Maths situations in everyday Indigenous family and community life

Australian Government

Department of Education, Employment
and Workplace Relations

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Acknowledgments

Project Officer

Claire Clayfield

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Software production

Daniel Bentley, Nathan Weber

Task Development Group

Claire Clayfield, Di Gordon, Jock Lawson, Kate Madden, Caty Morris, Alison Ware

Music

Amanda Long, Tahlia Long

Steering Committee

Mike Chartres, Claire Clayfield, Larry Higgins, Jennifer Johncock, Lynda Matthews, Caty Morris, Tess Were, Vicki Wilson

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Indigenous warning: Please be aware that materials within the *Interactive numeracies* resource contain imagery, voices and representations of people who may be deceased. This may cause distress to some people.

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Contact information

Caty Morris
~~Policy and Program Officer Primary Years~~
~~Department of Education and Children's Services SA~~
~~4/31 Flinders Street, Adelaide SA 5000~~
~~Email: morris.caty@saugov.sa.gov.au~~
~~Tel: 08 8226 4311~~
~~Mob: 0401 123 356~~

Manager Indigenous Programs
AAMT
cmorris@aamt.edu.au
0432 277 654

Contents

Numeracy

How one becomes numerate can vary enormously between individuals, families, communities and cultures. Some people can not play the piano without the theory, tutoring and coaching, and practice. Others can sit down and play a tune without needing a single recorded note to guide them. As with playing the piano there are different ways to arrive at numeracies.

What is numeracy?

The following sources explore what is meant by 'numeracy'.

To be numerate is to use mathematics effectively to meet the general demands of life at home, in paid work and participation in community and civic life. (Australian Association of Mathematics Teachers, 1998)

It's like playing sport. Mathematics is the training and coaching and practice you have during the week and the numeracy is when you play the game on Saturdays. (Maths300 participants, 2003)

Numeracy involves understanding, analysing, critically responding to and using mathematics in different contexts. These understandings relate to measurement, spatial sense, patterns and algebra and data and number. (SACSA, 2001, p. 5)

Numeracy is about the 'Maths we need'. Numeracy is a cultural construct in that unless the learned mathematics is 'practised' it is not necessarily retained as a skill.

For a child to be numerate they must have the disposition to draw on mathematics. There are two components to this: firstly, they must have a range or repertoire of mathematics skills and understandings upon which to draw; and secondly, they must have the 'disposition' or the attitude that will make them want to draw on that repertoire in the contexts in which it is appropriate to do so.

The teachers' role is two-fold in developing numerate behaviour; they must explicitly teach the repertoire of mathematics skills from which a child may choose, and they must do all that is possible to nurture the disposition needed to draw on the repertoire by giving children opportunities to gain confidence in risk-taking and choosing and using mathematical models with which to solve problems across a range of contexts. (Perso, 2003, pp. 5–6)

A numerate student

An interpretation of a numerate student juxtaposes Scott's (2000) model (in **blue** italics) in Figure 1 below with Perso's (2003) model (in **orange** italics). Both models suggest that for a student to be numerate all three layers need to be considered simultaneously.

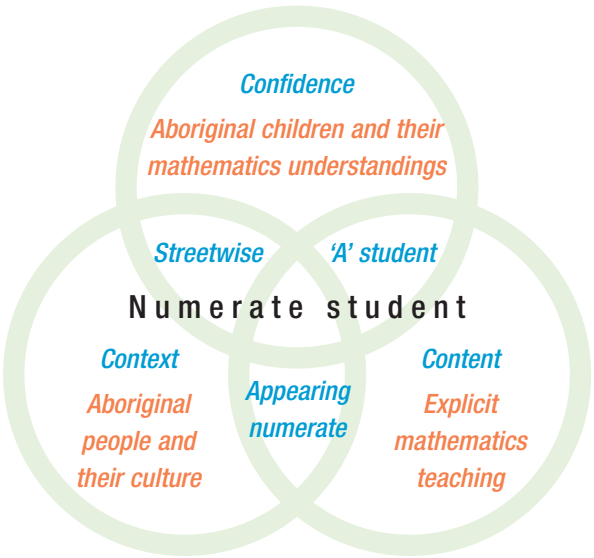


Figure 1: The numerate student

Indigenous learners and numeracy

In many classrooms, Indigenous learners may be working with unfamiliar contexts, language, teaching and mathematical learning that require different skills and strategies to the ones they're used to using in their families and communities. That is, they could probably do the mathematics but a combination of circumstances may prevent them.

Sometimes Indigenous learners may have the mathematics but not the classroom language. Or they may have **numeracies** but develop these numeracies in other ways – their ways of knowing and doing could be different to those taught and assessed in the classroom.

And the use of culturally unfamiliar evaluation tools can further exacerbate the teaching and learning issues.

Interactive numeracies takes the user on a journey that defines and connects both numeracy and mathematics. It shows ways to transfer mathematics to problem-solving situations in everyday life where mathematics becomes numeracy.

About this project

The Department of Education, Employment and Workplace Relations (DEEWR) funded the development of *Interactive numeracies: Maths situations in everyday Indigenous family and community life*. The project was founded on the knowledge that Indigenous learners bring to school a plethora of numeracy understandings, concepts, skills, strategies and language. There was a growing concern that these numeracies are often not reflected in mathematics and numeracy assessment in the classroom.

It was also known that numeracies exist in Indigenous communities and are applied in many contexts. The project set out to define these numeracies and bring them into the classroom.

Another prompt for the project was the way Aboriginal Education Workers (AEWs) in Certificate III training understood very easily what **numeracy** was but were a lot less confident dealing with **mathematics**. They were very quick to understand and apply numeracy as opposed to mathematics. Knowing this encouraged an underlying theory that perhaps the mathematics could be better learned if it were wrapped in familiar numeracies, contexts, language and activities. As one AEW (2003) said during training:

…I'm pretty competent at numeracy and maths now in everyday life but when you see a lot of numbers on the board…and maths was never that fun. They never had any activities to go with them…

Focus, objective and aim

Currently there is not enough recognition given to numeracies in Indigenous communities within our schools' curriculum and pedagogy. The project's main focus was to investigate the numeracies seen as important in regional and metropolitan Indigenous communities and find out what is unique about them.

Its main objective was to recognise contemporary numeracies in Indigenous communities and have them respected and applied by educators in the classroom.

The project aimed to develop a curriculum resource which could be used in the classroom with both Indigenous and non-Indigenous learners to support best numeracy practice in learning and teaching.

