Exploring Numbers - Introduction

One of the most important aims of adult numeracy education is to build students' confidence with numbers and their associated language. This means first acknowledging students' existing knowledge, then building on this to expand their understanding of the number system and how it works. Understanding of the patterns of tens within our number system provides the basis for a range of 'In the head' calculation strategies described in other sections of this resource.

The intention of this section, *Exploring Numbers*, is to bring together a collection of favourite activities which encourage students to become more familiar with the properties of numbers, the operations used with them, and their associated language.

Language and properties of numbers

These activities include a variety of games, problems solving tasks and small group and pair activities. Some explore the common, everyday language of number by encouraging students to listen to, and read numbers aloud, progressing from smaller, familiar numbers to those in the millions. These activities also highlight the importance of place value, the position of the numbers which determines their size. Other activities highlight the language of comparison and meaning of number properties such as odd, even, greater or less than, between.

Exploring operations, symbols and calculators

The words, symbols and meaning of arithmetical operations (+, -, x and ÷) and their associated calculator buttons are also explored in this section. Activities provide space for students to clarify, or perhaps learn for the first time, the many different ways in which a simple mathematical process, such as addition, can be expressed. For example '+', 'plus', 'add', 'and', 'total', 'the sum of', are all commonly used in everyday English to express the same operation.

Arithmetic operations (+, -, x and ÷) are also explored through *Number Patterns*, and *What's the rule?* Activities. These activities also highlight the inverse relationships of addition / subtraction and multiplication / division, which provide an important way of checking subtraction and division calculations, so often a source of difficulty for numeracy students.

The section also includes techniques and games for helping students learn and recall multiplication tables and addition facts.

Introducing estimation and approximation

Exploring Numbers also contains activities that lay the groundwork for estimation techniques by introducing the idea of approximating large numbers to make them easier to understand and compare.

Number Patterns

Overview

This activity uses sequences of numbers, called number patterns, to provide practice with basic operations.

It also provides an opportunity for you to assess the existing number skills and knowledge of your students.

Number patterns can be used with a range of students as they can be made easy or quite challenging.

Skills and Knowledge

- Pattern recognition
- Counting in 2's, 5's, 10's
- Addition and subtraction of whole numbers and money

Preparation and Materials

Copy Practice Sheets 1 – 5 (one for each student).

It is likely that you will use these over a few numeracy sessions rather than all at once.

Suggested Procedure

Introducing the activity

Write a set of numbers on the board: *2, 4, 6, 8 …*

Ask:
- *What comes next?*

Write the next few numbers on the board.

Ask:
- *Do you ever count like this?*
- *Have you heard other people doing it? Why?*
- *Can you think of other common ways that we hear people counting?*
- *What about with money?*
- *If you had a jar full of 10 cent coins how would you count it?*

As you get suggestions write the pattern sequences on the board.

For example for ten cent coins: 10, 20, 30 ….

Ask:
- *What about 5 cent coins?*
- *Or 20 cent coins?*
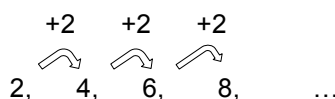
What's the rule?

When you have a few of the patterns on the board, Ask:
- *What are we doing to these numbers each time?*
- *Are we adding? Subtracting? Multiplying? Dividing?*

Explain:
- *On the first number pattern we are adding 2*
- *So our 'rule' is to add 2, or + 2*

One way to remember this it to make an arrow between each number and write +2 over it:

These arrows can be very useful later for exploring opposite operations. For example if we go to the left instead, we would write -2.

```
   +2    +2    +2
  ⌢     ⌢     ⌢
2,   4,    6,    8,        …
```

Try some examples that begin mid-sequence, e.g. 12, 15, 18 …

Fill in the arrows and extend the pattern.

Ask:
- *Can you make a few patterns like this yourself?*

Let students experiment for a minute and give you some of their examples to work through on the board. Ask other students what the next number will be.

Other practice

Practice Sheet 1 provides further examples that focus on addition patterns and could be done now, or after the *Guess my rule* game below.

Guess my rule – A game for pairs

Give a starting number to each student. (You could just whisper a number or have different numbers on pieces of paper to give out.)

Explain:
- *Write down the number I gave you and use it to start your own number pattern*
- *Don't tell anyone else your rule*
- *When you have four numbers in your pattern give it to your neighbour*
- *See if they can work out your rule and put in the next three numbers*

Patterns with subtraction

Explain:
- *So far we have only looked at patterns with rules that use adding*
- *Now we will look at some that are a bit different*

Work through a couple of examples together on the board. For example:

40	*39*	*38*	__	__	__
10	*8*	*6*	__	__	__

[Answers: (-1) 37, 36, 35
(-2) 4, 2, 0]

Adding and subtracting as opposites

Number patterns can be used to show that addition and subtraction are opposite processes, which is very useful for checking subtraction calculations. A powerful way to make this clear is by showing arrows going in both directions on the pattern, as explained below.

Add a dash at the beginning of the second pattern:

-2

__   10   8   6   4   2   0

Ask: *Do you know what number would go here?*

Help students to visualise the opposite pattern by suggesting they start at the other end (0, 2, 4, 6, etc.).

Ask: *What would the rule be going this way?*

Draw arrows under the numbers to assist students to see that the next number will be 12:

___   10   8   6   4   2   0

              +2   *+2*

This idea can be used later to encourage students to check their subtractions by adding.

For example 31- 9

-9

31   22

+9

If a student's answer was 23, the check (23 + 9 = 32) should highlight a mistake.

Further practice

Practice Sheets 2 & 3 contain a mix of addition and subtraction examples.

Practice Sheets 4 & 5 contain examples of number patterns using money and time.

Students should be allowed to work through these at their own pace. Those who finish quickly can be given later sheets to work on.

You can also generate a wide range of number patterns of your own to suit the level of your students as a group or individually.

One or two number patterns on the board is a good way to start off a numeracy session.

