Solving a problem

Strand	Organiser	Level						
		1	2	3	4	5	6	B6
Technology Practice	Investigation				■	▨		
	Ideation				■	▨		
	Production				■	▨		
	Evaluation				■	▨		
Information	Nature							
	Techniques							
Materials	Nature				■	▨		
	Techniques				■	▨		
Systems	Nature							
	Techniques							

Background

This project was conducted with a group of Year 8 students from the Cairns School of Distance Education. Students were encouraged to work on the design challenge. A design challenge completed by one of the students is included in the case study.

Procedure

Students were sent a booklet that outlined the design challenge (Appendix 1).

Design challenge
Identify something you consider to be a problem or causing a problem in your environment and find a solution to the problem.

During regular lessons on air, some time was used to explain the task to the students and to work on a hypothetical problem posed by the teacher. In this case, the teacher identified a problem (chickens fouling the water) in his own environment and, as a group, the students and teacher brainstormed ideas and discussed the implications of the suggested solutions. (see Appendix 2).

As the students were working on their individual projects, the teacher would respond to their solutions. The group would suggest modifications depending on the problems encountered.

While this was occurring, individual students were identifying problems of their own, brainstorming with family members, designing and creating products, testing and evaluating them.

Out of eight students, four completed the task, by finding a solution and creating a product, two identified problems but found it too difficult to come up with a viable solution, and two were unable to identify any problems.

Despite the fact that only half the class worked through the entire project to the end, it was felt that by working through the stages of the teacher's problem as a group 'on air', all the students were exposed to the processes involved and gained from the experience.

Assessment

In this case study, assessment information was contained in the Technology task booklet provided to the students (see Appendix 1).Some constraints were faced in the implementation and assessment of students' work. The nature of the delivery of lessons to the students 'on air' made it difficult for the teacher to assess students' demonstration of outcomes. Appendix 3 provides an illustration of how one student met a unique and real-life design challenge. Her report is reproduced in her own words.

Assessment strategies

The assessment opportunities outlined are examples of how to assess students' demonstrations of the identified learning outcomes. As often as possible, negotiate assessment with students and support a variety of ways of demonstrating the learning outcomes. Reflect with students on evidence gathered when making judgments about their demonstrations of learning outcomes. Some students may require more time and/or other contexts in which to demonstrate these learning outcomes. Other modules may provide such time and/or contexts.

The table below provides descriptions of anticipated evidence that teachers might gather to support their judgments about students' demonstrations of learning outcomes and suggests sources of evidence. The table is neither exhaustive nor mandatory. Once sufficient evidence has been collected, judgments can be made about students' demonstrations of learning outcomes.

Core learning outcomes	Anticipated evidence	Sources of evidence
TP 4.1 Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.	Consult people with relevant expertise. Interview or surveys potential users.	Oral presentations. Technology project folios.
TP 4.2 Students generate design ideas through consultation and communicate these in detailed design proposals.	Explain implications of consultation results for the design. Relate design decisions to results of research, survey and interview results and consultation.	Technology project folios. Oral presentations.
TP 4.3 Students identify and make use of the practical expertise of others when following production procedures to make products for specific users.	Identify and consult with peers or adults with expertise.	Work samples. Consultation with students to verify evidence. Oral reports of students' participation in activities. Products.
TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.	Present designs to others for feedback and use the feedback to inform their evaluation.	Feedback sheets. Peer- and self-assessment sheets. Technology project folios. Students' oral presentations.
MAT 4.1 Students explain how characteristics of materials affect ways they can be manipulated.	Choose appropriate materials from which to produce the product by considering cost effectiveness, ease of work, durability and availability.	Oral presentations by students as they participate in planned activities. Technology project folios. Work samples.
MAT 4.2 Students employ their own and others' practical knowledge about equipment and techniques for manipulating and processing materials in order to enhance their products.	Use equipment and techniques to construct the product. Employ the help of others when constructing the product.	Work samples. Students' products.

In gathering evidence to make judgments about students' demonstrations of core learning outcomes, it may be necessary to look at the level before and after Level 4. The following table indicates anticipated evidence for Level 5. Students may be demonstrating core learning outcomes at another level.

