based on those used in module 2 of the kit. The items were examined to determine which were most important to each individual. The students considered why they valued one item over another and wrote down the amount of money they were prepared to bid for each item. Each student was allocated $1500 of mock money.

Kathy reported that it was an excellent activity to emphasise the different values among individuals, and for individuals to recognise their own value choices. Besides creating high student enthusiasm and participation, assigning a monetary value to their own items of interest gave the students an explicit demonstration of how personal value systems influence decisions.

The after-auction questions allowed the class to identify why some items were considered more valuable than others. Some items were valuable because they met people's needs, others were considered valuable because "they were what I wanted".

Although it was difficult to assess learning about ethics, Kathy felt that at the conclusion of the unit the students were aware that ethics involved "fairness", "consideration of right and wrong", and the idea that not everything is "black and white" when making choices.

Switched On

Julie Kennelly, a teacher at the Thalgarrah Field Studies Centre (FSC), developed a unit for a visiting Year 6 class which focused on energy. The unit was based on *Switched On* from the Science and Technology K–6 syllabus, page 120. The unit involved pre-visit work at the home school, one day at the FSC and post-visit work back at the school.

For the pre-visit preparation, students researched sources of energy and a variety of materials, such as steel, plastic, wood, fabric, and their disposal after use. They brainstormed the social and environmental issues they thought they would face 30 years into the future. Students also designed the sort of house they thought they would be living in 30 years from now.

At the FSC, students investigated circuits and undertook the circuit work described in *Switched On*. On completion students were asked to design, make and evaluate a toy suitable for a five-year-old which incorporated a circuit.

In the post-visit work students were asked to use a futures wheel to investigate an energy issue and repeat the pre-visit brainstorm regarding social and environmental issues to gauge change in understanding.

Futures wheel

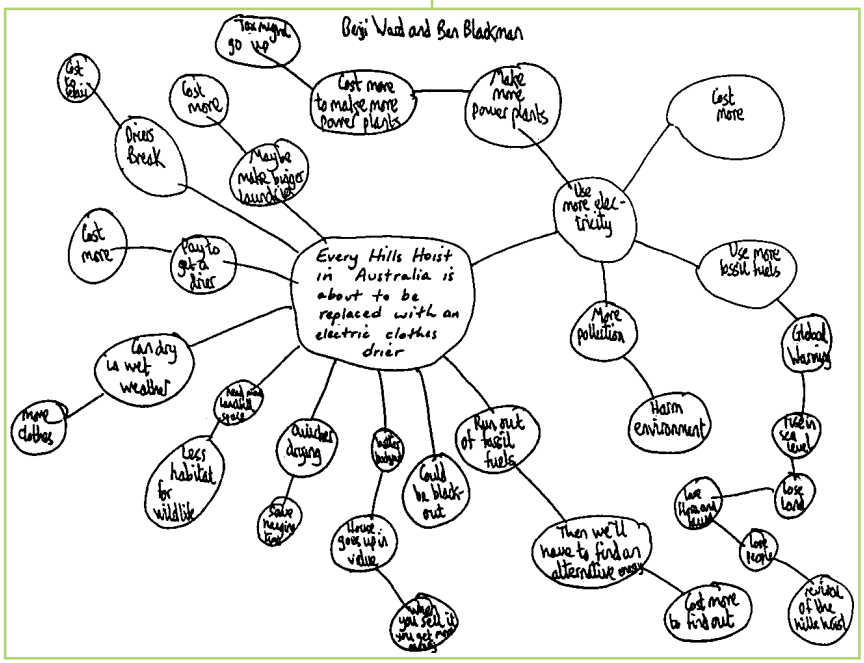
This was done in the home school after the Field Studies Centre visit. Students were asked to consider the consequences of the following situation:

> Every Hills Hoist in Australia is about to be replaced with an electric clothes drier.

The students were able to point out that more electricity would be required and related this fact ultimately to global warming. As this was the first time that these students had used a futures wheel, Julie was pleased with the results.

Julie explained the importance of appropriate technology in the work of the Field Studies Centre:

> Appropriate technology perspectives have guided the pre- and post-visit activities which we ask teachers to do at their home school and have strongly influenced the way in which we present activities here at the FSC. Appropriate technology gives us the tools by which we can make the technology education, which schools like us to offer, relevant to environmental studies. It also gives us extra tools with which to encourage client schools to place more emphasis on environmental education in their class work.



Student work sample of a futures wheel *for the hypothetical scenario:* Every Hills Hoist in Australia is about to be replaced with an electric clothes drier. *The work sample shows in particular that the students:*

- *recognised the impact of using coal-based electricity*
- *are considering the issue of alternative energy supplies*
- *have identified a wide range of consequences.*