Number Patterns

- Fill in the missing numbers

- Show the rule you used with an arrow

+/   +/

1.   **1   2   3   4**   ___   ___   **7   8**   ___   ___

2.   **2   4   6   8   10**   ___   ___   ___   ___   **20**

3.   **5   10   15   20   25**   ___   ___   ___   ___   **50**   ___

4.   **10   20   30**   ___   ___   ___   ___   ___   ___   **100**   ___

5.   **20   40   60   80   100**   ___   ___   ___   ___   ___   ___

6.   ___   **25   35   45   55**   ___   ___   ___   ___   ___

7.   ___   ___   ___   **34   44   54   64   74**   ___   ___

8.   ___   **50   100   150**   ___   ___   ___   ___   ___   ___

Number Patterns

- Fill in the missing numbers

- Show the rule you used with an arrow

1.   *1*   *3*   *5*   *7*   ___   ___   ___   ___   ___

2.   ___   *4*   *8*   *12*   *16*   ___   ___   ___   ___   ___

3.   ___   *6*   *9*   *12*   *15*   ___   ___   ___   ___   ___

4.   ___   *22*   *20*   *18*   ___   ___   ___   ___

5.   ___   *18*   *27*   *36*   ___   ___   ___   ___

6.   ___   *28*   *24*   *20*   ___   ___   ___   ___

7.   ___   *30*   *38*   *46*   ___   ___   ___   ___

8.   *100*   *90*   *80*   ___   ___   ___   ___   ___   ___   ___   ___

- Fill in the missing numbers

- Show the rule you used with an arrow

1. **1000 2000 3000** ___ ___ ___

2. **25   50   75**   ___ ___ ___

3. ___   **40   37   34**   ___ ___

4. ___   **11   22   33**   ___ ___

5. ___   **800   600   400**   ___ ___

6. ___   **29   27   25**   ___ ___

7. ___   **17   25   33**   ___ ___

8. **15   30   45**   ___ ___ ___

Number Patterns

- Fill in the missing numbers

- Show the rule you used with an arrow

1. **20c   40c   60c   80c $1.00**   ___   ___   ___   ___

2. **50c $1.00 $1.50 $2.00**   ___   ___   ___   ___   ___

3. **10c   20c   30c   40c   50c**   ___   ___   ___   ___   ___   ___

4. **$1.00 $1.05 $1.10 $1.15**   ___   ___   ___   ___   ___

5. **$40 $60 $80**   ___   ___   ___   ___   ___

6. **5c   10c   15c**   ___   ___   ___   ___   ___   ___

7. **$1.00 $1.20 $1.40 $1.60**   ___   ___   ___   ___   ___

8. **$2.00 $2.05 $2.10 $2.15**   ___   ___   ___   ___   ___

Number Patterns

- Fill in the missing numbers

- Show the rule you used with an arrow

1. **4 mins**   **6 mins**   **8 mins**   ___   ___   ___

2. **10 sec**   **15 sec**   **20 sec**   ___   ___   ___

3. **30 mins**   **1 hr**   **1 ½ hr**   ___   ___   ___

4. **1.45**   **1.50**   **1.55**   ___   ___   ___

5. **2 o'clock**   **5 past 2**   **10 past 2**   ___   ___   ___

6. **6.15**   **6.30**   **6.45**   ___   ___   ___

7. **45 mins**   **50 mins**   **55 mins**   ___   ___   ___

8. **10 to 9**   **5 to 9**   **9 o'clock**   ___   ___   ___

Capital Cities of Australia

Overview

This activity uses a map of Australia and the populations of Capital cities as a source of large numbers for students to practise ordering, verbalising, and approximating, whilst raising their awareness about Australia.

It is an ideal activity for integrating with literacy or language learning.

Skills and Knowledge

- Ordering large numbers
- Verbalising large numbers
- Rounding large numbers
- Knowledge of Australia

Preparation and Materials

Photocopy *Activity Sheet 1* and cut out the names of the states, cities and populations. Sort these small sets separately (i.e. 8 of each) with paper clips or rubber bands so that they can be distributed set by set to students.

Photocopy *Activity Sheet 2* (1 per pair or small group of students).

Suggested Procedure

Introducing the activity

As a preliminary warm-up ask:

- *What is the capital city of the country where you were born?*

Discuss this until you have heard from each student and established the meaning of 'capital' city.

Naming the states

Arrange students in pairs or small groups. Give each group a Map and the cards of state and territory names; ask them to try and place the names of the states in the correct position on the map. Ask:

- *Which were easy?*
- *Which were difficult?*
- *Were there any clues to help you?*
        [**West**ern Australia, **South** Australia, **North**ern Territory all provide clues to location.]

This can be a good time to discuss directions and compare students' methods of locating North, South, East and West. It is also an opportunity to explain that maps and street directories normally have North to the top of the page.

Placing of the Capital Cities

When the discussion of states is completed collect the state cards and distribute the cards of city names. Ask students to try to place them in approximately the right place.

Compare results and correct any significant misplacement. Leave these cards on the map.

The meaning of 'population'

Ask:
- *Do you know the approximate population of our city?*
- *What do I mean by the word 'population'?*

Discuss their guesses and clarify the term 'population'. You could ask about relative sizes of local towns compared with the capital city, for example:

- *Is this city/town bigger than …………....?*
- *Do you think of this city/town as a big/small city?*

You could use these questions about the population of Australia (approx 23 million in 2012) instead of a local city/town.

Ordering the populations

Explain:
- *We will now see how much you know about the size of the cities.*

Distribute the sets of population cards.
- *I am giving you cards of the populations.*
- *First I want you to arrange them in order from largest to smallest.*

If they are having difficulty arranging the numbers these pointers might help:

- There are 3 numbers less than one million and they must be the smallest.
- For the 6 figure numbers, arrange them in order by looking at the left hand side of the number (the thousands end).
- For the 7 figure numbers (millions), arrange then in order by looking at the millions number on the left hand side.

Matching the populations to the cities

Explain:
- *Now I want you to try and put the populations with the correct city.*
- *It may help you to remove the cards of city names from the map and order them from largest to smallest.*

[Students who have been to other cities could talk about their knowledge, which will help make decisions about relative sizes.]

After the students have made their guesses discuss the actual order of city sizes.
[Sydney, Melbourne, Brisbane, Perth, Adelaide, Canberra, Hobart, Darwin]

Emphasise terms such as largest/smallest, highest/lowest, second highest …

Answer (population taken from the 2011 census)

Sydney	4,610,000
Melbourne	4,170,000
Brisbane	2,150,000
Perth	1,830,000
Adelaide	1,260,000
Canberra	367,100
Hobart	214,700
Darwin	129,100

Note: the emphasis is on pronunciation of the numbers. You could write the actual number they say on the board.

To give students practice at reading these numbers aloud, ask questions such as:
▪ *What did you have for the population of..?*
▪ *Which is the biggest/smallest population?*
▪ *Which is the second highest/lowest population?*

Allow plenty of time for students to practise saying these numbers with focus on the place value of millions and hundreds of thousands.

Approximate numbers

Ask:
▪ *Do you think these are exact or approximate numbers?*

Discuss the meaning of the terms 'exact' and 'approximate'. Also introduce the term 'rounding off'.

For example:
▪ *Melbourne's population could be "rounded off" to 4 million to make it easier to remember.*
▪ *We could say it has*:
    ▪ *Approximately 4 million people*
    ▪ *About 4 million*
    ▪ *Just over 4 million*
    ▪ *A bit more that 4 million*

Ask:
▪ Can you make up similar statements for:
    ▪ *Brisbane?*
    ▪ *Adelaide?*
▪ *What about Perth?*

[Perth has:
▪ A bit **under** 2 million
▪ Approximately 2 million
▪ Almost 2 million.]

Practice Sheet 1 contains individual practice to reinforce the language of order and approximation.

Capital Cities Map

Population on Census night 2011

✂ Copy onto card and cut.

