



NUMERACY FOR ALL

RESOURCES FOR TEACHING MATHEMATICS

A guide for teachers and trainers on how to make and use low cost / no cost teaching and learning aids to encourage active and playful learning for Maths in the classroom.



INTRODUCTION

This guide contains ideas for making, using and storing teaching aids and resources that trainers, teachers and children can use to help with the teaching, learning and understanding of mathematics.

Why are concrete materials important for the teaching of mathematics? Understanding and meaning are central to a child's mathematical development and using concrete materials aids this process. Without understanding no strategy is meaningful. Many schools do not have professionally manufactured maths resources because they are expensive. This guide helps maths teachers solve this and will enable teachers and children to access a wealth of maths resources to make teaching more effective and learning both meaningful and fun.

It shows how resources can be made from locally found objects and waste materials that cost nothing, as well as cheap readily-available materials. Photos of actual resources are shown along with details of how to make them and suggestions of how to use them. It is key that enough resources are made for children to manipulate them. They should not be used just as a demonstration. Making multiple copies takes more time but is well worth the effort. It is pointless just using one example with a class with the teacher holding it up and showing it to the children.

Once resources have been made, it is important that they are stored properly to ensure they last a long time. Children must be taught to respect and look after the materials and to return them to their proper place. They should be accessible to the children so that when they need to use them they know where to find them. Labelling bags and containers is vital so children can find them easily and know where to return them. There are some suggestions for different methods of storage at the back of the guide.

It is also important that a variety of resources are available (for example there are many different materials for teaching place value – exploring different materials will deepen understanding.) This also relieves the pressure of making many sets of the same resources as children can use different resources that teach the same concept and swap them – for example one group can use place value blocks while another uses an abacus.

This guide should be used as a source of ideas and the resources can be made by trainers to demonstrate and use with teachers and children. By allowing teachers to try out the resources as if they are the children they will develop



their understanding of this method of teaching as it may be new to them. If possible, use the materials with the children in a demo lesson so the teachers really understand how they can be used.



All of the materials in this guide were made by me as a volunteer on placement with VSO using waste and locally sourced materials at low or no cost. They have been tried and tested with educators, teachers and children.

Mary Watkins.

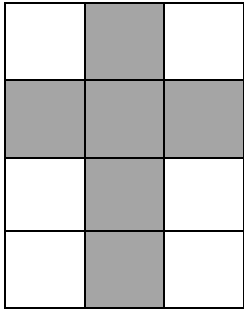


You are free to copy and redistribute the material in any medium or format, but must attribute and credit the materials. You may not use the material for commercial purposes. If you remix, transform or build upon the material you may not distribute the modified material.

There are also accompanying videos available. Search “MESHGuides Youtube” and further educational research and information -
<http://www.meshguides.org/>

Resource picture and description	How to make	How to use	Other comments
<p data-bbox="91 201 427 312">1. Show Me' boards. One side blank, the other side with a grid (eg 5X4)</p> 	<p data-bbox="465 201 1032 427">Thin wood or thick cardboard and cut a rectangle (ideally between A5 and A4 size). Remove any tape from the cardboard. Paint black on both sides. Draw a grid of squares on one side using white paint (NB this is not essential)</p> 	<ul style="list-style-type: none"> <li data-bbox="1077 201 1951 384">A. Individual (if there are enough boards), pair and group work. Children write on the boards with chalk and when the teacher gives the signal (eg 1,2,3 SHOW ME) the pupils all hold up their boards towards the teacher. Easy to see who is participating and to assess answers. <li data-bbox="1077 395 1861 507">B. Good for draft work, practising writing numbers, rough workings for maths problems, part-part-whole diagrams, number sentences, etc. <li data-bbox="1077 518 1906 630">C. The grid side can be used to help with place value – to make sure numbers are written correctly or for drawing simple graphs or an abacus for place value. <li data-bbox="1077 641 1951 705">D. The grid side is useful for fractions and for playing maths games such as bingo and dice games. <li data-bbox="1077 716 1917 748">E. Fractions – draw different shapes and shade half, quarter etc <li data-bbox="1077 759 1883 823">F. Shape drawings – draw a shape as asked by the teacher or another child in pair or group work <li data-bbox="1077 834 1883 898">G. Drawing clock faces and marking the hands on to show the time asked <li data-bbox="1077 909 1659 941">H. Practising drawing different types of lines <li data-bbox="1077 952 1906 1016">I. Estimating in centimetres – eg teacher asks children to draw something about 6cm long etc <li data-bbox="1077 1027 1928 1179">J. Playing 'Guess me". Child (or teacher) draws a shape, writes a number etc. Give clues for the other children to guess what is written. Or children can ask questions that can only be answered with Yes/No. Eg does it have four sides? <li data-bbox="1077 1190 1951 1294">K. When using with the whole class it is important that children are given thinking time and that they only show their boards on the signal from the teacher. 	<p data-bbox="1982 201 2197 911">Probably the most versatile and essential of the classroom materials. Can be used in every lesson. Allows instant assessment of the whole class and ensures 100% participation. Children may be excited the first few times they use the boards but if they are used daily they will soon regard them as the 'norm' and enjoy using them without disturbance.</p>