Core learning outcomes	Anticipated evidence	Sources of evidence
TP 5.1 Students analyse links between the knowledge, ideas and data gathered to meet design challenges and the design and development of new and improved products.	Identify needs wants or opportunities to envision future products and investigate ways these could be developed. Interpret information from different sources.	Research and development plans. Research summary in Technology project folios. Interviews with students about their research and development plans.
TP 5.2 Students generate design ideas and communicate these in design proposals that indicate an understanding of factors influencing the development of option(s) they have selected.	Devise a range of options and select viable design ideas. Record consultation with others to confirm that design ideas reflect needs and wants. Consider issues related to context appropriateness and management and how these effect the design and realisation of a product. Include specifications on plans and drawings related to materials and costs.	Students' detailed design proposals. Technology project folios. Interviews with students about their research and development plans.
TP 5.3 Students meet predetermined standards as they follow production procedures to make quality products.	Identify product standards. Follow production procedures to meet standards of quality. Manage resources within constraints. Respond to changes that occur during production.	Consultation with students to verify evidence. Work samples. Technology project folio.
TP 5.4 Students use predetermined criteria to judge how well processes and products meet the needs of specific users and recommend modifications or improvements.	Use criteria provided to evaluate products and processes and make recommendations about ways to improve a product for clients. Describe how particular criteria were met or were intended to be met.	Oral reports. Work samples. Products. Information and decision making recorded in Technology project folios.
MAT 5.1 Students compare and contrast materials according to their characteristics to determine how effectively the materials meet predetermined standards.	Prepare product specifications that identify required standards. Test the mass and strength of materials to determine their suitability for meeting required standards. Select materials based on their properties.	Analyses of the results of materials tests. Product specifications. Production plans. Product evaluation report.
MAT 5.2 Students operate equipment and apply techniques for manipulating and processing materials to meet predetermined standards.	Specify standards and equipment and techniques for manipulating materials to meet these standards. Select and use suitable equipment and techniques to achieve required standards.	Information and decision making recorded in a Technology project folios. Results of tests of materials and processes for manipulating them. Production plans.

Technology task booklet (sent to students)   **Appendix 1**

Core learning outcomes

Technology Practice	**TP 4.1** Students use consultative methods to gather knowledge, ideas and data when researching alternatives within design challenges.
	TP 4.2 Students generate design ideas through consultation and communicate these in detailed design proposals.
	TP 4.3 Students identify and make use of the practical expertise of others when following production procedures to make products for specific users.
	TP 4.4 Students gather feedback to gauge how well their design ideas and processes meet design challenges and how effectively products meet the needs of specific users.
Materials	**MAT 4.1** Students explain how characteristics of materials affect ways they can be manipulated.
	MAT 4.2 Students employ their own and others' practical knowledge about equipment and techniques for manipulating and processing materials in order to enhance their products.

What to send to your teacher

1. List of people with whom you discussed the problem.
2. Brainstorming sheet.
3. Labelled diagrams including scale.
4. Photographs taken at various stages of the process of developing your product.
5. Notes regarding any modifications you had to make to your product.
6. Photographs of your finished product.
7. Your evaluation of the product's effectiveness.

Technology task

In attempting this task you will:

- Investigate a problem
    – discuss with others the needs and wants to determine the actual problem and what solution is needed.
- Generate ideas for solutions to the problem
    – brainstorm
    – consider impacts and consequences
    – draw diagram to scale and label.
- Design and modify a product
    – modify design proposals with any help necessary from others with expertise
    – follow production procedures and create your product making any required modifications along the way.
- Evaluate the effectiveness of the product
    – evaluate process and finished products to determine whether the product has met specific requirements
    – consider how the product could be modified to meet the needs of specific users.
- Consider and select materials
    – choose appropriate materials from which to produce the product consider cost effectiveness, ease of working, durability, availability.
- Use equipment and techniques
    – use equipment and techniques to construct your product
    – employ the help of others when constructing your product.

What to do

Identify something you consider to be a problem or causing a problem in your environment. Your task is to come up with a solution that may assist with the solving the problem.

Ask yourself the following questions:

- What is the problem?
- Why is it a problem?
- What is causing the problem?

Discuss the problem with other people in your area to see if they agree that it is a problem:

- Brainstorm ideas to come up with possible solutions.

Investigate the impacts and consequences of each of the possible solutions by asking the following questions:

- Will it be cost effective?
- Will it be functional?
- Will it be aesthetically pleasing?
- Will it have any impact on the environment?
- Will it create additional/alternate problems?