New South Wales	Sydney	4,610,000
Victoria	Melbourne	4,170,000
Queensland	Brisbane	2,150,000
Western Australia	Perth	1,830,000
South Australia	Adelaide	1,260,000
Tasmania	Hobart	214,700
Australian Capital Territory	Canberra	367,100
Northern Territory	Darwin	129,100

Approximating Populations

Population of Australian Capital Cities 2011			
Sydney	4,610,000	Adelaide	1,260,000
Melbourne	4,170,000	Hobart	214,700
Brisbane	2,150,000	Canberra	367,000
Perth	1,830,000	Darwin	129,100

Use words from the box below to make each sentence true. Each word can only be used once.

1. Sydney's population is the ……………………………. in Australia.

2. Darwin's population is the …………………………... in Australia.

3. Melbourne's population is …………………..……… than Sydney's.

4. Adelaide's population is ………………………………… 1 million.

5. Brisbane's population is ……………………………… 2 million.

6. Melbourne has the second ………………………..population.

7. Perth has a ………………………………….population than Brisbane

8. Canberra's population is the ………………………….. smallest.

second	smaller
a bit less than fifth	third
largest lowest	equal to
just over approximately	highest

Back to Back Numbers

Overview

This pair activity is designed to encourage reading, writing, speaking and listening in relation to numbers.

It will enhance learners' capacity to:
- Interpret the value of numbers written in symbols (place value)
- Articulate the value of numbers using words
- Translate between numbers written in figures and spoken English

As a pair activity it is:
- A non-threatening way to encourage students to speak numbers aloud
- A means of fostering interaction between students
- A useful activity to add variety to a long session
- Adaptable to a variety of levels within one class
- An activity which can be revisited at regular intervals
- Especially useful if English is not the students' first language

Skills and Knowledge

- Speaking, reading, writing and listening with whole numbers using Australian notation
- Place value of whole numbers

Preparation and Materials

Photocopy Activity Sheets 1 and 2 onto card or coloured paper (1 of each per pair of students).

Cut out the cards, arrange them in sets (using a paper clip) and sort into labelled envelopes.

Note:
- The sets can be left on one strip of paper rather than cutting into separate cards if you think your students will not be daunted by seeing the whole set at once.

- The sets of numbers increase in difficulty from Set 1 to Set 8. So not all of them may are likely to be required the first time you use the activity with your group.

- Activity Sheet 3, *The Blank Sets* may be used to create further sets by inserting in numbers that suit your students' needs.

Suggested Procedure

The activity is best explained by physically demonstrating as you explain the procedure.

- Ask for a volunteer to act out the roles with you to make it clear.
- Write up a number such as 2,387 on a piece of paper in order to demonstrate.
- Your volunteer will need a pen and paper to write on.

▪

Introducing the activity

Explain:
- *This activity will give you practice at saying numbers aloud.*
- *Also at writing numbers when you hear them spoken.*
- *I will give each of you a set of numbers.*
- *You will take it in turns so you both have a turn at reading as well as listening and writing the numbers.*

Demonstrate with a volunteer, move your chairs back to back.
Explain:
- *You will sit back to back – so that you cannot see your partner's numbers.*
- *Pretend you are on the phone speaking – so you have to **listen** not look at the numbers.*
- *You have to read them in full so that the other person can understand them.*
- *You cannot read them out like you would read a phone number.*
- *For example my number is "Two thousand, three hundred **and** eighty-seven". Not "two, three, eight, seven".*
- *My partner will write down the number she/he hears me say.*
- *At the end we will compare what my partner wrote with the numbers I started with.*

Briefly go through the procedure of speaking the number, getting the students to write it (in numerals not words) and checking the number together.

Writing large numbers

Write the number **2387** on the board **without the comma** saying it again aloud as you do.

Ask:
- *Is this what she/he should have written?*
- *Is that enough, have I left anything out?*

Discuss the placement of a comma between the 2 and 3 as a marker to separate the thousands from the hundreds [2,387].

Cultural differences in notation

Ask:
- *Have you seen this before?*
- *Are you used to writing it like this?*
- *Or do you know a different way?*

Note: The use of commas is not a trivial issue for students who grew up in other cultures. The way we write and read numbers in our own culture becomes embedded into our language and our way of thinking. Changing it is not easy. Plenty of practice and focus is needed to help student do this.

If it is relevant to any of your students, explain that in the majority of countries in Europe, a point is used as a marker for thousands and the comma is used where Australians use the decimal point. This is also true in the countries Europeans colonised, such as Cambodia & Indonesia.

Remember: Emphasise that their notation is not wrong; it is just different from the norm here.

Also draw students' attention to the 'and' before the 'eighty seven'. This is another feature of the English and Australian way of saying numbers that is not necessarily shared in other languages.

Extending the pattern of notation

Depending on the students' capacity with numbers at this stage, you might want to show them how this pattern of using the of comma repeats after every three digits, making it easier to distinguish the size of numbers than if they were written without commas. For example 2,387,456 is "Two million, three hundred and eighty-seven **thousand**, four hundred and fifty-six."

Warning: Do not talk about this if students are not yet comfortable with smaller numbers.

Conducting the activity

Arrange the students in pairs (2 students of roughly equivalent standard is helpful for this activity)

Distribute Set 1 to one student and Set 2 to their partner.

These two fairly straightforward sets should build student confidence and allow them to get used to the activity. If they do not find them easy then you can backtrack with simpler numbers.

Explain:
- *You should take it in turns to read and write your numbers.*
- *When you have finished compare your numbers.*
- *Make sure you find out the cause of any mistakes – they could be reading or writing mistakes.*
- *If you don't agree and can't work out what went wrong in the reading and writing then call me for help.*
- *When you are happy that you can do these sets correctly let me know and I will give you more numbers.*

Circulate and listen to the students, distributing the slightly harder sets of numbers as they are ready for them. If mistakes are being made with the easier sets then create more of your own for students to practice at an appropriate standard, either now or later.

Back to back numbers

✂ Copy and cut.

Set 1 number 1 **70**	Set 2 number 1 **50**
Set 1 number 2 **890**	Set 2 number 2 **201**
Set 1 number 3 **605**	Set 2 number 3 **740**
Set 2 number 4 **9,000**	Set 2 number 4 **3,000**
Set 1 number 5 **2,300**	Set 2 number 5 **6,800**

Set 3 number 1 **417**	Set 4 number 1 **719**
Set 3 number 2 **903**	Set 4 number 2 **806**
Set 3 number 3 **725**	Set 4 number 3 **692**
Set 3 number 4 **1,900**	Set 4 number 4 **3,600**
Set 3 number 5 **5,267**	Set 4 number 5 **4,372**

Back to back numbers

✂ Copy and cut.

Set 5 number 1 **1,400**	Set 6 number 1 **6,511**
Set 5 number 2 **5,136**	Set 6 number 2 **1,290**
Set 5 number 3 **21,467**	Set 6 number 3 **32,596**
Set 5 number 4 **2,070**	Set 6 number 4 **4,802**
Set 5 number 5 **520,000**	Set 6 number 5 **76,000**

Set 7 number 1 **59,015**	Set 8 number 1 **72,010**
Set 7 number 2 **421,000**	Set 8 number 2 **301,500**
Set 7 number 3 **906,400**	Set 8 number 3 **816,700**
Set 7 number 4 **1,200,000**	Set 8 number 4 **6,800,000**
Set 7 number 5 **29,005,000**	Set 8 number 5 **12,060,000**

Back to back numbers

✂ Copy and cut.