Consultation and inquiry

A range of Indigenous communities were consulted during the *Interactive numeracies* project. Many AEWs provided valuable input through their interpretations of numeracies, their stories about numeracies, and their contributions and advice about the resource and tasks.

The consultation process included:

- information gathering
- interpretation and analysis
- storytelling
- identifying the mathematics and numeracies
- ongoing filming.

An inquiry process was also used and its many questions included:

- What are numeracies in the community?
- Where, when, how, why and by whom are they used?
- In what contexts and situations are they used?
- What mathematics are within them?
- What choices or options are made to represent and understand numeracies?
- How do people choose to use mathematics for a particular purpose?
- How are numerate decisions made?
- What determines the decisions that are made about numeracies and how mathematics is implemented (eg 'Do I walk or drive')?
- What affects the decision-making process?

The project developed an understanding around these questions and identified numeracies common to many Indigenous communities.

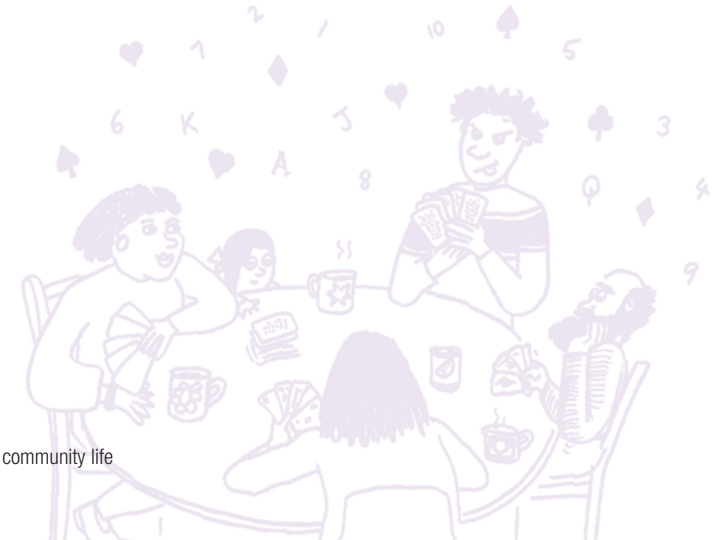


Figure 2: A possible process for determining numeracies

Numeracies and decision making

A process for determining numeracies and the basis for making decisions about numeracies is outlined in Figure 2 above. (For example, decisions about conducting a successful card game could be based on the size of the home the game is held in, who is likely to attend and where they should sit. This example is further outlined in the section 'Socialising' on page 13.)

The skill and strategy toolbox is the repertoire of skills (such as adding and subtracting) and strategies (such as looking for a pattern) a person brings to the situation and uses to problem solve or make a decision.

Note that the process flows **backwards** and **forwards** as the numeracies affect the decision making, and the basis for making decisions changes and grows through learning. This cycle is much like an informal action research process.

This process shaped the structure and content of the *Interactive numeracies* resource.

Literature and other projects

Knowledge gained from the literature and other projects was used to develop the *Interactive numeracies* resource and tasks.

Themes and key considerations

The *Interactive numeracies* resource reflects the recommendations made from Frigo's (1999) literature review about resources and strategies that support Indigenous numeracy learning. A number of themes and key considerations for the development of numeracy resources for Indigenous students emerged in this review. These include:

The teaching strategies suggested for numeracy activities should:

> *equip teachers with a range of teaching strategies to reflect the diverse learning needs and ways of learning of their Aboriginal students*
> *encourage the provision of positive, non-threatening, language-rich environments in mathematics classrooms.*

The content of numeracy materials should:

> *make explicit the link between community, home and school mathematics*
> *provide realistic and real-life classroom contexts for mathematics activities*
> *be developed in consultation with local communities and Aboriginal education workers*
> *be open to and encourage modifications of content and pedagogy to reflect particular students' interests and learning needs.*

If these resources are to be used effectively in classrooms they should:

> *encourage teachers to become fully aware of the complexity of the cultural and social contexts in which Aboriginal students learn mathematics*
> *encourage teachers to explore and use the particular contexts, especially numeracy ones, for their Aboriginal students.*

(Frigo, 1999, pp. 1–2)

About this project

Concept, content and context

The project was guided by a number of sources, including Harris' recommendation (1984) that new concepts and content are learned better if they are taught within familiar contexts, and that new contexts are learned better if they are taught within familiar concepts and content.

The project's interpretation (adapted from Harris) can be viewed in Figure 3 below.

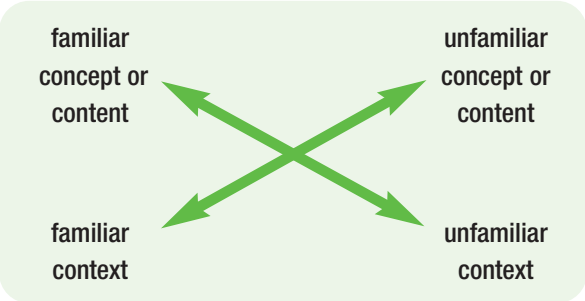


Figure 3: Concept, content and context model

The project also referred to the work of Perso (2003, p. vi) who suggests that:

> *Numeracy outcomes of Aboriginal children will only improve when teachers of Aboriginal children take three things into account in their planning and teaching:*
>
> 1. *Aboriginal people, their culture and their transition into schools of the dominant culture*
> 2. *The mathematical understandings brought into the classroom by Aboriginal children*
> 3. *Explicit mathematics teaching required by all children in our schools.*

Another influence was the problem-solving tasks in the Indigenous Kit from the Mathematics Task Centre (Curriculum Corporation, 2003). These tasks were used with great success in the Indigenous Numeracy in Secondary School Students (INISSS) project in Tasmania (Callingham and Griffin, 2002) and in Aboriginal Education (DECS SA) action research projects (2002 and 2005) that focused on improving the learning outcomes of Indigenous learners. Many of the tasks allow for further construction and extension of mathematics within a context.

The *Interactive numeracies* project aimed to develop mathematics within familiar and relevant contexts and situations using familiar numeracies, and then apply these in other situations.

There are different ways of making meaning with mathematics and educators need to be culturally aware.

> *To think that there is only one way of doing it, that it is universal, freezes maths into textbooks and experts' heads. To collect community ways of doing…adds an understanding that maths is generated by people, for social purposes.*
>
> (Johnston, 2002, p. 4)

The tasks in the *Interactive numeracies* resource reinforce that we learn mathematics through use, and can use the same mathematics in different ways or for different reasons or purposes.

