Introducing Co-operative Logic

Overview

This activity introduces students to a useful structure of problem solving activity. It encourages students to:

- Work co-operatively
- Apply problem solving strategies:
- Guess and check
- The use of diagrams and moveable pieces.

Skills and Knowledge

- Group interaction
- Logical reasoning
- Using hands-on materials
- Guessing solutions
- Checking
- Organising information

Preparation and Materials

Copies of the problems and their clues are attached to this session.

Photocopy each problem onto stiff paper or card (1 per group of 4). Place each problem into a labelled envelope.

For the **Build It** problems collect a selection of coloured blocks or cubes: 2 red, 2 yellow, 2 green, 2 blue, 2 orange for each small group. These can be centicubes, wooden blocks or small MAB cubes coloured with textas.

Photocopy Activity Sheet 8: *Self Assessment for Group Work* (1 per student) – optional.

Suggested Procedure

Introducing the activity

Explain:
- *In this class I want to show you a type of problem solving called Cooperative Logic, which will help develop your problem solving skills.*
- *Each problem is to be solved co-operatively, and you will need to work together to find an answer.*
- *Each person will have different clues so it is important to listen as each clue is read.*
- *If any of you find it hard to read, ask another student or the teacher for help.*

Work through one problem

Hold up the envelope containing *City Block* and show students the contents: one question card, a map, several moveable pieces and clue cards.

Place the question card, the map and the pieces in the centre of the table.

Explain:
- *Share the clue cards between you*
- *Some may receive more than one*
- *Read your cards aloud, in turn*
- *Listen carefully to each other's clues as they are read out*
- *No one can give their clue cards to another person or lay them down for others to read*
- *You can read you card aloud as many times as you need in order to solve the problem together*
- *As each clue is read you move the pieces around to help all of you solve the problem together*

Points to keep in mind

We have included moveable pieces in all of these problems in order to:
- Discourage students from using pencil and paper. When students start to work out solutions by writing, one person usually dominates and co-operative problem solving is replaced by individual problem solving.
- Encourage students to explain to each other words that are not understood, such as, opposite, west of. You should intervene only when no one in the group knows the meaning.

Although answers have been included it should not be necessary for students to ask you for correction. The group should be satisfied for themselves that they have met all the conditions. This is the beginning of the notion of self checking which should constantly be reinforced by you, e.g. checking subtraction by addition.

As the activity progresses you can observe which students understand all the terms used without help. This is a good opportunity for you to observe, without testing, any basic concepts missing in students' backgrounds.

Discuss strategies

Discuss the strategies used to solve problems. The two most important problem solving strategies underpinning these exercises are:

- Guess and check – take risks and try out solutions to see if they work.
- Using a visual aid, such as hands on materials. These give us a picture of what we are doing.

These two strategies form the basis of much problem solving in mathematics.

Discuss group dynamics (optional)

You *may* wish to draw attention to the behaviour of you students in the group and discuss how they actually operate in a co-operative situation. There are several ways to approach this:

1. When students have completed one or two problems ask them to describe what happened in the group while they solved the problem.

   Ask questions like:
   - *Did anyone talk more than the others?*
   - *Was anyone very quiet?*
   - *Did you all have a say?*
   - *Did someone take a role, maybe as a leader?*

2. Have a more theoretical discussion about general roles that emerge in group situations e.g. leaders, followers, talkers. The discussion could draw on roles taken within their homes, classes, workplaces, etc.

3. Distribute a copy of *Self Assessment for Group Work* to each student. Ask them to reflect on working in the group and place ticks beside statements that were true. Then ask if they have anything to discuss with the rest of the class.

Finally ask students to reflect on their own way of operating in groups and to decide whether they would like to change it in any way.
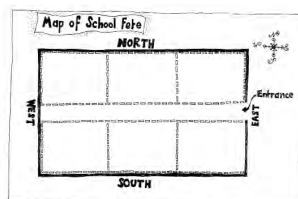
Doing more of the problems

Select a second problem and distribute it to the groups.