Set number 1	Set number 1
Set number 2	Set number 2
Set number 3	Set number 3
Set number 4	Set number 4
Set number 5	Set number 5

Set number 1	Set number 1
Set number 2	Set number 2
Set number 3	Set number 3
Set number 4	Set number 4

Set number 5	Set number 5

Key Words for Calculations

Overview

Words to do with arithmetic such as add, multiply, subtract, divide are not often used in ordinary conversation. As a result many people, especially those from other language backgrounds, have not acquired this vocabulary and are confused in mathematical learning situations.

This activity promotes discussion of the arithmetic related words, practice at hearing and speaking them and relating them to the appropriate symbols and calculator keys.

Skills and Knowledge

Language of basic operations (+ − × ÷ =).

Use of calculator for basic operations

Preparation and Materials

Photocopy *Activity Sheets 1 & 3* (1 per pair of students)

Photocopy *Activity Sheet 2: Key Words* onto stiff paper or card, cut them into small cards and place in labelled envelopes (1 for each pair of students).

Calculators (1 per pair).

Suggested Procedure

Introducing Key Words

Distribute calculators (1 per pair of students)

Distribute Activity Sheet 1: *What Operation?*

Explain:
- *Look at the pictures*
- *Work out your answers any way you like*
- *You can use calculators, but you don't have to*
- *Write your answers in the space provided next to 'How much'*

Go through the illustrations one by one.

Ask:
- *What answer did you get?*
- *What did you do?*
- *What language did you think in?*
- *What were the words that you used in your first language?*

This introduction allows students to show the simple arithmetical calculations they can already do before focusing on language & symbols.

It is a good idea to discuss some of the words students were 'thinking'; ask for volunteers to write their own language on the board. Spend some time on discussion and comparison of words before continuing with the activity.

Now refer students to the empty calculator button and for each illustration ask:

- *What is the sign or symbol that will go on this calculator button?*
- *What sign or symbol do we use instead of these words*

For each illustration the class should:

- Agree on the arithmetic answer
- Briefly discuss the words
- Agree on the symbol to place in the empty calculator button.

'Symbol' is an important mathematical word to spend some time discussing.

Key word sorting

Distribute envelopes of cut up symbols and words (one to each pair of students). If appropriate, you could pair people of similar language backgrounds.

Explain:

- *You are to work in pairs*
- *Use one copy of Activity Sheet 1 between you*
- *Arrange the words and symbols beside the correct picture*

After 5 or so minutes to discuss their results and see if all agree on which words and symbols go together.

Distribute the *Key Words Summary Sheet*. Allow time for students to write in the blank spaces any other key words they used in English or their own language.

Explain:

- *Take this home and put it on your fridge or similar to help you learn the words.*

Practice Sheet 1 is a reinforcement of this activity. It could be used now or as a revision in a later session.

Which Key?

$59.95 jacket

$52.49 shirt

$19.60 shorts

How much?

$2.59 each

How much?

193cm

?

148.5cm

How much?

$119.10?
share between
3 people?
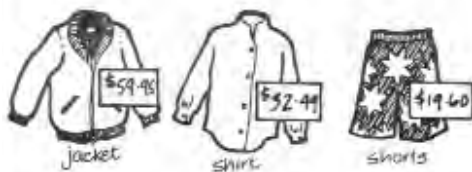
How much?

✂ Copy onto card and cut.

and	from	add
multiply	plus	times
take away	by	subtract
divide	minus	into
is	makes	equals
$+$	$-$	$\times$
$\div$	$=$	total

➕	add plus total and	✖️	times multiply by
Your words:		Your words:	
➖	take away minus subtract from	➗	divide into
Your words:		Your words:	
=	equals makes is		
Your words:			

Calculator Symbols

Write the symbol from your calculator in each square.

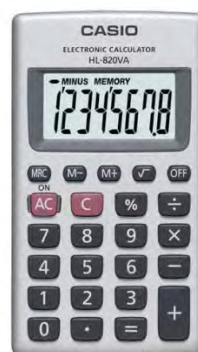|				
add	☐	zero	☐	
subtract	☐	times	☐	
multiply	☐	is	☐	
minus	☐	take away	☐	
plus	☐	by	☐	
divide	☐	makes	☐	
equals	☐	into	☐	
from	☐	and	☐	
total	☐	point	☐	

What's the Secret Number?

Overview

This activity is designed to reinforce students' knowledge and use of the language of numbers and operations (+ - x) as they perform simple arithmetic calculations. It comprises a selection of 'cooperative logic' problems related to numbers and their properties. To solve the problems students interpret conceptual language such as odd, even, greater/less than, as well as the language of the operations.

Ideally students work together in small groups to solve the problems cooperatively, thereby reading, listening to and interpreting the relevant language as well as doing the calculations.

This activity is best done after the class have experienced some of the problems in the *Introducing Cooperative Logic* activity in the *Getting Started* section of this resource.

Note: Fewer sets are needed if you start each small group with a different problem and swap them around as they finish. However, this does require more attention during the class and can distract from observing and assisting students.

Skills and Knowledge

Addition, subtraction & multiplication of single digit numbers.

Language of number operations, such as:

- add, subtract, multiply, difference, total.

Language of number properties and comparison, such as:

- digit, odd, even, greater than, less than.

Preparation and Materials

Read the procedure for these problems as described in the *Introducing Cooperative Logic* activity (see *Getting Started*)

Photocopy *Activity Sheets 1 – 5*: (1 each per small group of students) onto stiff paper or card. Cut the clues and place into labelled envelopes.

Photocopy *Activity Sheet 6: Digit Sheet*. Cut to create one set of digits per small group (**two** of each digit per set).

Suggested Procedure

The suggested procedure for this activity is outlined in *Introducing Cooperative Logic.*

If students have experienced these problems before then remind them of the rules before they commence. If not explain the rules as in *Introducing Cooperative Logic*

Distribute one set of digits per small group and ask them to tip the contents onto the table.

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Explain:

- *You will be doing a few problems that ask you to find a 'secret' number*
- *I will give them to you one at a time*
- *The set of numbers, digits, I gave you can be used to solve all of the problems so keep them on your table*
- *Who knows what this word 'digit' means?*

Ensure that students realise that the term 'digit' refers to the single figures within a number. For example 56 is made of two digits, 5 and 6. If they were arranged in a different order, 65, the digits would be the same but the value of the number would be different.

To get students warmed up for the problems you could ask a few questions about this number, 56, and discuss the meaning of the words as they answer.

For example, ask:

- *Which digit is greater/smaller?*
- *Which is the tens digit?*
- *Which digit is odd/even?*
- *What is the sum, or total of these digits?*
- *What is the difference between these digits?*
- *If we multiply the digits what is the product (answer)?*

Distribute the problems one at a time to the small groups as they are ready. Ensure that they double check their own answers by reading out the clues again rather than relying on you for the correction.