Mathematical language

Mathematical language is an essential element in working mathematically and developing thinking around mathematics. The tasks in the resource encourage the use and development of mathematical language, and the use of **doing words** such as 'flip', 'rotate', 'translate' and their nominalisations 'rotation' and 'translation'.

A useful suggestion on the task cards (under 'Educator options') is to identify mathematical language used by learners as a form of mathematical assessment. For example: *'What are the nouns and verbs Indigenous learners are using in mathematics and numeracy?'*

A learner's use of language is a good indication of their conceptual understanding and thinking. Educators can use the tasks as a basis for developing explicit and scaffolded teaching of mathematical language.

Contextual teaching strategies

Crawford and Witte's (1999) work was also very relevant for learning and informing pedagogy. They observed **five common attributes** they call contextual teaching strategies:

> ***Relating:*** *learning in the context of one's life experiences*
>
> ***Experiencing:*** *orchestrating hands-on experiences… learning by doing – through exploration, discovery and invention. Problem-solving tasks engage students' creativity*

while teaching problem-solving skills, mathematical thinking, communication and group interactions

Applying: *learning by putting the concepts to use. The tasks pose a realistic situation and demonstrate the utility of mathematics in a student's life, current or future*

Cooperating: *learning in the context of sharing, responding, and communicating with other learners*

Transferring: *using knowledge in a new context or situation ie transferring newly acquired knowledge in unfamiliar situations*

(Crawford and Witte, 1999, pp. 36–8)

The tasks in the *Interactive numeracies* resource provide opportunities for all five of these elements.

The family web

The *Interactive numeracies* project began with a focus on the **family tree**. This was later referred to as the **family web** because of the 3-D concepts generated through lengthy community discussion and the intricate web of connections and interconnections made by people. People talked extensively and complexly about grouping and levelling of family in a variety of ways and combinations.

Participants were asked to represent their family web in any way they wanted through posing the question: *'What do you see when you visualise your family web?'* A variety of processes was used to communicate this concept including imagery, body language and gesture, talk, symbols, straws and joiners, and pencil and paper.

Criteria around place

Criteria used by community members to determine their places in the family web include:

- place (where a person is born, where the parents come from)
- time
- generations
- colour
- politics (eg voting rights)
- who delivered the baby
- relationships
- tolerance
- sharing
- acceptance
- recognising the rules and obligations that help fit people in the family web
- grouping
- who can marry whom
- respect of Elders.

The National Aboriginal Education Committee (1986, p. 11) says that Indigenous society is structured around the community. The development of *Interactive numeracies* was based on this premise.

Harris (1988) explains that in Aboriginal cultures quality (of relationships) is more important than quantity (of things). Members absorb and learn the culture and connections of their family web and the wider community (enculturation), which could also include learning to use mathematics that **structures** things as opposed to **counting** things. For example, when explaining the family web there is an order of thinking that helps describe the generational levels (see below).

The big picture

The family web is seen as 'the big picture' and involves:

- shifting between the generations of the family web. This means going up and then down again 'like a lift' which opens up on different floors and in different directions, stepping back from this side of the generation, going the other way (hence the 3-D model)
- using living memory for generational order and classification
- representing the family web in different ways (eg one person's web is like a family river – an 'oral map')
- making complex connections and interconnections
- 'having a picture that you're brought up with that that's where you belong' within the family web or kinships structure
- using algebra to describe connections – 'he has eight mothers'
- using mathematics to describe where people are at or belong in the family web
- representing the point of relationship as an intersection on a graph.

(The quotes in this section are typical of the many quotes gathered from community members across a range of communities.)

Perso (2003, p. 20) suggests that:

> *Whereas non-Aboriginal people use number patterns based on counting and measurement, the patterns used by Aboriginal people are based on relationships between people. Number patterns are also used by Aboriginal people as a form of ordering, just as familial patterns are used by non-Aboriginal people; the difference is found in the importance placed on these.*

The family web was shown to be hugely complex. Because family is generally seen as integral to Indigenous community life and its many intricate and complex numeracies, the family web was used to develop the three contexts for the problem-solving tasks in this resource.

Developing the tasks

Figure 4 below outlines the **stages** followed for developing the problem-solving tasks.

Each of these stages is represented on the accompanying CD-Rom, which uses the same steps to map its content.

These stages are expanded upon in the next section of this handbook.

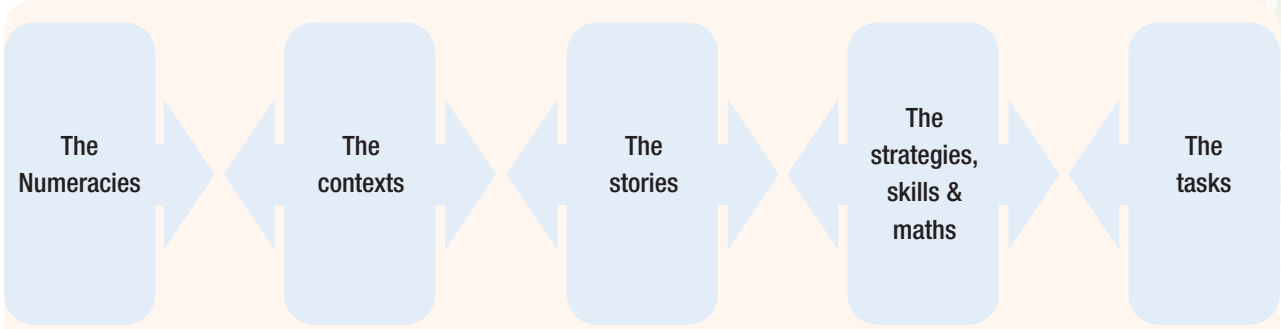


Figure 4: Task development stages

About this resource

Indigenous communities across Australia demonstrate a diversity of numeracies. The resource uses examples common to many of them.

Audience

In a spirit of co-construction between Indigenous communities, the school and TAFE sectors, and Aboriginal Education personnel, this resource provides an **inclusive learning strategy** for school and TAFE learners and educators. It aims to also position the educator as a learner.

Using this resource

The *Interactive numeracies* resource consists of a handbook, seven problem-solving tasks and a CD-Rom with accompanying interactive software which:

- describe a variety of contexts that support classroom learning
- provide an Indigenous approach to dealing with the mathematics
- give snapshots of stories from families
- allow educators to make connections between **home** mathematics and numeracies and **school** mathematics and numeracies
- can help educators move outside their current practice and pedagogy
- provide learners and educators with a challenge on which they can build or extend their learning
- provide a model for learning
- allow learners to participate in hands-on activities where they can openly discuss and compare with other learners the strategies they use for problem solving
- provide tasks for small group work which focus on cooperation and communication
- reinforce a **learning community model** with student–student and student–educator interaction
- reflect a sense of family and community.