Generate a design of the product that you decide will be most efficient in solving the problem. Consider the following:

- What materials do you need?
- What materials are available?
- Will you need to make the product at the site or can it be moved there later?
- Draw a diagram of your product:
    - Label your diagram to show the main parts of the product.
- Ensure your design is to scale.

Produce the product:

- Do you need to make any modifications to your design as you put it into practice?
- Make the product.
- Use the product to test its effectiveness.

Evaluate its effectiveness

- Is it a viable solution?
- Does it need to be modified?
- Would modifications make it effective?
- Could your product be modified for use in another area with a slightly different problem?

Ideas you might consider

- Automatic gate closer.
- Dog-food bowl that does not tip over.
- Drip watering system to water plants in the garden.
- Bird feeder that attracts birds to the garden.
- A way to protect seedlings and saplings from rabbits or livestock.
- A way to eliminate feral pigs from a particular area.

These are only a few examples you could consider.

Each of you will discover problems in your environment that may be unique to your situation. You will also encounter other problems that are universal.

Example of teacher's proposed problem

Appendix 2

Chicken water feeder

Problem: Chickens keep fouling the fresh water containers

Ideas	Impacts and consequences
Hook containers on side of wire-netting coop.	Smaller birds may not be able to reach.
Raise the containers above the ground.	Birds may knock containers off wire.
Use recyclable materials; easy; cost efficient; available.	Have a bubbler which is continuously bubbling fresh water into the container.
Construct a device that allows fresh water to seep out of one container into another in such a way that there is no room for birds to actually stand or sit in the water.	Waste a lot of fresh water; expensive to install hose under ground to supply bubbler.
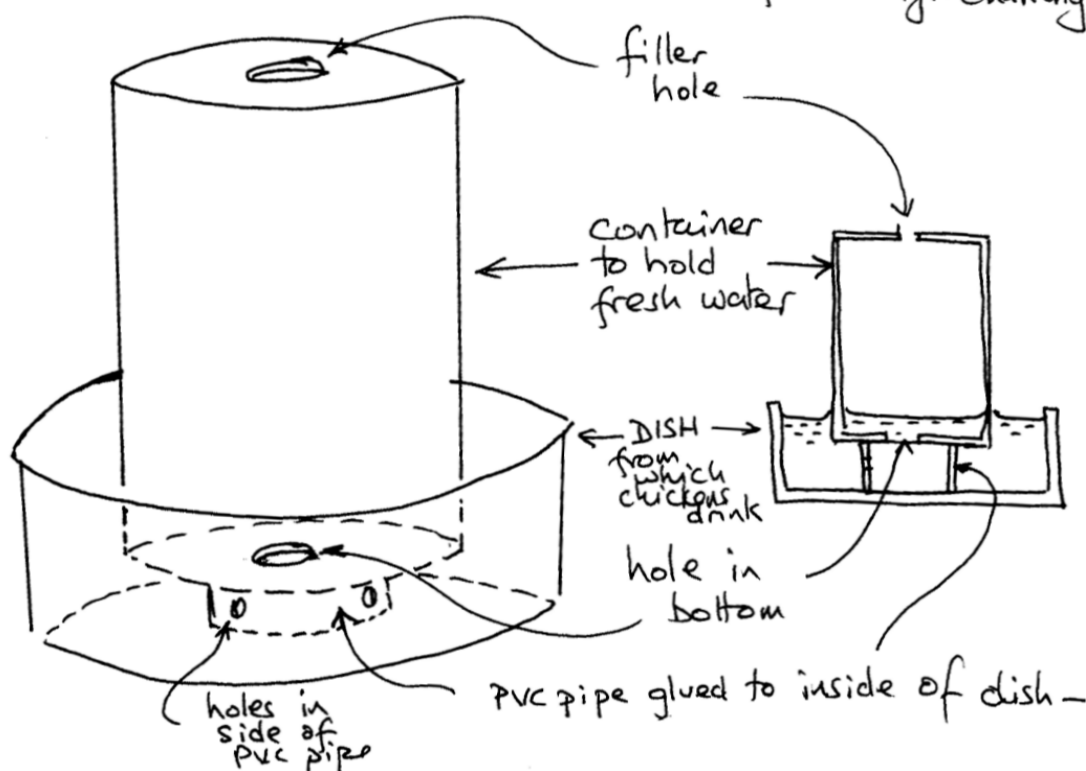
[End of booklet]

Example of student's work

Year 8 Technology task

McIvor Valley goat milking stand

My problem

1. The goats often put their feet in the milk while we're milking them because they aren't properly restrained.

2. Due to difficulties with my knees, I can't sit on the ground to milk the goats.

3. The horses often eat the goat's feed because we have to milk them next to the paddock.

I discussed this problem with the family and another goat owner.