Extension

Ask students to work in pairs to create a secret number problem of their own, based on the sorts of clues in the problems they have just done.

They should then cut up the clues and give them to other pairs or groups of students to solve.

Collect the successful problems to use yourself when you do this activity with another class of students.

What's the Secret Number?

Activity Sheet 1

✂ Copy onto card and cut.

What's the secret number?　　Set 1 The number has two digits	What's the secret number?　　Set 1 The number is even
What's the secret number?　　Set 1 The number is less than 50	What's the secret number?　　Set 1 The difference between the digits is 1
What's the secret number?　　Set 1 The tens digit is greater than the other digit	What's the secret number?　　Set 1 The number is greater than 20

What's the Secret Number?

✂ Copy onto card and cut.

What's the secret number? Set 2 **The number is even**	What's the secret number? Set 2 **The total of the digits is even**
What's the secret number? Set 2 **The number is not 20 or 24**	What's the secret number? Set 2 **8 is not one of its digits**
What's the secret number? Set 2 **Only one of its digits is 2**	What's the secret number? Set 2 **The number is less than 30**

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What's the Secret Number?

✂ Copy onto card and cut.

What's the secret number? Set 3 **The number has two digits**	What's the secret number? Set 3 **The sum of the digits is 10**
What's the secret number? Set 3 **The tens digit is less than the second digit**	What's the secret number? Set 3 **There are no odd digits in the number**
What's the secret number? Set 3 **The number is greater than 30**	What's the secret number? Set 3 **The difference between the digits is less than 5**

What's the Secret Number?

✂ Copy onto card and cut.

What's the secret number? Set 4 ## The number is between 20 and 100	What's the secret number? Set 4 ## The difference between the digits is odd
What's the secret number? Set 4 ## The largest digit is even	What's the secret number? Set 4 ## If the digits are multiplied the product is even
What's the secret number? Set 4 ## The tens digit is the smallest	What's the secret number? Set 4 ## The sum of the digits is 9

What's the Secret Number?

✂ Copy onto card and cut.

What's the secret number? Set 5 **The sum of the digits is even**	What's the secret number? Set 5 **The number is less than twenty**
What's the secret number? Set 5 **The number is greater than 10**	What's the secret number? Set 5 **Zero is not one of the digits**
What's the secret number? Set 5 **The difference between the two digits is 6**	What's the secret number? Set 5 **The number is odd**

Digit Sheet

✂ Copy onto card or stiff paper and cut into sets of digits.

1	1	1	1	1	1	1	1
2	2	2	2	2	2	2	2
3	3	3	3	3	3	3	3
4	4	4	4	4	4	4	4
5	5	5	5	5	5	5	5
6	6	6	6	6	6	6	6
7	7	7	7	7	7	7	7
8	8	8	8	8	8	8	8
9	9	9	9	9	9	9	9
0	0	0	0	0	0	0	0

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Talking About Numbers

Overview

This activity is a game in which players practise listening to and understanding mathematical language.

Although competitive, winning is based purely on chance, not on mathematical skills.

It could be used as a way of checking students' knowledge of language related numbers & operations. For beginners it could follow preliminary discussion of names for operations, for example, using the activity *Keywords for Calculations.* It is a complementary activity to *What's the Secret Number?* Cooperative Logic's Activity.

Skills and Knowledge

Language of numbers and operations, such as:

- Odd/even
- Multiply/divide
- Sum/difference
- Greater/less than
- 'Digit'

Preparation and Materials

Photocopy Activity Sheets 1 & 2 (1 per student)

Suggested Procedure

Introducing the activity

Depending on students' level of English you can decide whether you think it appropriate to introduce the term 'digit' to students.

If so, before starting the game introduce it as: a single figure from 0 – 9 that is part of a number. For instance 348 is made of the three digits 3, 4, and 8. The same digits, if arranged differently, would create different numbers, such as, 483 or 834.

When reading out the questions below, decide whether you want to substitute 'digit' for 'number' when it appears.

Explain:
- *This is a game that encourages you to listen to language of numbers and calculation*
- *Whether you win or not depends on luck.*

- *Think of two numbers between 0 and 9 and write them next to each other.*
- *This makes a two-digit number.*
- *For example, if you wrote 3, 7, your number is 37.*

- *I am now going to read some questions.*
- *The winner is the player with the most 'yes' answers.*

Read the questions below aloud, one at a time. Repeat if students need to hear the question again.

1. *Is the first number even?*
2. *Is the second number odd?*
3. *Is the first number bigger than the second number?*
4. *Do the two numbers add up to more than 7?*
5. *When you multiply the numbers is the answer an even number?*
6. *When you multiply the two numbers is the answer more than 20?*
7. *Is the sum of the digits odd?*
8. *Is the sum, or total, of the numbers less than 15?*
9. *When you multiply the numbers is the answer less than 30?*
10. *Is the difference between the numbers 3 or more?*

When all questions have been read out, ask players to count their 'yes' answers.

After students have counted their 'yes' answers go over the questions one by one to clarify meaning. Give students a chance to ask about their own initial responses and change them if necessary.

To encourage greater use of the language if would be a good idea for students to work in pairs and to check responses with one-another before you go over the questions.

Activity Sheet 2 provides another example of the game. It could be used now or at the beginning of another session.

Extension

Distribute Activity Sheet, *Talking Numbers 1*.

Ask:
▪ *Can you find a number that would give 'yes' to all 10 questions?*

Ask students to work in pairs and to think of a number and create a set of at least 5 questions that would be true for their number. The number of 'yes' answers needed to win can be varied to emphasise that this game depends on luck.

Talking Numbers

To start choose a number made of two digits.

Questions
1. Is the first digit even?
2. Is the second digit odd?
3. Is the first digit bigger than the second digit?
4. Do the two digits add up to more than 7?
5. When you multiply the digits is the answer an even number?
6. When you multiply the two digits is the answer more than 20?
7. Is the sum of the digits odd?
8. Is the sum of the digits less than 15?
9. When you multiply the digits is the product less than 30?
10. Is the difference between the digits 3 or more?

Can you find the two digit number that will give 'yes' to all of these questions?

To start choose a number made of two digits.

Questions
1. Is the first digit even?
2. Is the second digit odd?
3. Is the first digit less than the second digit?
4. Do the two digits add up to more than 8?
5. Is the difference between the digits greater than 4?
6. Is the second digit greater than double the first digit?
7. When you multiply the numbers is the product even?
8. Is the total of the two digits odd?
9. When you multiply the digits is the product less than 20?
10. Is the difference between the digits less than 6?

Can you find the two digit number that will give 'yes' to all of these questions?

Estimate or Accurate

Overview

Estimation skills are extremely important in an era when students are tempted to trust any result displayed on a calculator or spread sheet. These skills are also powerful tools in budgeting or planning situations when exact calculations are not necessary.

This activity is designed to develop students' awareness of the idea of estimation, the language associated with it and the use of sensible or friendly numbers to approximate simple calculations.

Skills and Knowledge

Language of estimation, such as:
- almost
- just under/over
- approximately
- about

Preparation and Materials

Photocopy Activity Sheets 1 & 2 (1 per student).