Explain:
- *You should use the same process as before to solve this problem*
- *When you think you have the answer check through all your clues to double check*
- *Then let me know you are ready for another one.*

Proceed until all groups have completed at lest three problems (even if you have to assist some with hints).

Some groups will inevitably operate more quickly than others. You can give them more of the problems to solve. However, this will diminish your supply for a follow up session.

Another idea is to ask them to create a version of their own (see over).

Creating their own problems

In order to solve *Cooperative Logic* problems students need to *understand* the numeracy related language within them.

You can go one step further and encourage students to *use* the language themselves by creating a problem of their own.

Select one of the problems the groups have done already, a good example is *City Block*.

Distribute some scrap paper cut into clue sized pieces.

Explain:
- *I want you to create a new problem based on this one*
- *First change the pieces around*
- *Then write your own set of clues*
- *Later you will give it to another group to solve*
- *Make sure you use the numeracy words like 'north of', 'opposite' 'next to'*
- *Your problem is only a good one if it can be solved by other people*
- *So don't try to make it so hard they can't solve it*
- *Remember to keep a copy of your solution to check with.*
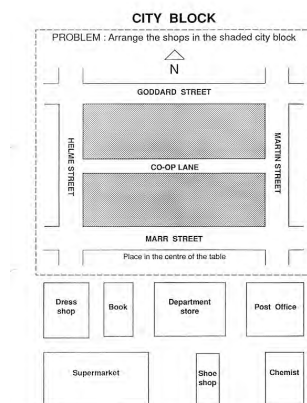
Note: if using *City Block* you may also have to give extra paper for students to change the size of the shops to fit. They could even draw their own map but don't let it get too complex.
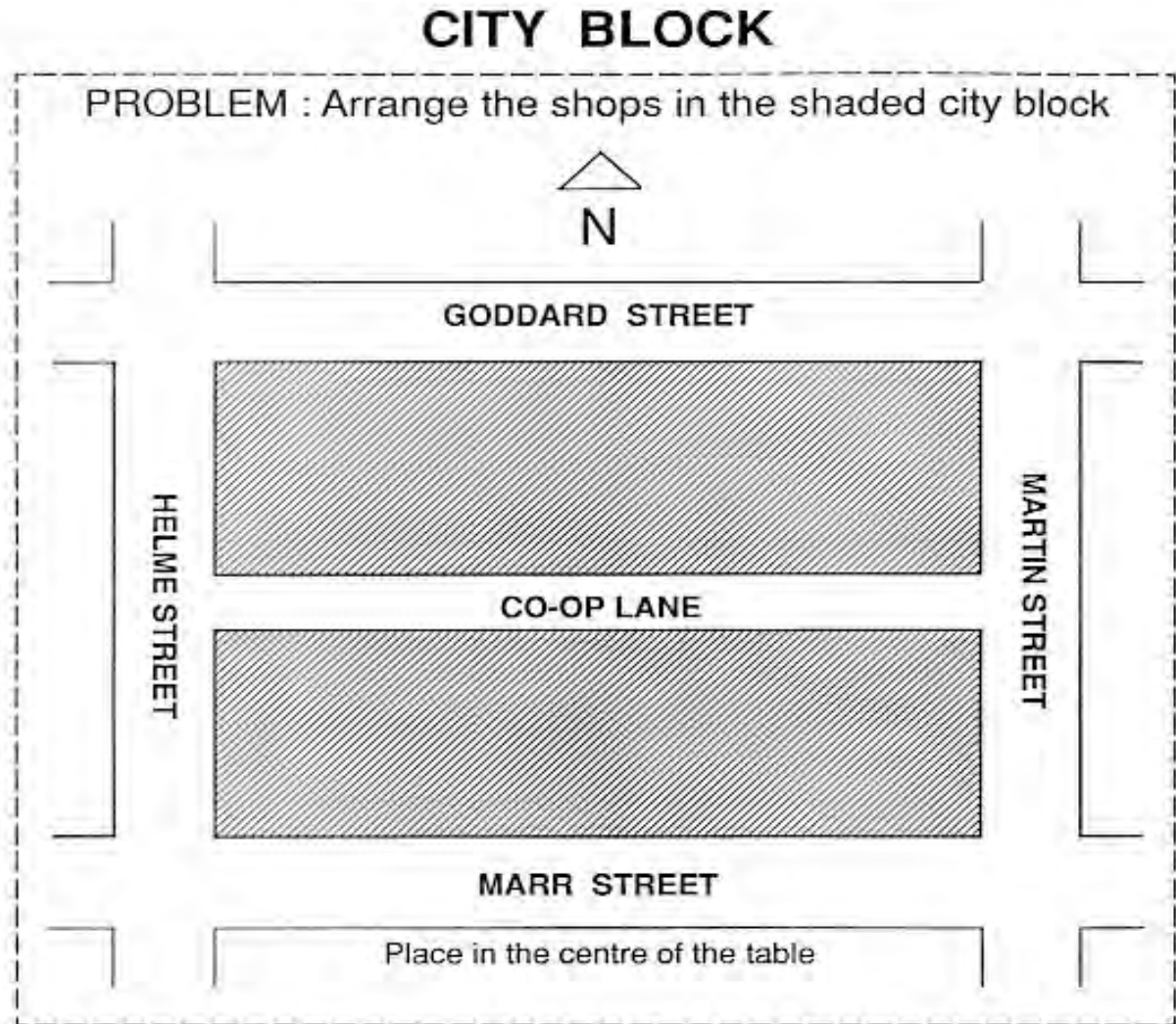
✂ Copy and cut