2. Dice



Use small wooden cubes (about 4 or 5cm) and marker pen to mark the dots or write numbers.

Dots 1 – 6

Dots 0 – 5 (one side is blank and the others are 1-5 dots)

Make cubes from cardboard.

Draw gridlines of squares (4cm or 5cm or the width of the ruler is easiest) and then cut out a net of 6 squares. Fold along the lines (using a ruler to fold against makes them straighter) and stick using tape to make a cube.

Milk and juice cartons make excellent cubes as they are foil lined making them easy to wipe clean as well as looking very nice!

If there isn't enough card to make a net, squares can be stuck together to make a cube. They can also be stuck onto paper first in a net formation and then folded and stuck.

Using large squares (eg 20-30cm sides) you can make a large classroom dice. If this has plastic pockets stuck on the side then flashcards can be put into the pockets and the dice is multi purpose

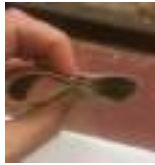
- A. Pair or group work. Roll the dice. Count the dots and tell the others the number. Then clap the number. Can be done with one or two dice.
- B. Play a game – either in pairs or divide a group into two teams (2, 3 or 4 in a team depending on the group size) Using paper or 'Show Me' boards each team writes the numbers between 2 and 12 (if using the 1-6 dots) or 0 – 10 (if using the 1-5 dots). They take it in turns to throw two dice (with group work two children in the same team can throw one dice each to increase participation). They add the dots and if they have the number written down they cross out the number (or cover it with a stone or bottle top). If the total is already covered then cover numbers that add to make it. Eg if the total is seven then they could cover 5 and 2, 1 and 6, or 3 and 4. Keep playing until all numbers are gone. Every time they throw they must say the answer to practise the calculations. Winners are the first to cross out their numbers or the team with the most numbers crossed out when time is up. You can also play this game with pre-prepared boards (cardboard) with all of the possible numbers on. eg 1-10 or 2-12 The above game can also be used with other number operations (eg throw the dice and multiply or subtract the numbers) Division will work sometimes but that can get complicated!
- C. To make a more challenging game use three dice and a hundred square and the children place a bottle top on the answer to the calculations. (eg throw 2,3,5 and you could make $2 \times 3 = 6$ plus 5 = 11, place a bottle top on 11 or $2 \times 3 \times 6 = 36$). You can limit the game to just using addition or subtraction or include all four operations. If playing in teams the children will need different coloured bottle tops or one team uses upside down bottle tops, or bottle tops v stones to differentiate which team has covered which numbers.

Endless ways to use dice.

The 1 – 5 dots with blank dice is a good way to have a zero and is also useful for number bonds to 10.