Photocopy Practice Sheet 1 (1 per student.

Collect menus or price lists from a local take-way food outlet or restaurant (1 per small group of students).

Suggested Procedure

Introduce the idea of estimation

Begin by describing a situation in which a rough c calculation or estimate would be appropriate.

For example:

The other day I was going to a picnic with friends. On the way I wanted to buy a roast chicken, a bottle of soft-drink and some chocolate. But I discovered I had left my wallet at home. I found $15 in my pocket.

Before I went up to the counter I needed to decide if I could still afford to buy everything or whether I had to change my plan.

Ask: *How do you think I could do this quickly?*

Discuss students' input and, if no one suggests it, explain how approximate prices would help you in this situation. As you talk, emphasise the different words used to express the ideas.

Model for the students the estimated calculation of buying food for the picnic, emphasising language and friendly numbers as you do so. Try to keep it as authentic as you can by using local, current, knowledge and students' suggestions for the prices.

The process would be something like:
- *How much is a hot roast chicken?*
- *$8.95 – we will say **approximately** $9*
- *How much is a large block of chocolate?*
- *On special at $4.20 – OK **a bit over** $4*
- *A large soft-drink?*
- *$4.80 – that's **almost** $5*

Ask:
- *So what's the approximate cost?*

On the board   *Approximate cost $9*
                                                    $4
                                                +$5
                      Total $18

I can't afford it! Have to change plans.

Discuss with students the possibilities e.g. buy only half a chicken, choose a smaller bottle of drink or a cheaper brand, substitute sweets for the chocolate.

Explain:
- *What we have done is worked out an **approximate** cost*
- *Quite often in the adult world we don't need to do **exact** calculations*
- *Sometimes it's good enough to get a **rough** idea*
- *We call this an **estimate** or **approximation***

Estimation or accurate calculation

Using the exact prices (real or fictional) get students to calculate the accurate total cost of the original items using calculators.

Ask:
- *What is the **exact** total for those things?*
- *How close was our **estimate**?*
- *Was it good enough to make my decision about what to buy?*
- *Do you ever think like that yourselves?*

During your discussions stress the words **exact** and **estimate** and use as many variations for accurate and estimate language as you can.

Highlighting the language of estimation

Arrange students in pairs.

Distribute *Activity Sheet 1* and use it as a guide to assist students to get used to the idea and the language of estimation as opposed to accurate calculations.

To create a more hands on activity you could put the words onto separate cards and get students to sort them into two groups.

They could also match the numbers with their best estimates in the following activity.

Follow up activity

Use the local menus or price lists to pose scenarios similar to the picnic story.

For example:
- *I have $10 in my pocket can I buy a pie, a cake and a cup of coffee?*
- *Make rough estimates to decide what you could afford to buy if you had:*
    - *$8*
    - *$10*
    - *$15*

Extension activities – planning and budgeting

For students who are able, it is a good idea also to look in more detail at situations in which estimation could be used for planning or budgeting decisions. Ask students to look at their copies of *Activity Sheet 1* again, or read the examples to them.

Explain:
- *Estimation is often used by people who want to make long terms plans about the best use of their money*
- *Activity Sheet 1 has some examples of this*
- *Which would they be?*
             [6 and 7 both involve long term planning]

Ask: *Jo is thinking about whether it is worth buying a yearly ticket for the tram. So first she needs to know how much she now pays each year. How could she use estimation to get an idea of that?*

Model the process on the board using realistic local prices. A mythical example is given below as a possible guide.

Example: *A single ticket from home to the city costs her $2.85.*
            Each week she does the return trip 3 times

1 trip = $2.85	*approximately*	*$3*
Return trip	*approx*	*2 x $3 = $6*
3 times each week	*approx*	*3 x $6 = $18*
	approx	*$20*
52 weeks in a year	*approx*	*50*
Approx $20 a week for 50 weeks		*= 20 x 50*
	20 x 5 = 100 then add 0 = 1,000	

It costs her approximately $1,000 every year on the tram.

A similar example worth doing if there are smokers in the group would be:

   How much money could a smoker save in a year if they gave up smoking?

Follow up activities

Budgeting, allocating money per week to put aside for bills such as electricity or gas is also a useful practical application of this technique. Base the examples on real, local bills. Add the totals for the year and divide by 50 to give an approximated weekly amount.

Encourage students to do this with their own expenses, such as phone, gas, Internet, electricity or transport.

Estimate or Accurate - Language Activity Sheet 1

Do this activity in pairs.

1. Look at each of the words and expressions in the box. Decide whether it is a word you would use for an estimate or an accurate number. Beside the word write **'E'** for estimate or **'A'** for accurate.

<div>

About   *Just under*

Exactly   *A bit over*   *Roughly*

Spot on   *Nearly*

Almost   *Precisely*

Approximately

A little less than   *Accurately*

</div>

2. Think of some other words you could add to the list.

3. In pairs discuss these examples and decide what kind of calculation is needed: accurate or estimate. Write 'E' for estimate or 'A' for accurate.

   1. Working out if you have enough money in your wallet to go to the movies tonight.

   2. Giving change to someone who buys a movie ticket.

   3. Deciding how many pizzas to buy for a party.

   4. Working out how long it will take to drive from Melbourne to Brisbane.

   5. Working out the number of hours to write on your work time sheet.

   6. Deciding how much money you should budget (save) each week to pay for electricity.

   7. Calculating what public transport costs you for a year.

   8. Deciding on your share of the electricity bill if you share it with 2 other people.

   9. Working out a quote for a house renovation.

   10. Working out the invoice for a finished renovation.

11. Working out how much smoking costs every month.

Estimate or Accurate

1. For the amounts in the box, decide if they are likely to be estimates or accurate.

    Write '**E**' for estimate or '**A**' for accurate.

$3.95	*$52.85*	*$3*	*$10,985*
	29 cents		*3,000 km*
267 km		*30 cents*	*$50*
22 c	*$4*	*200 km*	*20 c*
	200 km	*3,110 km*	*$10,000*
$11,000	*4,000 km*	*300 km*	

2. Match each of the estimate figures in the box with the number, which could be used to estimate it. For example: $5.95 → $6. Join the matching pairs with a line.

3. Complete these sentences using phrases from the box below. Each phrase can be used once only.

    $ 3.95 is .... $ 4

    291 km is .... 300 km

    51 hours is .... 50 hours

    $2,090 is $2,000

    5.9 kg .... is 6 kg

    $24.00 is $24

    73 kg is .... 70 kg

    912 km is .... 900 km

    $0.15 is .... 15 cents

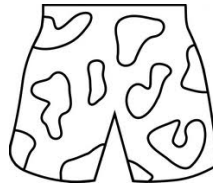 | | | | |
    |---|---|---|---|
    | a little less than | almost | a bit over | the same as |
    | just over | equal to | a bit more than | approximately | about |

Can I afford it?

$9.90

$10.30

$2.85 a pair

$6.95

You have two $10 notes in your pocket. Use rough calculations to decide if you can afford to buy:

1.   2 shirts?

