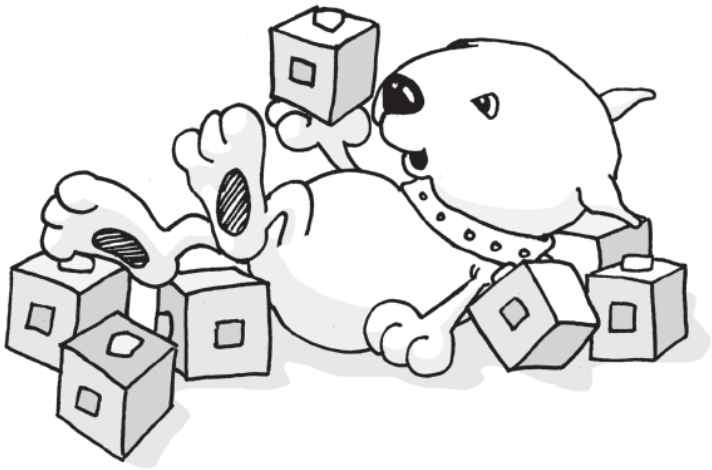
1cm Linking Cubes

Product code 075994



An Introduction to Manipulatives

A manipulative is any object that aids children in visualising mathematical processes. Our range of manipulatives includes Tangrams, Geoboards, Fraction Pieces, Fraction Circles, Fraction Bars, Linking Cubes, Pentominoes and Pattern Cubes. However a manipulative can be as simple as a piece of string or a tin can.

Manipulatives are invaluable in the classroom because, as modern research tells us, children retain information gained from hands-on experiences better than information they gain from memorisation. They learn in a physical way - with their hands as well as their minds. As a physical learning aid, manipulatives encourage this natural learning process by adding a concrete element to ordinarily abstract concepts.

Above all else, children enjoy working with concrete materials - in the hands of young children manipulatives will excite their natural curiosity and motivate them to take responsibility for their own learning. Children will become flexible thinkers with a knowledge of mathematics that can be applied to a wide variety of situations - instead of being taught seemingly unrelated rules, they will learn to be problem solvers.

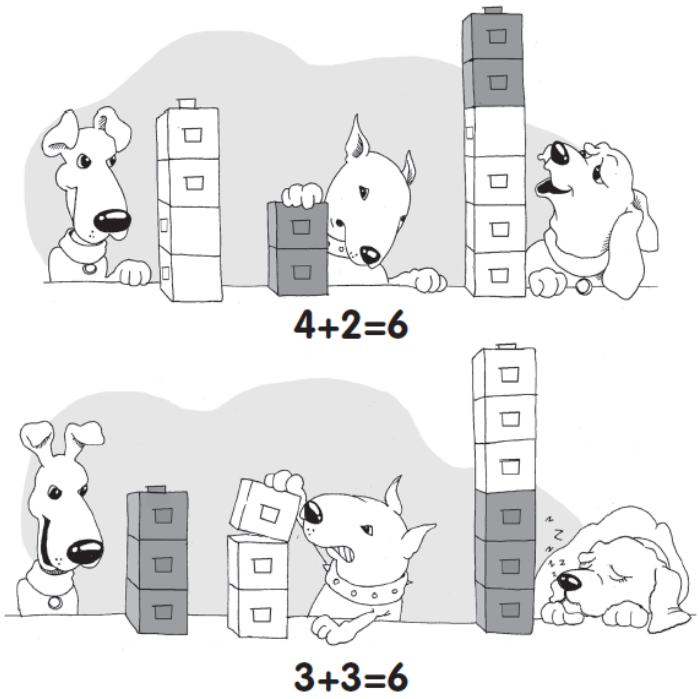
Introductory Activities

- Firstly, allow the children to engage in free play with the cubes. Then gradually introduce various fun activities. Suggest that they make towers. Challenge them to build a tower as big as they possibly can without it falling over. Ask them to estimate how high it will be when it topples before they begin. Can they make a person, a dog, or a camel? Help them form patterns with different colours. Familiarity with the cubes will help activities go smoother and hopefully reduce the fear of numbers that sometimes develops with traditional maths classes.
- Ask the children to follow your instructions as you form a pattern with the cubes in front of the class. Take the exercise one step further by drawing the patterns on the board and asking the children to build them. This simple exercise helps children make the leap from the abstract (your instructions) to the physical (the cubes).
- Ask students to estimate how many cubes they are able to hold in one hand. Get them to check their estimations against the number of cubes they can hold. What about two hands?