Problem: Arrange the shops in the shaded city block

CITY BLOCK

PROBLEM : Arrange the shops in the shaded city block

N

GODDARD STREET

HELME STREET

CO-OP LANE

MARTIN STREET

MARR STREET

Place in the centre of the table

Dress shop

Book

Department store

Post Office

Supermarket

Shoe shop
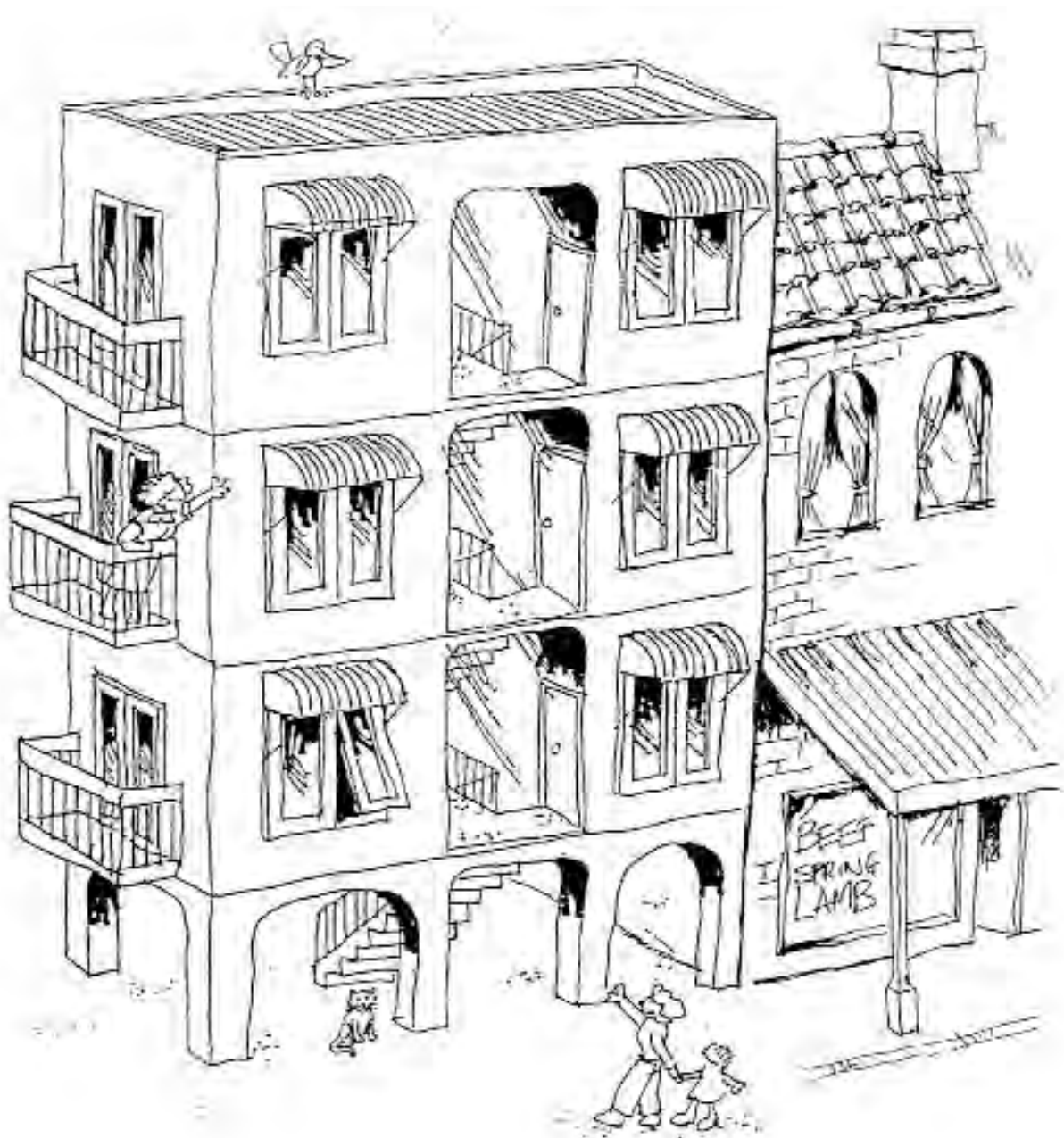
Chemist

✂ Copy and cut

Walking from the supermarket to the chemist you pass the dress shop	The post office is south of the chemist, and next to the shoe shop.
The department store and the post office are on corners.	The post office is opposite the dress shop.
The chemist shop is east of the supermarket.	The supermarket is north of the bookshop.

Problem: Who lives in which flat?