2.   3 t-shirts?

3.   5 pairs of sports socks?

4.   2 pairs of shorts?

If you had $25 could you afford to buy?

5.   1 shirt and 2 t-shirts?

6.   1 pair of shorts and 2 shirts?

7.   A t-shirt, a pair of shorts and a shirt?

8.   3 pairs of socks, a shirt and a t-shirt?

Approximately how much would it cost to buy:

9.   3 shirts and 1 pair of shorts

10.   A t-shirt, 2 pairs of socks and a shirt

11.   4 pairs of socks and 1 shirt

12.   1 shirt, 2 pairs of shorts, a t-shirt and a shirt

Multiplication Tables: Grids

Overview

Many students feel really bad because they still don't know their tables 'after all these years'. Sometimes only a few shaky facts will lead to students becoming anxious about all tables, and so a small investment of effort will give a large return in confidence.

Certainty with multiplication and addition facts will go a long way towards overcoming maths anxiety.

This activity introduces table 'grids' as a method to assist your students learn and explore helpful patterns in the multiplication tables.

Skills and Knowledge

- Automatic recall of multiplication tables

Preparation and Materials

Copy Activity Sheets 1 & 2 (1 per student)

*If students do learn their tables it is important that they work towards recalling **random facts** and do not have to recite the tables in order, e.g. to find 7 x 4 = 28, they do not have to go through 7, 14, 21, 28.*

Suggested Procedure

Filling in the Multiplication Grid

Distribute copies of Activity Sheet 1 – the large Multiplication Grid.

Show the students how to fill in the grid.
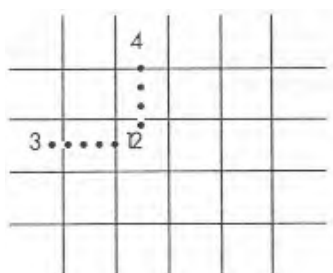
11 and 12 times tables are often omitted in these days of the metric system. If your students want to include them you can reduce the grid slightly on the page as you copy it, so students can add the two extra rows and columns.

Explain:
- *First fill in all of the tables you are confident about*
- *This might not leave many spaces left to fill in*
- *For those I want you to work out the answer by adding, or getting help from someone else, or using a calculator*
- *When you have filled all the spaces in compare your grid with someone else to make sure they are the same*

You might like to check that students' final grids are correct so that they can keep them for reference.

Note: If students prefer tables set out 'the old way' in columns. They may still find these on the back of some exercise books. They could also write them out for themselves using the grid as a reference.

Searching the grid for patterns

Patterns in the tables can sometimes help students to remember multiplication facts.

For example:
- 2, 4, 6, 8, 10 tables: all have even numbers
- 5 times table: all end in 5 or 0
- 10 times table: all end in 0

These patterns can be found by looking for commonalities in the columns or rows.

Ask:
- *Can you see anything that the numbers in the 10s column have in common?*
- *What about the numbers in the 5s column?*
- *Can you see anything similar about the numbers in the 2s column?*
- *Do any of the other columns have only even numbers?*

Discuss responses to these questions long enough for all students to see the patterns.

Patterns of added digits

Some tables have interesting patterns that are not so obvious to see at first glance.

- 3 times table: the digits of all the numbers add to give 3, 6, or 9. For example:
  - 3 x 5 = 15   1 + 5 = 6
  - 3 x 6 = 18   1 + 8 = 9
  - 3 x 7 = 21   2 + 1 = 3

  [Following this pattern for all numbers in the 3 times table, from 1 onwards gives an interesting repetition]

- 9 times table: the digits of all the numbers add to give 9. For example:
  - 9 x 2 = 18   1 + 8 = 9
  - 9 x 3 = 27   2 + 7 = 9
  - 9 x 4 = 36   3 + 6 = 9

To help students uncover these facts show them what *adding the digits of the numbers* means.

Start with the 3 times table.

Ask:

- *Write down all of the numbers in the 3 times table column*
- *Now add the digits for all of them*
- *What do you see?*
- *Is there anything in common?*

Explain

- *This can help you when you are not sure of the tables*
- *For example if you guessed that 3 x 9 = 26*
- *You can check if it is right by adding the digits*
- *In this case 2 + 6 = 8*
- *That's not, 3, 6 or 9 so 26 is wrong*

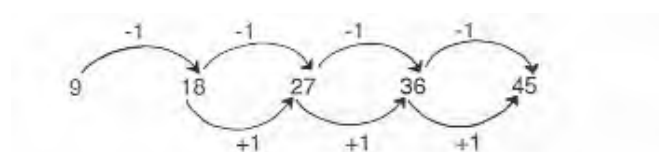Repeat this procedure for the 9 times table until students can see the pattern of 9 s from the added digits.

Nine times table patterns

Other interesting patterns that can help students remember the 9 times tables are the following.

- The tens digit is always 1 less that the number you are multiplying by. For example:
    - 2 x 9 = 18   1 (in 18) is 1 less that 2
    - 3 x 9 = 27   2 (in 27) is 1 less that 3
    - 4 x 9 = 36   3 (in 36) is 1 less that 4

- Once you know the first digit, then you can use the fact that both add to 9 to find the second digit. For example:
    - For 3 x 9:   first digit is one less than 3 = 2
    - 2 + second digit = 9   second digit = 7
    - answer is 27

Another helpful pattern:

- As the tens digit goes up by 1 the units digit decreases by 1:

Using the multiplication grid for division

Explain

- *The grid can also be used for division*
- *For example for 12 ÷ 4*
- *Look for the 12 in the main part of the grid along a column (or row) headed by 4.*
- *Find the row (or column) that meets it, in this case 3.*

Demonstrate using a grid or draw the diagram on the board.
These 3 squares show us that: 4 x 3 = 12, or 12 ÷ 4 = 3, also 12 ÷ 3 = 4.

Further practice

Activity sheet 2 – Tangled Tables can be used as a follow up for student practice.
The blank grids on the page can be filled in by students individually (with your help) to
practise the multiplication facts that they find difficult.

Alternatively, as a whole class practice exercise, you can fill in the as blanks before
copying.

Multiplication Grid

X	0	1	2	3	4	5	6	7	8	9	10
0											
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											

Tangled Tables

Activity Sheet 2

1. Fill in each grid.

x	7	3	5
8			
6			
2			

x	4	5	10
5			
4			
2			

x	6	1	3
3			
7			
4			

x	8	4	0
9			
2			
3			

2. First choose the numbers for the sides of the grid and then fill it in.

x			

x			

x			

x			

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Multiplication Tables: Flash Cards

Overview

Certainty with multiplication and addition facts will go a long way towards overcoming students' maths anxiety.

Sometimes only a few shaky facts will lead to students becoming anxious about all tables, and so a small investment of effort will give a large return in confidence.

This activity introduces the long-term strategy of flash cards, based on visual learning methods, to assist students memorise the multiplication facts they have not mastered in the past.

It can be used with individual students who need extra help in learning the table facts or with the whole class, depending on need.