The children will often throw numbers that don't match but they are still doing lots of mental maths. Games are an excellent way of children doing a lot of mental maths calculations without even realising they are! NB you can't make 1 by addition if using 2X 1-6 dice with the number but they could make 1 if they use subtraction, multiplication 1X1 or division)

The hundred square can be used in various ways. Throw the dice and the children make as many calculations as they can, they can choose one and



A very simple and very cheap cube can be made from a toilet roll tube. Flatten the toilet roll on both sides to create a cuboid shape.

Cut a small piece off the top and use this to measure down the tube (Alternatively measure one of the edges and measure down the side of the cuboid). Cut two pieces.. They should be identically sized cubes without a top or bottom. Turn one so it is perpendicular to the other and slide it inside the other piece. This is a very simple cube. You can use tape to make it stronger and neater but this is not essential. Draw pictures, write numbers or dots on the faces as required.

Digit Dice/ number cubes



All of the above types of cubes can be used as digit dice. These are cubes with numbers written on the faces (abstract dice). As there are only 6 faces and often 0-10 is required one way to best utilise the dice is to have two cubes per set – one label 0,1,2,3,4,5 and the other 0,6,7,8,9. You will have one blank face on the 2nd dice or you can have a second zero.



- D. Simple P1/ lower ability game. Each pair/group has a board (made from milk bags, paper or card) with a grid of 1-9 dots. Throw 2 dotty dice (0-5) and add the dots. Find the corresponding bottle top with the digit written on it and place on the grid. Winner is the first to cover all squares. If they throw a double blank they can either throw again or choose any number on the dice to use (makes them think). This game can be made more challenging if played with the digit dice (see below) rather than the dotty dice.



- E. One child chooses a number between 2 and 12 or 0 and 10 depending on which kind of dice being used and take turns to throw two dice and add the numbers. See who is first to get the number chosen. Write the possible combinations that could be thrown to make the number on the 'Show Me' board. (could use part-part-whole diagram)
- F. Throw one dice and count out the same number of bottle tops or throw more dice, add them (or subtract, multiply) and count out the same number of bottle tops/stones etc.

have to try and make four in a row



Can use different colours (to match the place value resources -yellow=thousands, green=hundreds, blue=tens, red=ones.) Although yellow can be a problem as yellow markers are not readily available so black can be used instead.

A set of 8 cubes

4X 0,1,2,3,4,5

4X 0,6,7,8,9

will make all numbers from 0 -9999

G. Throw the dice and write the digit on the 'Show Me' board or notebook or match a flashcard.

Ideas for using digit dice:

- H. Any of the dice games above can be used with digit dice instead of dotty dice (ie abstract rather than pictorial).
- I. Use to make given numbers in groups in a similar way to using small flashcards or bottle tops with numbers on.
- J. Roll 1,2 or 3 dice and make the number using concrete materials (using place value materials).
- K. Roll 4 dice and arrange to make a 4 digit number (3 dice for 3 digit etc). respond to teacher's instructions (eg without turning the dice, rearrange to make the largest number possible, smallest number possible, add 6 to the number (they will have to turn or change dice for this).
- L. Make a given number and then respond to teacher's instructions. Add 14 to the number, rearrange to make the largest etc. If all the class are making the same numbers it is easy to assess by walking around the room.
- M. Using dice (with dots) and digit dice together. Throw one, two or three dice, count the dots and make the number with the digit dice. This could be done in pairs or groups with one 'team' throwing and the other making the number.
- N. For more challenge give the digit cubes with the higher numbers (ie 6-9) and with less able you can use the lower numbers (1-5). Play games to practise multiplication tables. Throw two cubes and multiply the numbers. If they throw a blank side they can throw again or choose any number they want. Take turns and keep a running total. The winner is the one who has the bigger total when time is up.

3. Other cubes/dice



Make as above but use for other maths topics.
Draw different shapes, fractions, clock faces etc on the faces of the cubes.