The handbook

Educators can use this handbook as a guide to understanding and using the resource.

The tasks

The seven tasks consist of cards and hands-on materials. Students can work through the tasks on their own or with other participants, depending on task requirements.

Make sure students play with the tasks before being given access to the digital tasks on the CD-Rom.

The CD-Rom

Students can see and hear community members talking about numeracy situations that are important to them or play a part in their lives. Their stories reflect the three contexts outlined below.

The CD-Rom includes digital tasks that consolidate and extend the learning achieved in the problem-solving tasks. Once students are familiar with the hands-on problem-solving tasks, they are ready to use the digital tasks software.

The numeracies

The problem-solving tasks enable access to and stimulate numerate discourse and numerate thinking.

The tasks also bring numeracies in Indigenous communities into the classroom. Mathematical skills, concepts and language from these numeracies are identified and reinforced within familiar contexts. For example, the 'Pack a box' task uses the contexts grocery shopping and packing an esky, freezer or cupboard with the bought food. These contexts can be used in the classroom to teach mathematics.

About this resource

The mathematical learning in the tasks can be developed further by applying mathematical strategies in other familiar situations and contexts, thus expanding numeracies.

The contexts

In many Indigenous communities, family and community life are central to everything. Numeracies that are seen as essential for **everyday living** and impact on **family and community life** seem the most appropriate for students to work on.

Therefore, the following contexts were chosen as the basis for the *Interactive numeracies* resource:

- family organisation
- shopping
- socialising.

Figure 5: The three contexts

The ensuing seven problem-solving tasks were drawn from these contexts. In **FAMILY ORGANISATION** the tasks are about organising for travel and food, in **SHOPPING** the tasks are about short-term and long-term spending and budgeting, while the **SOCIALISING** task focuses on card playing. See page 14 for more details.

The three contexts (expanded below) provide examples that develop the user's understanding about the complexities of mathematics in numeracies and how they are used in everyday life.

Family organisation

Many families lead busy lives with kids at preschool or school, TAFE or university; adults going to work; trips to football and netball matches to organise; family functions to attend or help cater for (see below); and relatives to visit in far flung places.

The problem-solving tasks and CD-Rom provide an opportunity for the learner and educator to interact with many of these types of activities and stories from Indigenous people.

Catering for events

Enormous collaboration, communication and cooperation can go into organising and managing a big event. The catering part of an event is a great example of a diversity of numeracies and mathematics at work.

Catering for major events such as a funeral, 21st birthday party or Christmas can be a big thing. Organisers of the catering may need to consider the following:

- funerals are often held in pension week
- Indigenous women's group can often support the catering for a funeral (eg by providing cakes, BBQ, Milo, coffee, tea, sugar)

- funds can be provided from the community
- organisation occurs around:
  - timing of the event and having enough time to prepare
  - preparing food
  - the different aspects and sequence of things
  - relationships of and between people
  - rules and traditions
  - roles
  - who does what (especially the number business), who shouldn't be left out, estimating numbers
  - how money is used
  - making decisions about how much more food may be needed (to cater for more than expected) and how to make it spread.

Recipes can be handed down from one generation to the next. These ways of learning and knowing can be achieved through mentally retaining and recalling information, procedures, numbers and quantities.

For example, a family recipe for the Christmas pudding has been handed down **orally** through several generations:

> ***Q:*** *Have you any family recipes written down?*
>
> ***A:*** *No. We have a Christmas pudding recipe that we make each year. I just remember it. Sometimes if I'm not sure I'll ring Julie (sister). She remembers it.*

Time management

People may lead very busy lives which require many skills to get through the day and week. To manage time effectively the family may set up rules to ensure everything gets done on time and runs smoothly.

These rules might consist of:

- kids doing chores to get pocket money
- helping one another
- sticking to a routine
- working like clockwork
- organising shower time between am and pm, and alternating showers every second night.

Shopping

There are many different ways to shop and the decisions around these ways can be based on various considerations. One of the most popular situations in Indigenous communities is shopping for Christmas.

Christmas hampers

Buying hampers from Christmas hamper clubs is an excellent way of budgeting and preparing for Christmas.

Decisions made during this time can include the following calculations:

- Christmas time involves catering for the whole family, that is, 20 or more extra people staying for a couple of weeks
- Christmas hamper club can mean 4–5 packs or hampers being purchased through direct debit. A typical family could set a maximum debit of $50 per fortnight.

Socialising

Card games

Card games can be very popular in many Indigenous communities and may be played on a regular basis. Some communities have well organised processes in place where 'the game' (can be concurrent games played at the one time) is hosted in someone's house.

Organisation can include:

- people with whom you can play cards
- people moving from one game to another
- 3–4 scores or games going at the one time
- a 'main game' which is usually in the kitchen as you can fit more people around the kitchen table
- 'fast games' where participants play really quickly
- sitters and standers – sitters are people actually playing while standers are waiting for someone to withdraw so they can play
- different people hosting games – these hosts supply the cards, food, video for the kids etc
- all ages can play
- circles of players looking like 'a great big ringworm' (community member, 2004).

(An interesting comment from the consultation process was that pokies quietened things down for a while but cards are making a comeback as users realise that there's more chance of winning with cards and the winnings stay within the community.)

The stories

The numeracies detailed within this resource would not be complete without including the many intricate stories within them and the different ways of knowing, thinking and doing.

The CD-Rom provides audiovisual stories that illustrate some of the important numeracies used within Indigenous families and communities. The stories come from a diversity of urban, rural and remote communities, and reflect the many ways people use numeracies in their lives, as seen in Figure 6 below.

Figure 6: Overview of the stories

The strategies, skills and maths

Many people who worked with the project team were unaware of the mathematics they used in everyday living.

This resource provides users with the opportunity to:

> recognise the skills they already use in the world
> develop these skills further
> develop new skills in familiar contexts
> think critically about their mathematical choices in real-life contexts
> use familiar skills in unfamiliar contexts.

The mathematics that may be used are outlined on the task cards (under 'The mathematics include…'), and also on the CD-Rom within the scripts provided for some of the stories told by community members.