✂ Copy and cut

SARTORI	BATES
TRAN	FISHER
JOHANNSEN	WOODS

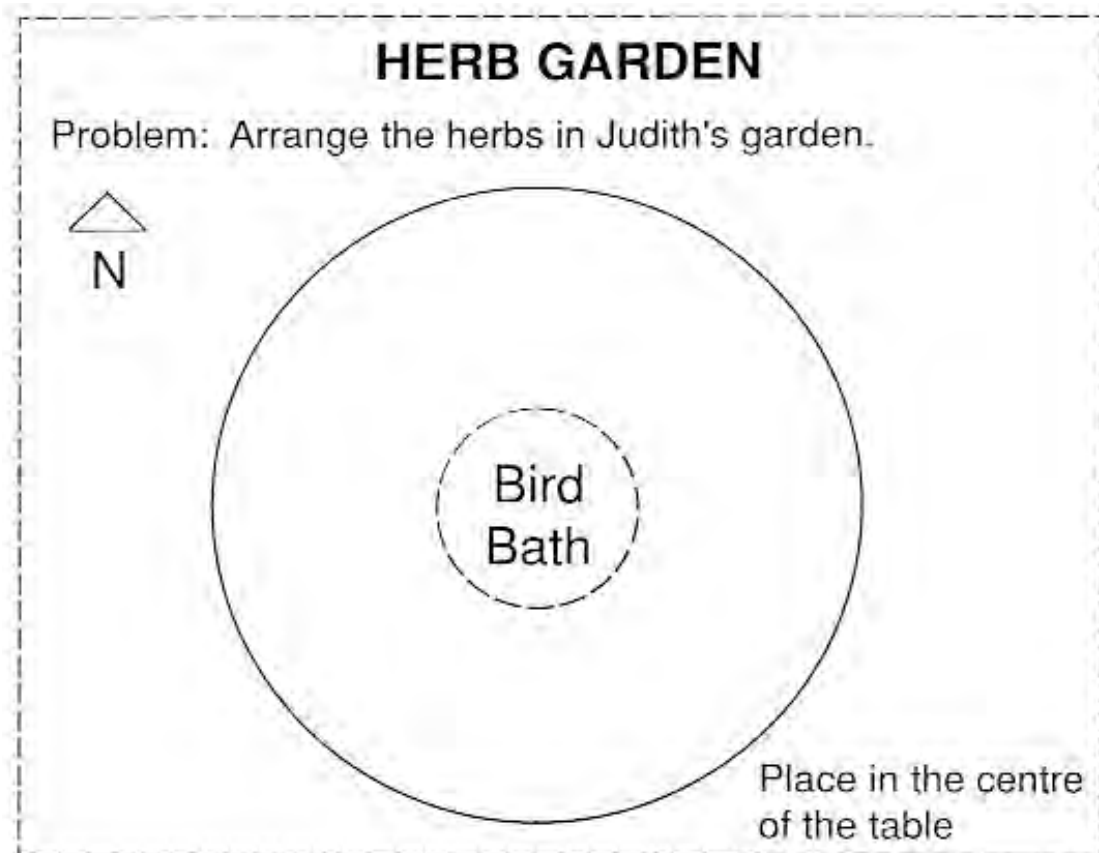|	
Jo Fisher walks downstairs to feed Maria Sartori's cat when she is away.	The Woods knock on the Tran's floor when their music is too loud.
The Johannsen family hear Mr Wood's feet overhead when he dances.	The Fishers do not live opposite the Johannsen family.
Maria Sartori goes up past the Bates' flat on the way up to visit the Tran family.	The Fishers grow tomatoes on their balcony in summer.

Herb Garden

✂ Copy and cut

HERB GARDEN

Problem: Arrange the herbs in Judith's garden.

N

Bird
Bath

Place in the centre
of the table

Moveable
pieces

Basil | Sage

Rosemary | Parsley

Oregano | Dill

Mint | Garlic

✂ Copy and cut

The oregano is opposite the garlic.	The sage is between the mint and the basil.
The rosemary is at the south end of the garden.	The bird bath is in the centre.
The parsley is opposite the mint.	The dill is next to the garlic.

✂ Copy and cut

Problem: Where is each stall at the School Fete?