Addition & Subtraction

- An extension to the introductory counting exercise mentioned above can be used to form a simple introduction to addition. In this case hold up one cube, add two or three and ask the children to count the cubes in order to find the total. The process can be reversed for subtraction.
- This exercise can be made much more exciting if the teacher comes up with little stories to represent the addition or subtraction and the children use the cubes to act out the stories. For example "There were 6 oranges on the tree and 2 fell off. How many oranges were left on the tree?"
- Part of a well-developed concept of, say, the number 6 is the fact that "2+4=6" and "3+3=6". These facts can be illustrated with the cubes by forming 6 different towers made up of 2 colours - for example 6 red (6+0=6), 5 red and 1 blue (5+1=6), 4 red and 2 blue (4+2=6) right through to 6 blue (0+6=6). Ask the children to make up cubes in this way. The patterns formed by the cubes will help children learn the various attributes of the number 6.

Addition & Subtraction



Encourage the children to use sentences to describe the towers in front of them. Perhaps the word "equals" could be substituted by "is the same as the number" in the early stages. Similarly, substituting "4 and 2" for "4+2" could be helpful. This exercise can be extended to point out the commutative nature of addition - "5+1=6" is the same as "1+5=6". It can also be used for fractions - "3 out of the 6 cubes are blue".

Multiplication & Division

- When approaching multiplication for the first time, children are required to think of two numbers that represent two different things - the number of sets and the number of members in each set. This concept can be made more concrete using cubes as sets. Set out some simple multiplications and encourage children to count how many sets and how many cubes in each set before counting all of the cubes to arrive at the answer. Thus 2 sets of 3 cubes is the same as the number 6. And 4 sets of 2 cubes is the same as the number 8.
- Take the above exercise one step further by asking the children to set cubes out in front of them as you call out various simple multiplications. Perhaps at this stage more specific terminology such as "4 times 2 cubes is?" can be used. Eventually "equals" can be substituted for "is".
- To introduce the concept of division a sharing game can be used. A pair of children can be handed 6 cubes and asked to share them equally amongst themselves. Thus 6 cubes shared out equally between 2 children means they get 3 each - 6 divided by 2 equals 3. Repeat the exercise this time asking the children to form groups of 3. This will lead to the realisation that 6 cubes between 3 children means 2 cubes each - 6 divided by 3 equals 2. Teachers can then extend the exercise, being sure to use a number of cubes that is easily divisible before moving on to remainders.

Sorting Fun

This activity aims to teach children about cooperation and achieving group goals as well as sorting skills.

1 Place 4 pieces of coloured paper onto a table.

2 Put one container on each piece of paper.

3 Give each participating child a random set of cubes all joined together. Each student should have between 5 and 20 cubes.

4 On the count of "1,2,3 Go!" the teacher starts timing and the children disassemble their towers and try to put each of their cubes into the container representing the corresponding colour.

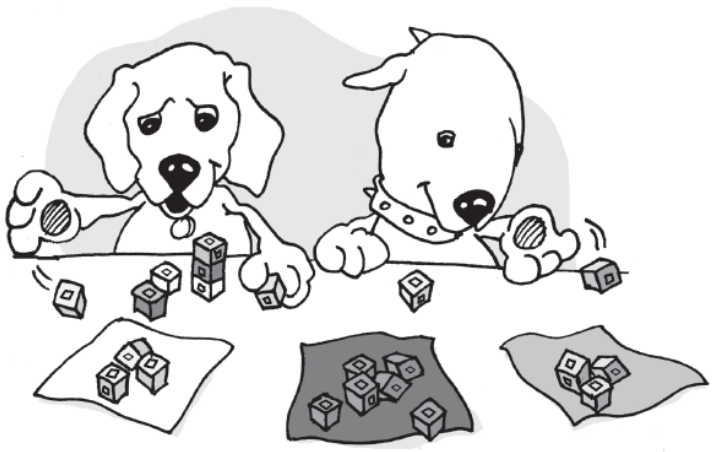
5 If someone places the wrong colour in a container they must get it out before they continue.

6 If one student finishes first, he or she should help one of the other students place the last of their cubes into the containers.

7 The timer is stopped when the last cube is placed in its container.

8 Be sure to explain to the children that there is no winner in this game - the goal is for the whole group to complete the activity in the shortest time.

Cooperation and communication are the key to achieving group goals. Groups should try to improve their times by investigating different methods for completing the activity. Is it better to pull the whole tower apart first and then do the sorting or do you save time by dealing with one cube at a time? Maybe the children should swap the towers around before the activity starts so that the person nearest to the red container, for example, has the most red cubes.