For a summary of the ideas and concepts discussed above refer to the 'Checklist for educators' (page 26). This checklist is designed to stimulate thinking and discussion about numeracy, Indigenous learners and mathematics.

The tasks

Each of the seven tasks consists of a **double-sided card** and the required **hands-on materials** within a zipped plastic bag.

The front side of the card provides the participant with:

> the task's goal
> a list of enclosed materials and how many participants are required
> step-by-step instructions for carrying out the task
> a further challenge.

On the back of the card the learner and educator can read about:

> where the task came from
> the numeracies included in the task
> the mathematics included in the task (key ideas)
> educator options for extending and deepening the learning

About this resource

- learner options for constructing further learning
- how the task links with the contents of the CD-Rom, so the user knows the contexts and where to find digital tasks to extend the task.

Each task relates to one of the three contexts:

- **Family organisation:** BBQ burnout; Footy trip; Pack a box
- **Shopping:** $20 round off; Checkout challenge; Chrissy combo
- **Socialising:** Maths most.

BBQ burnout

Where the task came from

Whether it's for a family get-together, a birthday party or just an evening meal during the summer, BBQs can be regular events. Lots of food needs to be prepared quickly for hungry mouths.

Task goal: to practise arranging, manipulating and combining 2-D objects or shapes.

Solution: To cover the 6x4 BBQ plate and starting with 3 chops will require 4 sausages. There are many ways to arrange 3 chops and 4 sausages on the BBQ plate. The combination of 3 chops and 4 sausages is the only combination using both chops and sausages that will fit on the 6x4 BBQ plate.

Footy trip

Where the task came from

Transporting people to sports matches can sometimes be tricky if there are more people than seats in cars. Often more than one trip might be needed to get everybody there. Other times, car pools are organised to pick up players who don't have their own transport.

Task goal: to use logic, algebra and patterning to solve a problem.

Solution: To get everyone to the main road will require 12 trips. To get each adult to the main road requires 4 trips.

	Paddock	Main road
Trip 1	→ 2 children →	
Trip 2	← 1 child ←	
Trip 3	→ 1 adult →	
Trip 4	← 1 child ←	
Trip 5	→ 2 children →	

Trip 6 (as in Trip 1, that is, repeat the pattern of Trips 1–5)

Pack a box

Where the task came from

Sometimes it is necessary to pack food items into boxes, eskies or freezers to transport them long distances or keep them for long periods of time. Food and other items can be bought in a major town or city, packed into boxes and eskies in a car, and taken home. They are then unpacked and repacked into freezers, fridges and cupboards.

Task goal: to practise arranging, manipulating and stacking 3-D shapes into a box.

Solution: There are many solutions to this task.

$20 round off

Where the task came from

Rounding off to the nearest dollar is often used in grocery shopping. Shoppers select their items, round the price off and keep a running total as they shop. Then they know they have enough money to pay for their shopping. Many people find it easier to round amounts up to the higher dollar. For example, $2.40 is rounded up to $3.00. However, in this task the strategy of rounding off to the nearest dollar is used.

Task goal: to practise rounding off and keeping a running total.

About this resource

Handy hint: Players will soon discover that there is a 'secret number' that can help them to win (or lose) the game. This is the number that is always seven numbers before the target total, whether it's $20, $30, $40 or whatever. This will become more obvious as the task is played more often.

Checkout challenge

Where the task came from

Aboriginal Education Workers put fun into shopping by challenging each other to get the closest to $20 at the checkout.

Task goal: to add and subtract amounts to $20.

Solution: There are many solutions to this task.

Chrissy combo

Where the task came from

In some communities people choose to plan and prepare for Christmas by joining a Christmas hamper club. They then pay a set amount of money each week towards a variety of (or just 1 or 2) hampers.

Many families choose more than 1 hamper and pay for them over 40 weeks.

Near Christmas the hampers are delivered to the families. This can be a fun time for the children as all the boxes arrive at once.

Task goal: to practise combinations.

Solution: When selecting a number of objects from a larger group of objects without any consideration of the order in which the objects are chosen, the method of selecting is referred to as **combinations**.

It is written as C_r^n and said as **selecting *r* objects from *n*** and $C_r^n = \frac{n!}{(n-r)!\,r!}$

So C_3^5 is selecting three objects from a larger group of five objects and order does not matter.

$$C_3^5 = \frac{5!}{2!3!} = \frac{5\,x4\,x3\,x2\,x1}{2\,x1\,x3\,x2\,x1} = 10$$

For example, selecting three objects at a time from the set of five objects {a, b, c, d, e} would be {abc, abd, abe, acd, ace, ade, bcd, bce, bde, cde} and shows there are 10 ways of selecting three objects from a group of five objects.

Note: With this particular task the notion of 'order does not matter' is different from saying 'order is important'. If order does not matter {abc} is what we want. If we need to consider order, then we need to also think about {abc, acb, bac, bca, cab, cba} which would then be called permutations.

Maths most

Where the task came from

Card games can be an important social activity in many communities. Many different types of games can be played.

This task uses some of the rules and strategies of one of the games common to many Indigenous communities, adapted for the classroom.

Task goal: to practise combinations and addition to maximise results.

Solution: There are many solutions to this task.

About the CD-Rom

The CD-Rom consists of:

- videoed snapshots of stories from Indigenous community members about how they use numeracy in their lives (social, work, shopping)
- integrated software consisting of digital tasks which allow for extension of learning after using the problem-solving tasks
- educators' notes, including extension options for the learner and educator.

How to use the CD-Rom

System requirements

Windows operating system

Minimum requirements:

- Windows XP/Vista
- 1.0 GHz processor or better
- 256 MB RAM (512 MB recommended)
- Monitor displaying 800x600 at 16 bit (thousands of colours)
- 24x CD-Rom or better and working sound card
- Windows Internet Explorer 6.x or better
- Java 2 Runtime Environment.

Apple Macintosh operating system

Minimum requirements:

- OS X 10.3x
- 500 MHz G3 Power PC/ 1.0 GHz Intel
- 256 MB RAM (512 MB recommended)
- Monitor displaying 800x600 at 16 bit (thousands of colours)
- 24x CD-Rom or better and working sound card
- Safari
- Java 2 Runtime Environment.

Instructions

Windows operating system

1. Insert *Interactive numeracies* CD-Rom into CD drive unit (usually D drive).
2. The CD-Rom should start automatically. If it doesn't, follow the steps below.

- Click the START button (usually at the bottom left of your screen).
- Click RUN.
- Type 'D:\clickme.exe' (assuming D is your CD-Rom drive).