Skills and Knowledge

- Automatic recall of multiplication tables

Preparation and Materials

Buy packets of small index cards or blank invitation cards or cut card into pieces approximately 10 x 3 cm

The number needed depends on the students' current ability to recall table facts.

Bright coloured textas

Prepare 2 or 3 sets of multiplication facts Quick Questions. (See the *Quick Question* activity in *Getting Started* section.)

*If students do learn their tables it is important that they work towards recalling **random facts** and do not have to recite the tables in order, e.g. to find 7 x 4 = 28, they do not have to go through 7, 14, 21, 28.*

Suggested Procedure

This method is a long- term strategy, which students may start in class then continue at home over a few weeks.

The following procedure is designed around a class of students but can be done with individuals even more effectively, if time permits.

Reflecting on the multiplication gaps

If using the activity with the whole class perhaps begin with two or three sets of Quick Questions on multiplication facts. Mix table facts that students are confident with and others they are not.

What is important is that students reflect on what they do and don't know and that they also realise that each of them has different needs in this area.

Ask:

- *Which questions were easy for you?*
- *Which were difficult?*

This is likely to be met with mixed responses from individuals but will give some feel of their needs.

You could follow by going through the tables one by one asking students which they find easy and which they find difficult. For example:

Ask:

- *Who finds the 2s difficult?*
- *What about the 3s? etc.*

Try to make notes about students' needs while they are talking to you as a group.

Introducing the flash cards

Explain:

- *Often learning tables at school was done through saying or singing the tables over and over again*
- *This method is not always good for people who are visual learners*
- *They learn things better by seeing them*
- *Today we will make some flash-cards of your difficult tables - the ones you haven't learned yet*
- *You can use them for a while and see if they help you remember*

Demonstrate what the cards look like:

Example: | 7 x 6 = | Side 1

| 7 x 6 = 42 | Side 2

Explain:

- *We will make a bundle of these – not too many at a time*
- *To use them – first shuffle your cards*
- *Pick one card from the pack and hold it up at eye level*
- *Try to answer it*
- *Check the answer on side 2 instantly by turning the card over*
- *Still hold it up near your eyes so that you **see** the correct answer*

Demonstrate this to students using a couple of sample cards.

Explain:

- *If you were correct, put the card in your 'do know' pack*
- *If not, return to the 'don't know' pack*
- *Repeat with next card etc.*
- *As you get better at this your 'don't know' pack will get smaller and your 'do know' pack will get bigger*
- *When you know all of them you can start with a new pack*

Making the cards

Distribute a pile of 12 – 15 cards to each student then move around to help them make their own flash cards, concentrating on one multiplication table at a time and their individual gaps.

Explain:
- *The cards you make will be different for each person*
- *I want you to start with the first tables that you find hard*
- *For example, if you can remember all of the 5 times table up to 6 then start with 5 x 7*
- *Remember that this method is about visual learning (seeing) to help your memory*
- *Big numbers and bright colours are apparently helpful for this*
- *So make the numbers big and use your favourite colours*

This will take time but the act of creating the cards will also aid students' memory process.

Check that the cards they make are accurate.

Practice with the cards

Allow about 10 minutes for students to practise using their cards in class. They could do it as a pair activity but remember that it is important to **look** at the answer side of the cards each time.

Ask students to then take the cards home and practise in their spare moments – about 5 – 10 minute every day would be perfect. They might like to also use them with other family members and make a game of it.

You may want to set up a recording system so that students are motivated by their efforts and improvements being acknowledged.

Follow up

In future sessions ask students how they are progressing and make new sets of 10 – 12 cards.

Later encourage them to then shuffle the two packs together and check they still remember all of their tricky tables.

Keep going with new packs until all of the tables are remembered.

Multiplication Bingo

Learning Overview

Learning multiplication facts (tables), and being able to recall them when needed, not only assists students with in the head calculations, it also boosts their confidence with numeracy enormously. This activity is a game, modelled on the traditional Bingo, which provides practice at recall of multiplication facts. The element of luck and competition keep students' attention and interest more than multiple practice examples on paper could ever do.

The game could be used many times after its introduction. It could be used to start a session or as a break in a session when a change of pace or mood is needed.

Preparation and Materials

Recall of multiplication facts

Skills and Knowledge

Photocopy *Activity Sheet 1 (3 pages)* and cut into separate playing cards. These could be done on card and laminated for reuse.

Photocopy *Activity Sheets 3: Question Cards* and cut into separate cards. Place in a small box or bowl suitable for 'drawing' from during the game.

A collection of counters or coins.

Suggested Procedure

Introducing the activity

Distribute one bingo card and a pile of counters to each student.

Describe the game

Begin by asking students if they have ever played Bingo, and if not, describing the general idea to them.

Explain:
- *I will draw one multiplication question at a time from this bowl*
- *You work out the answer*
- *Don't call it out – keep it to yourself*
- *If the answer is on your card cover it with a counter*
- *When you have covered all of the squares on your card call 'Bingo'*

Conduct a trial run

As a trial run, pick a card at random, and go through the motions together, asking what the answer is and then getting students to see if they have it on their card and deciding who could have put a counter on their card and who could not.

Replace the card in the bowl.

Play the game

Pick cards at random, one by one, or let the students select them for you.

Put the used questions aside rather than replacing them in the bowl.

Note: If you put them aside in the order they were selected, it will be easier to check students' winning cards at the end.

Check the cards

At the end you could repeat the questions and get students to check each other's placement of the counters.

Extension or variation

Get students to create their own cards by writing down 12 different multiplications and placing the answers on their card.

They could simply make up the multiplications or they could generate random questions by throwing two 10-sided dice, or selecting two cards from a pack (either remove or ignore the face cards).

✂ Copy onto card and cut.

3	16	12	24
27	6	54	60
56	48	7	32

25	21	10	36
40	0	54	72
60	50	45	8

8	32	45	28
0	24	80	18
28	36	16	72

3	12	0	15
42	64	60	18
49	27	10	30

✂ Copy onto card and cut.

56	25	7
60	14	54
3	14	15
24	49	0

25	10	6
63	12	80
21	36	28
16	0	15

70	64	6
27	12	72
40	60	32
8	21	25

48	32	14
8	50	45
7	81	15
42	49	18

✂ Copy onto card and cut.

63	49	9
18	14	54
3	8	15
24	30	0

25	10	4
14	12	45
24	9	60
16	0	15

70	64	6
0	50	72
40	60	81
8	21	25

48	32	14
8	50	45
7	81	15
60	12	18

✂ Copy onto card and cut.

3x0	2x2	3x5	9x4	9x9
1x1	3x2	6x3	10x4	9x10
1x3	4x2	7x3	5x5	10x10
4x1	2x5	8x3	6x5	10x6
5x1	2x6	3x9	7x5	7x7
1x6	2x7	10x3	8x5	8x7
7x1	8x2	4x4	9x5	9x7
8x1	9x2	5x4	5x10	7x10
1x9	2x10	6x4	6x6	8x8
1x10	3x3	7x4	6x7	9x8
6x9	3x4	4x8	8x6	10x8