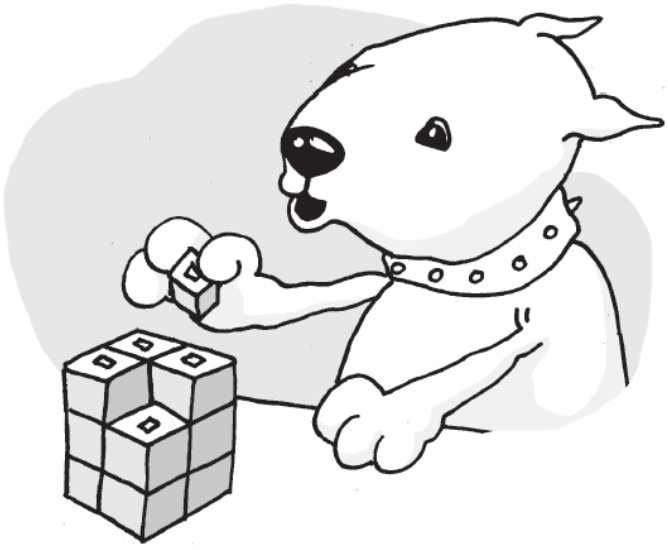
Graphing

As an introduction to graphing, cubes can be used to make simple, two column, bar graphs. Ask the children to come to the front of the class and select a red cube if they eat cereal for breakfast and a blue cube if they don't. The first child to eat or not eat cereal should simply place their cube in a designated place. All the following children should join their cubes to form two towers representing those that do and don't eat cereal.

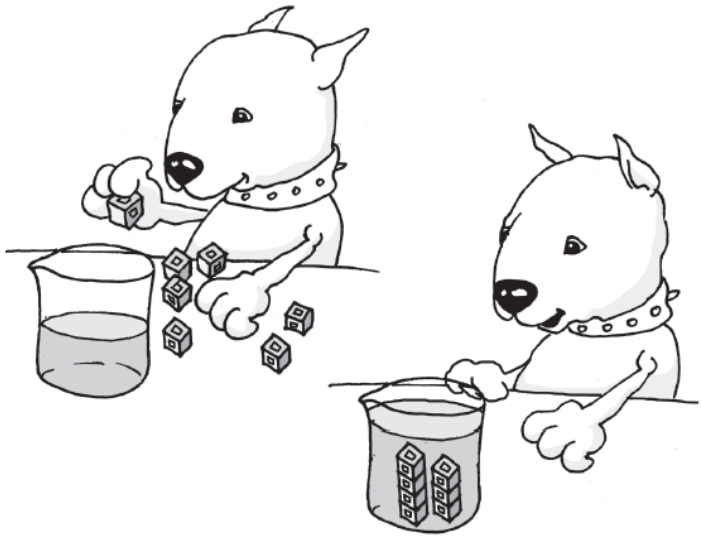
More complex graphs can be introduced by collecting data each day of the week - perhaps graphing how many children are away each day or the temperature at a particular time.

Area, Perimeter & Volume

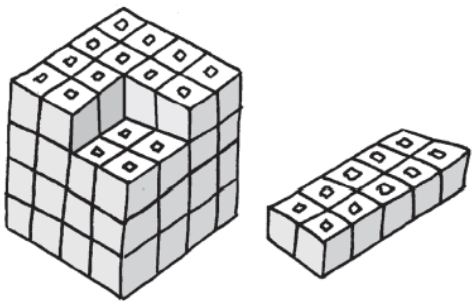
- The difference between length, perimeter, area and volume can be simply demonstrated using cubes. An small sheet of paper can be used as an example. Ask the children to predict how many cubes can be laid end-to-end along one of the long sides of the sheet. Then ask them to try it, recording their results. The perimeter can be demonstrated in a similar way.
- Area can be determined by covering the sheet with cubes. In this way simple area calculations for squares and rectangles can be made using "number of cubes" as a unit of measurement. It can be pointed out that the number of cubes along the length of the sheet multiplied by the number along the width will equal the total number of cubes. The students should verify this fact themselves by counting the cubes as well as trying the same exercise with different squares and rectangles.
- Use a similar exercise to explain volume. Build a cube that measures 3 by 3 by 3 cubes. Point out that the volume in cubes can be determined by multiplying 3 x 3 x 3 = 27 cubes. Again the children can verify this by pulling the cube apart and counting the cubes. Ask them to build other cubes and rectangular prisms and work out their volumes.