We came up with the following ideas:

- a yoke

- a milking stand.

Solution

We chose the milking stand. However, I altered the design of it to suit our purposes better. Design 1 is basically the original design but I've added supports in front and behind to provide a visual barrier to the goats. The main problem with this design is that it relies on the fence to tie the goat onto. Therefore it doesn't solve the problem with the horses.

The Design 2 has been altered and is an independent unit. I've also added the extra wall on the far side so that (a) the goat can't jump off the side (b) the goat can be tied to one of the bars instead of the fence and (c) hooks can be placed in the horizontal bars to hold a dustpan and brush for sweeping the stand and a wet cloth for cleaning the udders and that sort of thing.

I've also put more emphasis on support beams to make the stand stronger. With four vertical posts a tarp can be put over the stand to provide shade in the dry season and shelter from the rain in the wet season. This solves the problems of cranky goats (goats, dislike the rain) and diluted milk. It also means that whoever is milking them can stay dry.

Evaluation of effectiveness

This milking stand has been wonderful. The only problem with it is that it's too big because I over estimated how large I needed it. Thus it's also a bit too heavy. When I made it, I also altered the design of the seat. I didn't cut a section out because I didn't want to weaken the structure. Other than that, it solved all of the problems that I designed it for.

The problem

This milking position is extremely uncomfortable and hot. The goat often kicks dust into the milk and the horses lean over the fence to eat the food.

The solution

To make the floor of the stand, I measured three planks of timber to the same size and connected them with a plank at either end. I then nailed timber onto this frame as floorboards.

Once the floor was completed, I made the walls by nailing the wood into roughly 'H' shapes. I then began measuring and sawing the supports.

I put a lot of work into the supports because they are what give the stand strength. I sawed the ends of each support at angles so that they slid between the vertical bars that they were supporting.

At last the stand was finished. Dad used his circular saw to neaten the edges then Mum and I carried it down to the goat pen and put it in the shade under a mango tree. This location is excellent because it is in the shade yet it is right in front of the goat pen. I decided against putting legs on it because I didn't think I could make it sturdy enough. Instead I put four 20L oil drums under the stand. After attaching the feed bucket, I tied the rope onto the side and brought out the first goat.

Cindy, my first client, was incredibly curious as to what in the world this thing was but with the help of a bucket of feed, she was soon up on the stand. The goats have quickly adapted to using the stand. It has been absolutely wonderful.

[Also, see the three drawings on the following pages.]

Design 1, diagram A
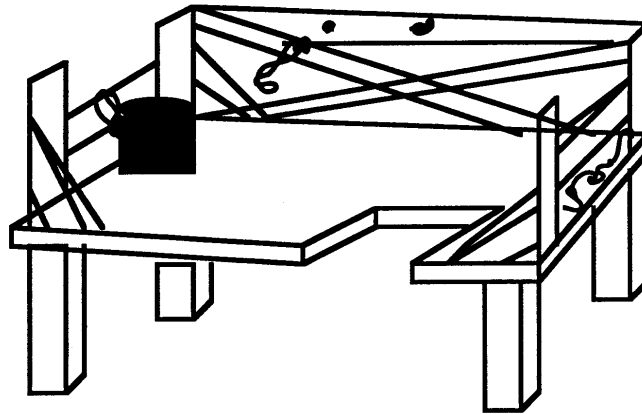
Jacynta
Technology
Draw Lesson 1
Work Sample
(Design of Year 8 Technology
Task)
This a modified version of the first
one.