Apple Macintosh operating system

1. Insert *Interactive numeracies* CD-Rom into CD drive unit.
2. Double click on the *Interactive numeracies* CD-Rom icon.
3. Click on the 'Clickme' icon.

Navigating the CD-Rom

1. Insert the CD-Rom and open the program.
2. The opening page of the CD-Rom leads to the main menu with the three contexts – **Family organisation**, **Shopping** and **Socialising**.

3. Click on one of these contexts. Each one takes you to a screen where you can listen to **numeracy stories** from community people. Click on a title to see and hear a community person tell their story OR hit the 'Next' button to go to a new screen.
4. This screen provides links to more stories about **numeracy situations** in everyday life. Again, click on a title to see and hear a community person talk about their own experiences in using numeracies.

At this level of the CD-Rom you will find not only stories describing a variety of numeracy situations but also:

- story scripts
- the mathematics that might have been used by the storyteller
- the numeracy outcomes.

Some of these stories relate to the seven problem-solving tasks and will have links to information about the tasks. (Make sure learners play with the hands-on tasks *before* attempting the digital tasks).

For example, from the opening page go to the three contexts. Clicking on **Shopping** takes you to a choice of five stories OR the Next button. Clicking on the **Next** button takes you to two numeracy situations within the shopping context. Clicking on **Saving for Christmas** takes you to some stories about saving for Christmas. Clicking on **Ordering a hamper** takes you to a story and script by community member ***Eunice***. **Task description** tells you where the task came from. To get to the digital task click on **Home**, then **Tasks**, and choose **Chrissy combo**. See Figure 7 below and follow the steps.

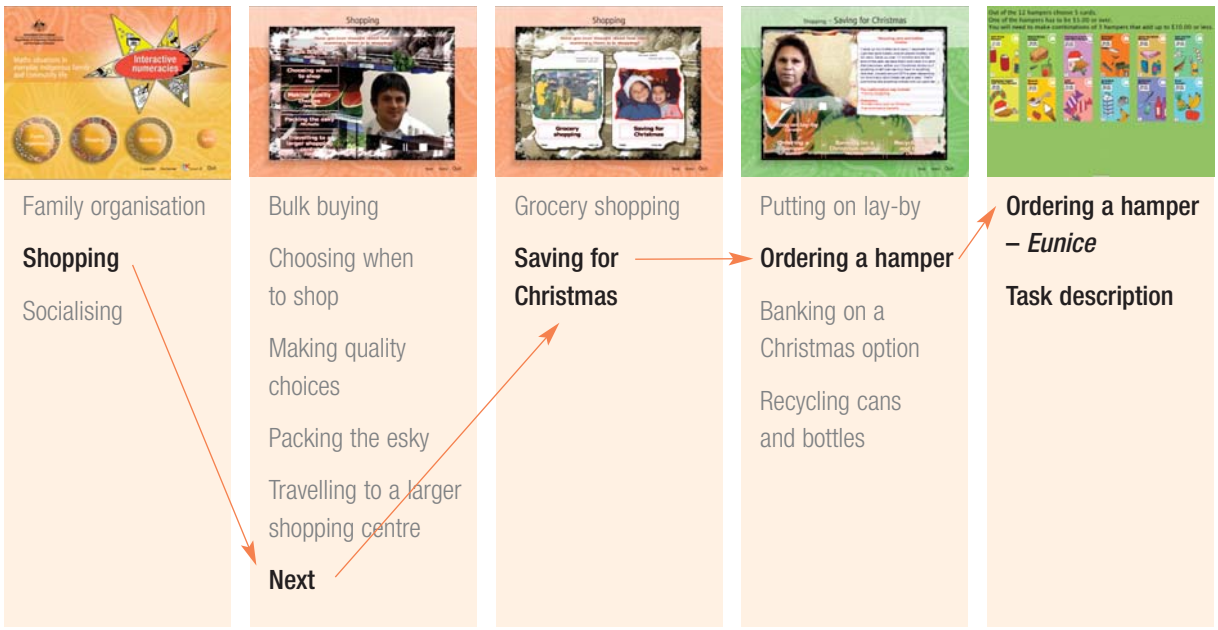


Figure 7: Example of a pathway through the CD-Rom

What next?

This resource is just the tip of the iceberg of what is possible. Given the right circumstances, many more mathematics resources that embrace numeracies in Indigenous communities could be developed.

Hughes (2004, p. v) recommends that numeracy curriculum needs to involve 'identifying which contexts are relevant and meaningful', and that educators need to 'listen to the questions Indigenous students are asking while they're working mathematically as this will help to understand the strategies and skills being used'.

Hughes also makes the following suggestions to improve numeracy outcomes with Indigenous students:

- doing a large-scale longitudinal study across Australia re numeracy outcomes, and trialling different approaches which are based on previous successful research projects
- working with a cohort of Indigenous students who are doing well in numeracy and researching the factors that contribute to their success.

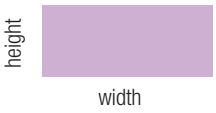
Based on this and other recommendations, findings and research, further development of this project would include:

- doing research re engagement and outcomes of Indigenous learners
- developing resources and strategies based on numeracies that build community economies
- setting up a professional development program for educators of Indigenous students
- building in explicit teaching, that is, using Brian Gray and Wendy Cowey's *Accelerated Literacy* pedagogy in numeracy substituting mathematics texts for literacy texts
- developing rich assessment tasks that have relevance for learners.

Glossary of mathematical language

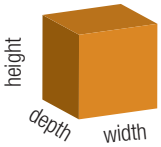
2-D (Two dimensional)

Something with two dimensions (eg height and width). Shapes such as rectangles, circles and triangles are two dimensional.



3-D (Three dimensional)

Something with three dimensions (eg width, length and depth). Objects such as cubes (dice) and cones. Example: an esky or box (as in the task *Pack a box*).



Add (Addition) +

To join or combine or add two or more numbers to find the total or sum.
Example: 10 + 5 = 15.

Algebra

In algebra, numbers are represented by symbols (such as a, x, Δ or □). Example: In the task *Chrissy combo* A + B + C = $10. If A = $2 and B = $7 what must C equal?
Answer: C = $1.

Amount

The quantity (amount), size, or how much of something. Example: You have an amount of $20 to buy food for dinner tonight (as in the task *Checkout challenge*).

Arithmetic

In everyday life we make all sorts of calculations using numbers. We use arithmetic to do this and calculations can be based on addition, subtraction, multiplication and division of whole numbers, decimals and fractions.