- Displacement can be demonstrated by filling a see through container half full with water (a tall and relatively skinny container is most effective). Place 9 cubes joined together as a prism in the water and mark the new height of the water. Disassemble the cubes and reassemble them into a tower. Place the tower in the water and point out that the water reaches the same height. To re-enforce the point all the cubes can be pulled apart and individually placed in the water.



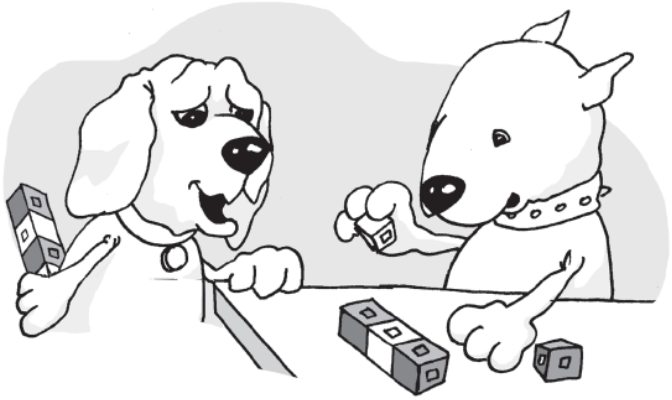
- Give the students diagrams of 3-D models like the ones below. Ask them to estimate how many cubes will be required to make the models. Build the models and count the cubes. Are there any short cuts to counting every cube?



Patterns

1. Ask the children to form pairs.
2. Let each pair take 10 cubes - 5 of one colour and 5 of another.
3. Ask one child to make a pattern with four cubes.
4. Ask that child to memorise the pattern and hide the tower behind his or her back.
5. Now ask that child to give the other student instructions on how to build the pattern without looking at the cubes.

Patterns



6 What happens if the original pattern is 5 cubes long?

7 As an extension, ask the child to write the instructions down.

Probability

1 Put 15 cubes into a cloth or plastic bag that is not see through. Use 5 cubes of 1 colour and 10 of another. Mix them up thoroughly. Don't let the children see you put the cubes into the bag but tell them that you put 5 of 1 colour and 10 of another. Don't tell them which colour is more common.

2 Pull 3 cubes out one at a time, join them and show them to the class.

3 Tell the children that there are 12 cubes left and ask them to predict how many are one colour and how many are the other. Remind them that if they add their predictions together they must equal 12. Ask them to record their predictions.

4 Pull out another 3 cubes and join them to the original 3. Count how many of the 6 are one colour, and how many are the other. Tell them that there are now 9 cubes left and, again, ask them to record how many they think are left of each colour.

5 Continue this pattern until all the cubes have been taken out of the bag.

6 Point out that the laws of probability tell us that the cubes we pull out of the bag give an indication of what colours remain in. As we pull out more cubes, our predictions should get better and better.

7 Try the exercise again to see if the children have gained an appreciation of probability. For advanced students, introduce fractions as a convenient notation for probability.

8 Repeat the exercise without telling the children the initial ratios.

Weight

Weight is the force exerted on an object by gravity. This force cannot be seen, but it can be felt when we lift an object. Centimetre cubes can help turn a child's initial simple experience of weight into a more accurate and useful perception because each cube weighs one gram and is one cubic centimetre in volume.

- Ask the children to feel two "cube towers" of different lengths with their hands behind their backs and guess which one is heavier. Ask them to record their predictions and then place both on either side of a balance to compare the weights accurately. The children should record these results also.
- Give a random collection of cube trains to two children and ask them to sort them into groups that balance each other. They will not only develop a concept of equilibrium but also learn that cooperation and communication are necessary to achieve a group goal.
- Repeat the above activity, this time ask the children to write down the results in the correct mathematical format. E.g. 3 + 3 + 6 = 12. This provides another concrete example of the usually abstract concept of addition.
- Try comparing the weight of the cubes to that of other materials. Try to select materials of varying density such as foam, plasticine, rocks etc. Children (and most adults!) rely heavily on their sight. Children may develop a concept of "larger than" that is somewhat simplified. This activity will help children realise the difference between size and weight - not all "big" objects are "heavy".

A Cubic Metre

How many centimetre cubes equals one cubic metre? Provide students with large numbers of cubes to begin working on the problem. Discuss with them their strategies for finding the figure. Suggest putting together 3 lots of 100 cubes and using them to model the base of the cubic metre and the height. Ask the class to guess how many cubes would be needed to complete the cube and how much it would weigh if it was built.

Point out that the volume can be found by multiplying the length x width x height - which means that we would need 100 x 100 x 100 (one million) cubes to make a cubic metre and the cube would weigh one tonne.