Base of Milking Stand

Design 1, diagram B

Fence

support rope to tie up goats

Feed Bucket

Where I sit

Rope to tie the feet of troublesome goats.
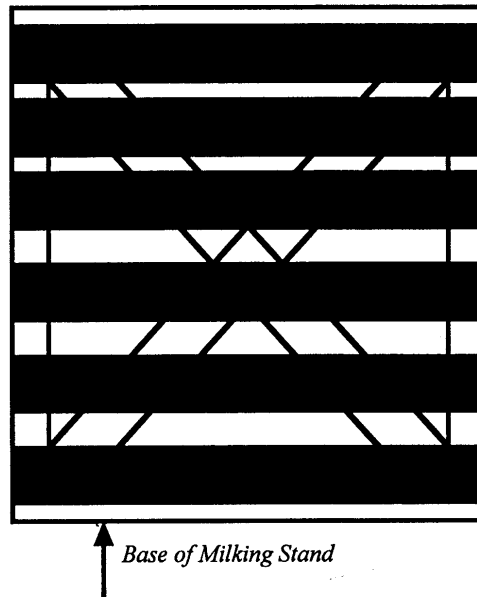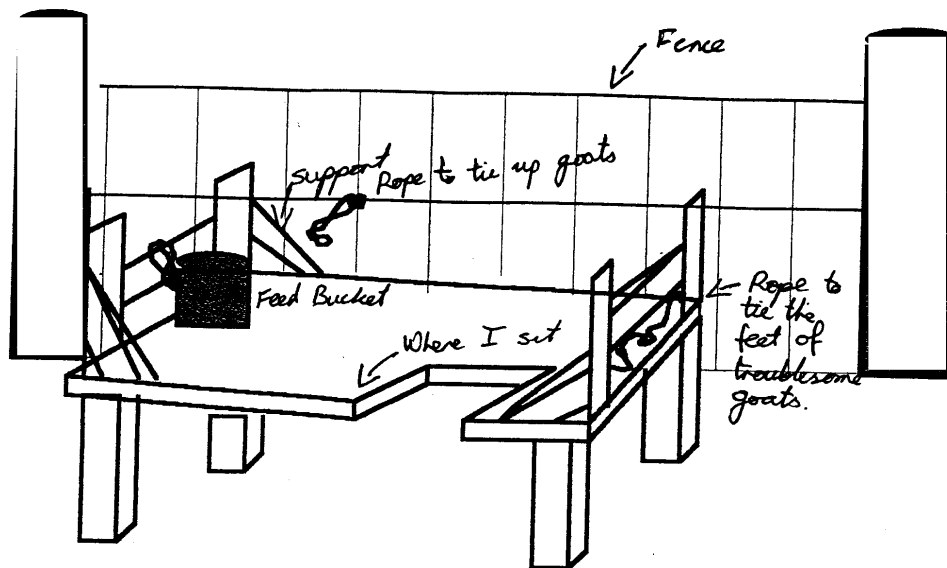
Design 2
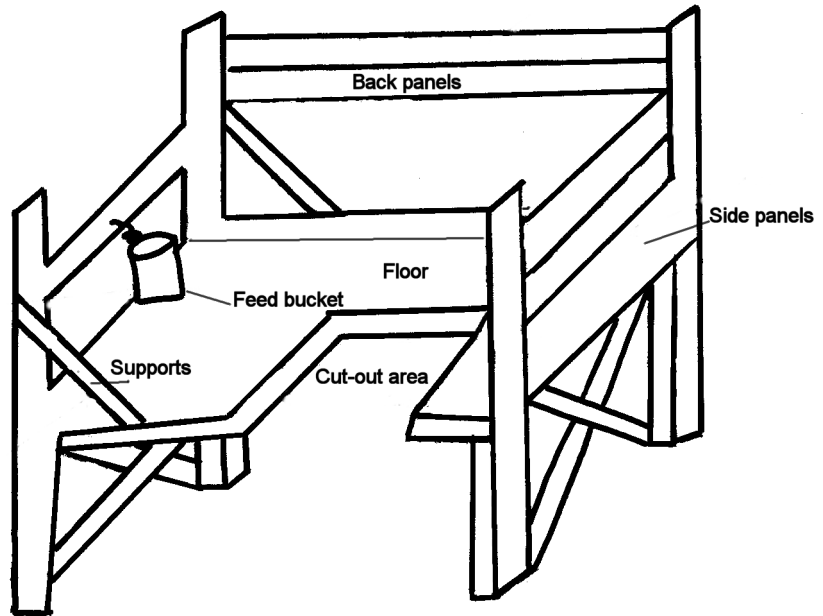
Acknowledgments and support materials

This sourcebook module should be read in conjunction with the following Queensland Studies Authority materials:

Years 1 to 10 Technology Syllabus

Years 1 to 10 Technology Sourcebook Guidelines

Technology Initial In-service Materials

Technology CD-ROM

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