Breadth

Means the same as width. The distance from side to side (see 2-D and 3-D above).

Calculate (Calculation)

When you calculate something you work out the answer by adding, multiplying etc. Example: $3.90 + $2.20 = $6.10. You can use mental, calculator or paper strategies to calculate.

Capacity

The amount that can be held by an object such as a cup, jug or esky (as in the task *Pack a box*).

Chance

The likelihood or possibility that something is the case or will happen. Example: When you throw a dice you have a one in six chance that you will throw a two or you have four chances out of 52 of picking up a jack from a full deck of cards (jokers removed) as in the task *Maths most*.

Combination

A collection of things where order does not matter. Example: How many different combinations of chops and sausages fit on a BBQ plate (as in the task *BBQ burnout*), or how many different combinations of 3 hamper cards can you make from a total of 5 (as in the task *Chrissy combo*)?

Compare (Comparison)

Put side by side. Example: Compare, or make a comparison between, Christmas hamper catalogues to work out which catalogue has the best value for money (as in the task *Chrissy combo*).

Glossary of mathematical language

Cube

A 3-D, box-shaped object which has six identical square faces or sides (not including colour).

Data

A collection of information or facts. This may consist of numbers, words or images obtained from surveys or experiments. Example: In the task *Footy trip* you could collect data by recording the number of trips for the different numbers of adults, and use the data to develop a formula.

Decimal number

The decimal number system has ten as its base (base ten) and counting occurs in groups of 10. It is the most widely used number system, probably because humans have ten digits over both hands. There are 10 numbers: 0, 1, 2, 3, 4, 5, 6, 7, 8 and 9.

Diagonal

A straight line that joins two opposite (non-adjacent) corners (vertices) or one corner to another within a straight-sided shape (polygon).

Divide (Division) ÷

To share or split a number (of things) into equal parts. Example: If you share or divide 10 apples between 5 people, how many apples each will they have? Answer: $10 \div 5 = 2$.

Estimate (Estimation)

To make a reasonable guess at something or make an approximate calculation after thinking about the situation. Example: When shopping you can round off items to the nearest dollar and keep a running total. This will give you an estimate of how much your shopping will cost (as in the task *$20 round off*).

Equal

Having exactly the same value, amount or size.

Face down

To place something so that its face is pointed downwards. Example: a deck of cards placed so that the faces of the cards are pointed downwards and can't be seen.

Face up

To place something so that its face is pointed upwards. Example: a deck of cards placed so that the faces of the cards are pointed upwards and can be seen.

Flip (Reflect)

To turn over something so that it appears as a reflection such as in a mirror (mirror image). Example: In the task *BBQ burnout* you can manipulate chops and sausages by flipping them over.

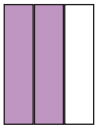
Glossary of mathematical language

Formula

A rule in mathematics that is written using symbols, letters, or numbers to show how something is worked out. Example: In the task *Footy trip*, to get each **A**dult across the paddock to the main road on the motorbike requires **4** trips plus **1** more trip to get the last child across. The formula for this is: **4A + 1** where 4A = 4 times how many Adults or 4 trips for every adult plus one more trip. If there are 3 adults and 2 children the answer is (4 x 3) + 1 = 13 or just 4 x 3 = 12 if the children don't need to get across the paddock.

Fraction

Any part of a whole (number, apple etc) or part of a group. A fraction is a number written in this way: *a/b* where *a* is called the numerator and *b* is called the denominator. The numerator (the top part) tells how many you have and the denominator (the bottom part) tells you how many parts the whole has been divided into. Example:



$\frac{2}{3}$ Numerator / Denominator $\qquad \frac{2}{3}$ can be read as 2 ÷ 3

Geometric (Geometry)

Using the area of mathematics about size, shape, lines, space, angles, curves, surfaces and objects. Example: 2-D geometry (as in the task *BBQ burnout*) and 3-D geometry (as in the task *Pack a box*).

Height

The measurement of vertical distance (ie from top to bottom).

Horizontal

Parallel to the horizon or going from side –> side. (Vertical is up –> down or down –> up.) If you are in a horizontal position you are lying down.

Linear

Relates to lines. If something is linear it's to do with lines.

Manipulate (Manipulation)

To move or handle something. Example: In the task *BBQ burnout* you manipulate the chops and sausages by flipping them over (a reflection), sliding them (a translation), or turning them around (a rotation).

Maximise (Maximum)

To make something as big or great as possible. To find the maximum of something is to find the greatest amount or value. (To do the opposite – make something as small or little as possible – is to minimise it.)

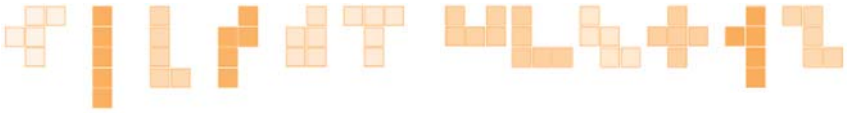
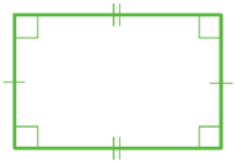
Measure (Measurement)

To find the quantity, size or amount of something. Example: To measure your height you will measure from the top of your head to the bottom of your feet. To measure the mass of something you could weigh it on a set of scales.

Multiply (Multiplication) X

To find the total number of things that are in equal-sized groups.
Example: 4 x 3 = 12
You have 4 three times.

Glossary of mathematical language

Numeracy	Numeracy involves understanding, analysing, critically responding to and using mathematics in different contexts. These understandings relate to measurement, spatial sense, patterns and algebra, and data and number (SACSA Framework 2001, p. 5)
Numerical (Number)	Made up of numbers or using numbers.
Operate (Operation)	To operate is to perform one or more of the mathematical operations such as: > Addition (+) > Subtraction (–) > Multiplication (x) > Division (÷)
Pattern	Something that is repeated in a predictable way.
Pentomino	A plane figure made by joining together identical basic polygons with the square as its base form, and made up of five identical squares connected at right angles. 
Perimeter	The distance around a 2-D shape or figure (ie the sum of the length of its sides).
Polygon	A 2-D or plane shape that has three or more straight sides.
Predict (Prediction)	To make a guess about something that is going to happen in the future based on reason.
Probability	The likelihood or chance that something is the case or will happen.
Problem	A question that can be analysed, and possibly solved, using mathematics.
Quantity	Amount, how much, or the number of something. Example: What quantity of flour is needed to make a cake? Answer: about two handfuls.
Random	Chance event, having no pattern, cannot be predicted (eg drawing a number out of a hat).
Rectangle	A quadrilateral (a polygon with four sides or edges and four vertices or corners) where all four of its angles are right angles, and with two pairs of opposite sides that are equal. 
Reflect (Reflection)	To flip an object across a line so it's a mirror image of itself. See 'Flip'.