Map of School Fete
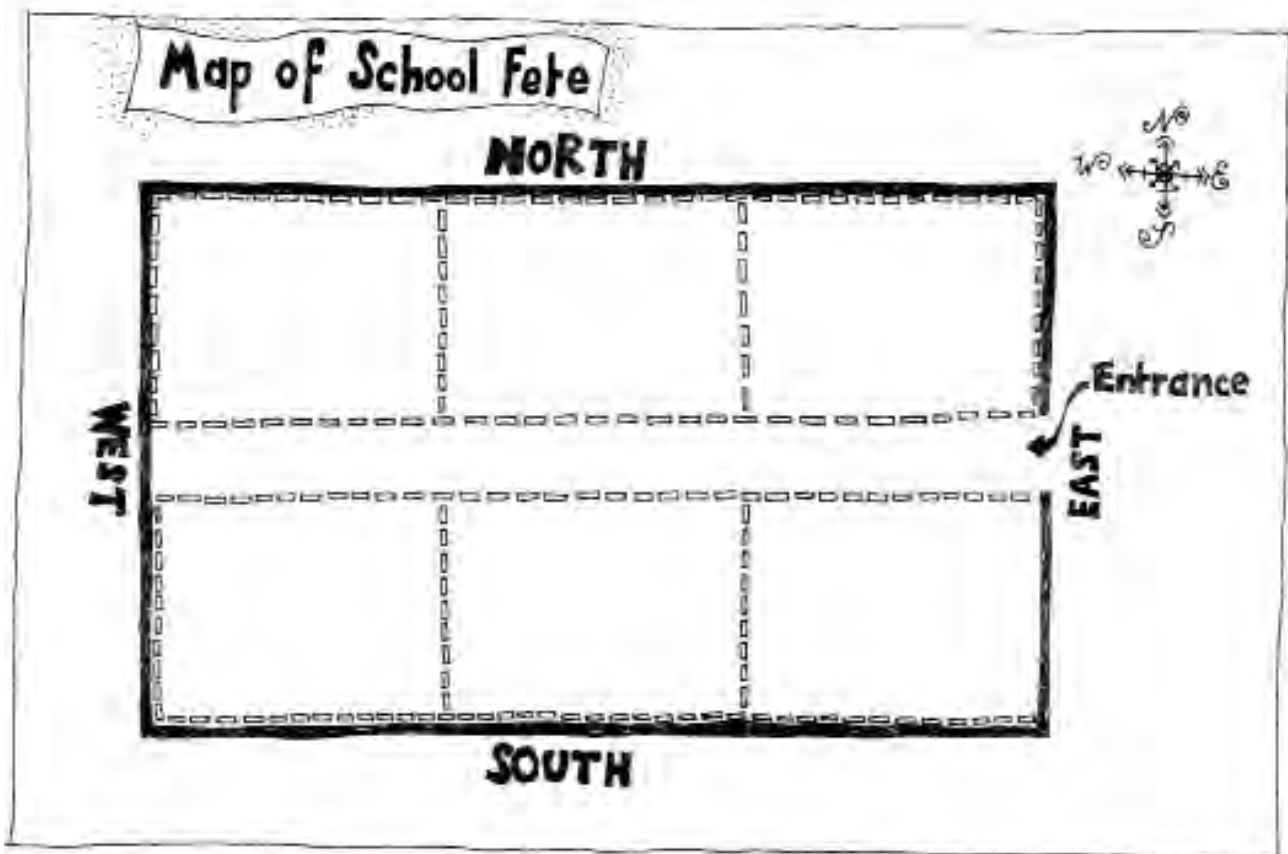
School Fete clues

✂ Copy and cut

When Sylvia arrived at the hall she saw the clothes stall on her left.	The plant stall is opposite the hot dog stall.
The hot dog stall is next to the clothes stall.	The clothes are next to the cake stall.

The plant stall is west of the art and craft stall.	The lucky wheel is adjacent to the plant stall and north of the clothes stall.

✂ Copy and cut

There are six blocks in all.

One of the blocks is yellow.

The green block shares one flat side with each of the other five blocks.

The two red blocks do not touch each other.

The two blue blocks do not touch each other.

Each red block shares an edge with the yellow block.

Each blue block shares one edge with each of the red blocks.

✂ Copy and cut

There are six blocks in all in a tower six blocks high.

There is a yellow block on top.

The red block is above the green block.

One of the yellows is above the green block; the other is below it.

Each of the blue blocks shares a flat side with the green block.

No two blocks of the same colour touch each other.

There are two yellows, two blues, one green, and one red in the set of blocks.

✂ Copy and cut

There is a red block directly below a yellow block.

There is a green block on the bottom level.

There is a red block directly on top of a yellow block.

The highest block is on the third level.

There are six blocks in all.

An orange block shares a flat side with a green block and two others.

A blue block shares a flat side with a yellow block.

There is a red block on the bottom level.

A blue block touches red and green blocks only along edges.

There are three blocks on the bottom level.

A yellow block touches an orange block only along an edge.

Self Assessment for Group Work

✔ Tick the statements that were true for you.

I liked being in the group.

I listened to others.

I learned something.

I talked in the group.

I talked too much.

I helped other people.

I didn't talk much.