When making clock faces use an ordinary biro pen to draw the numbers on as a marker is too thick. To get a perfect circle draw around something (such as the inside of a small roll of tape)



- A.** Matching activities – small written flashcard that is labelled and match to one of the sides. Play as a game. Roll the cube and then find the correct flashcard to match. Or turn over a flashcard and then the members of the group take it in turns to roll the cube until they get the picture that matches the flashcard. With every roll they say what they can see. (repeatedly practising)
- B.** Use like flashcards. In groups, the teacher asks a question and the children have to find the answer on the cube and either hold it up or place it on the table face up. Eg show me a triangle with a right angle, show me a circle, show me a shape with straight edges. The teacher circulates around the classroom to check answers.
- C.** Play a game in groups. One child names a shape (eg square) children then take it in turns to throw the dice until the square is shown. For every throw the name of the shape is said. Award a point (or a bottle top) to the child who throws the named shape. Repeat with another child naming the shape.
- D.** Throw the dice and another in the group draws the shape on the 'Show Me' board. Then another throws and another draws. Try and combine the drawn shapes to make a picture.
- E.** If you have the words on one cube and the picture on the other play a game – one child rolls the words and another the picture the rest have to say when they match. Or one child rolls the word cube and then they all take it in turn to see who is first to roll the picture (or vice versa)
- F.** With clock faces use the time fan (see picture) to show the matching time on the cube.
- G.** To add challenge the teacher can vary the questions such as – find 4 o'clock, what is half an hour later than/earlier than...
- H.** Roll the clock cubes and put them in order.

To do pairwork and small groupwork can mean a lot of resources are needed. To make the resources go further one set can be shared between more than one group. For example the 8 clock cubes – 4 can be given to each of two groups. They play games with the four cubes and then swap.

Tip – throwing wooden dice on wooden desks can be noisy so children throw the dice on something like a notebook to decrease the noise.

4. Bottletops - number work



Mini counting stick using bundles of ten.



Before using bottletops in the classroom, wash them in soapy water and leave them to dry properly.

Bottletop counting sticks and 'beads' on strings

Use a hammer and thick nail to make holes in the bottletops



Thread them onto string, wire (or banana fibre), old cables (eg phone chargers) or thin sticks. (bamboo brochette sticks are perfect or collect bamboo from the environment) The bottletops can be grouped by colour to make multiples of 1,2,3 etc.

Grouped in tens they can be used for making bigger numbers.

A mini counting stick is made from a bamboo stick and two water bottle tops that stop the bundles falling off. When the bottletops are pushed together they keep the metal tops in place – good for storage and they don't get tangled.

- A. Counting – using loose bottletops for counting as a simple concrete material
- B. Single bottletops can be used for addition and subtraction.
- C. Group bottletops for multiplication and division
- D. Bottletops on sticks are good for counting and other number operations (+ - x :) and are easy to manipulate (rather than having a big pile of single tops)
- E. Sets of ten counters on string can be used on mini sticks to show 100 and are useful for counting up to 100 and beyond when you don't want to count one by one.
- F. Place value and an understanding of number – a 'snake' of 1000 bottletops will amaze the children and give them a feel for what a thousand looks like. A threaded string with 100,10 and 1 can help children understand place value. Group the bottletops in tens by colour so it is easy to count them. In the example below it is 10 yellow, ten mixed colours repeated.

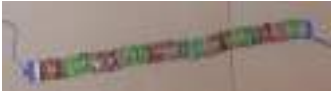


- G. Using the 100 bottletop string the children can line it up and move it along the 1000 string to see how many 100s are in 1000 or to count in 100s to find out how many bottletops there are. Can do the same thing with the ten string and 100 string.

Good tactile material for visually impaired children and those who struggle with understanding

The 'igihumbi snake' is a very visual way of making children understand what a thousand looks like. Useful for showing 4 digit numbers eg 1267 – the number can be made with bottletops and the misconception children often have that the '7' would be the biggest number here can be clearly shown. A very effective way of showing how place affects the value of a number.

Bottletop strings



Long bottletop counting sticks and strings.



To prevent the bottle tops falling off the ends of the sticks you can use tape, elastic bands or a small piece of rubber (eg old moto inner tube) to seal the ends. If using rubber make a small hole with a nail not using scissors – the hole needs to be small for it to stay securely on the stick.