Glossary of mathematical language

Rounding (off) — To change a number to a more suitable number by reducing the number of digits. Example: $4.80 can be rounded to $5 and $4.20 can be rounded to $4.

Running total — A total that is added to. Example: 3 + 10 = 13 + 6 = 19 + 5 = 24 etc.

Score — To keep count or tally. Example: The footy score at half time is 39 points.

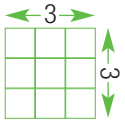
Shape — The outline or appearance of a 2-D figure. Some common shapes are triangles, squares and circles.

Slide — See 'Translate'.

Spatial — To do with space. If something is spatial it involves or has something to do with space. Example: Your spatial awareness will help you to fit the objects into a box so there are no gaps (as in the task *Pack a box*).

Square — A polygon (four-sided shape) with four equal sides and angles, that is, the sides of a square and its diagonals meet at right angles.

Square number — The answer or result you get when you times a number by itself.
Example: 3 x 3 = 9



Subtract (Subtraction) — The opposite (inverse) of addition which means to take one number away from another number. This is also called: take from, take off or deduct.
Example: 10 – 7 = 3

Symbol — Objects, pictures or other representations of numbers, operations or other things. Example: x is the symbol for multiplication; $ is the symbol for the dollar or dollars.

Tally — Marks made in groups of five to record counting.

 = 15

Tessellate (Tessellation) — To make a pattern with identical shapes fitted together with no gaps or overlaps.

Total — Adding two or more numbers together will result in their sum or total. Example: 3 + 2 + 5 = 10.

Transform (Transformation) — To move or manipulate a shape so that it is in a different position. This can be done through:

- Reflection (a flip)
- Translation (a slide)
- Rotation (a turn)
- Enlargement (a zoom).

Glossary of mathematical language

Translate (Translation)	To move a shape in a certain direction by sliding it but not rotating, turning or flipping it.
Value	How much something is worth. Example: This amount of gold has a value of $100.
Vertical	At right angles to the horizon or in an up –> down or down –> up position. Example: If you are in a vertical position you are standing upright.
Volume	Amount of space that the inside of an object takes up. Example: The volume of a 1 litre carton of milk is 1 litre.
Whole numbers	The counting numbers from zero to infinity (0, 1, 2, 3, 4,…) with no decimal or fraction parts.
Width	The distance from side to side, measuring across the object at right angles to the length. Also called 'breadth'. See 2-D and 3-D.

Please note: Some of these definitions are adapted courtesy of Wikipedia
http://en.wikipedia.org/wiki/Main_Page

Checklist for educators

Assess your understanding and thinking around pedagogy, numeracy, Indigenous learners and the mathematics classroom.

Statement	Agree	Disagree	Comment
1. I recognise and transfer to my teaching and learning cycle the numeracies learners already use, or engage in, within the classroom, in their own settings and in the wider world (including technology eg calculators, mobile phones).			
2. I apply successful and appropriate strategies, frameworks and/or pedagogies I've used in other disciplines (eg literacy) in mathematics or numeracy teaching.			
3. I link new learning with old learning (ie unfamiliar content in a familiar context; unfamiliar context in familiar content).			
4. I use familiar contexts for learners to apply, use, develop and/or understand their new learning.			
5. When teaching mathematics I also teach how, where, when and why it can be applied outside the classroom (ie connect it to the real world).			
6. I provide opportunities that enable access to numerate discourse and numerate thinking.			
7a. I understand that learners may be using mathematics in various contexts but are not identifying or recognising it in the classroom.			
7b. I alert learners to (and help them identify) the different ways they may be using mathematics and the different situations in which they use it. They may, in fact, not realise they're using mathematics in certain situations.			
8. I use explicit language and instruction.			
9. I am continually developing my higher order and critical thinking, and pedagogy in mathematics.			
10. My learners know and understand what mathematics and numeracy are, and how they're connected and different.			
11. I build on the knowledge, thinking, ways of knowing and doing, skills and mathematical language my learners bring to the classroom.			
12. I listen to the questions learners are asking and/or the mathematical language they are using (eg nouns and verbs) in order to assess their understandings.			
13. I consider whether my Indigenous learners learn best collaboratively or independently, and when best to provide different opportunities to cater for different ways of, or preferences for, learning.			
14. I understand that the learner may not be interacting with, or seeing, the mathematics because the context is too distracting, unfamiliar and/or more interesting than the mathematics. Consequently I may need to explicitly draw their attention to it.			
15. I understand and can articulate my learning and teaching goals in mathematics and numeracy.			
16. I notice or look for other, unusual uses of patterning and patterns that students see or make.			
17. I allow for different ways of problem solving. For example, 27 + 35: work out this problem mentally – how many different ways have students used to work it out?			
18. I allow learners to 'play' with mathematics – have fun and be creative with it.			

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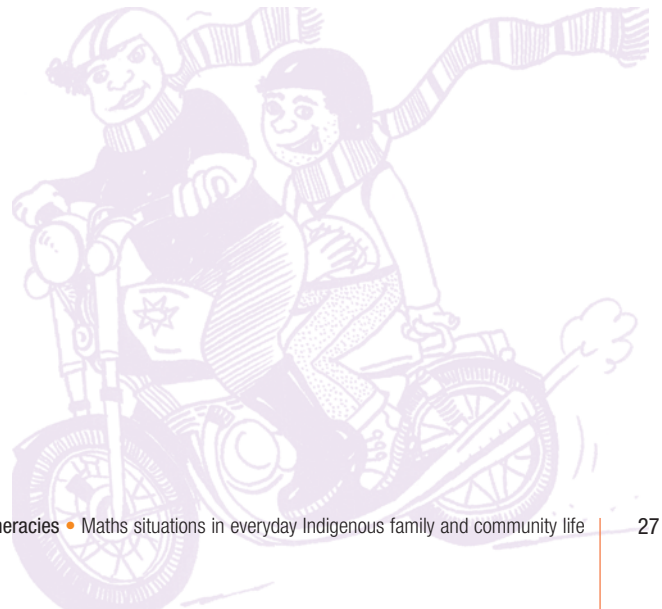

Educators' notes