Metre stick (eg bamboo) and tie string to one end. With plastic string the knot can be melted using a candle to make it secure. Or use a small piece of rubber from a bike/motorbike innertube. If you only want to use some of the tops or you want to divide the tops into groups or multiples, dividers can be made



using rubber or string. These are easily removed and can be placed anywhere on the stick.

- H. Bottle top sticks arranged in multiples can be used for multiplication and division. For example, the children can first find out how many tops of the same colour are together. Then they can count in multiples.
- I. Bottle tops on strings and on wooden sticks are a useful learning material to help children when they are working individually on addition and subtraction of small numbers.
- J. Strings and sticks where the bottle tops can be removed is also a useful aid. Children can count, add, subtract as they thread. (See note in additional comments regarding safety of bottle tops that can be removed)

- K. Can be used as demo counting stick with class or children can also use it in groups.
- L. Use the rubber dividers to section numbers Eg to add two numbers together, to make multiples, to isolate the numbers you want to count to –eg teaching 1-20, isolate those.
- M. Counting 1-100
- N. Estimating numbers between 1 and 100
- O. Use in the same way as the small counting sticks and threaded strings as detailed above

Sticks and strings with bottle tops should be readily available in the classroom for those children who learn in a visual or kinaesthetic way. Or for those who are struggling with the abstract idea of numbers or when numbers are being introduced.

If bottle tops are used for threading it is important that the area around the hole is not sharp. After the hole has been made with the nail, a hammer and the head of the nail can be used to flatten any sharp / jagged edges.

Bottletops digits and dots



Bottletops that are blank are ideal for making number counters.

You can write a number on the bottle top and record the number pictorially (using dots) on the other side. (Concrete Pictorial Abstract – CPA)

Use marker pen to write clearly on the blank side. If you use different colours it can be easier to find sets of numbers when sharing for group work.

With bottletops that are not blank you could use tape to cover the writing on the bottle top and write on them or paint them white. If you only need one side then write on the underside of the bottle top.

0-9 sets are very versatile – good for making 2,3 and 4 digit numbers. Using different colours makes sets easier to identify.

1-10 for P1 counting and 0-10 with an extra 5 for making number bonds to 10

Store the bottle tops in jars or tins and label clearly.



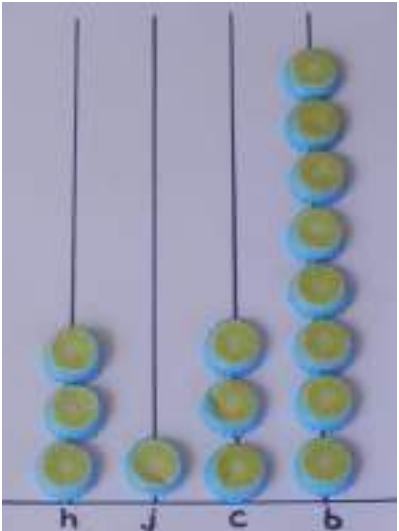
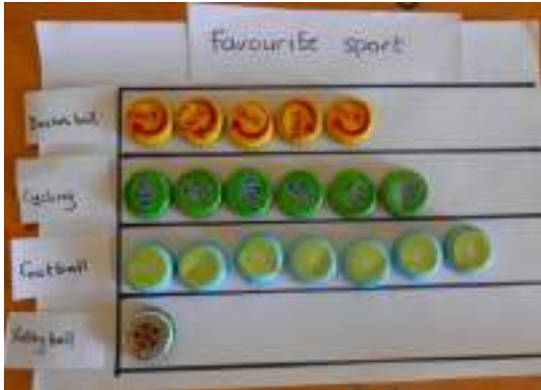
Or sets can be stored in envelopes made from scrap paper or old milk bags for easy distribution to groups.

- P. Counting
- Q. Ordering the bottle tops using the dotted side
- R. Ordering using the digits
- S. Matching dots to digits – use two sets and the children try and pair up the dots and digits as quickly as they can.
- T. Sets of 0-10 (with an extra 5) can be used for number bonds to 10. Children work in groups to pair up the numbers. Or the teacher can call out or show a number and the children hold up a bottle top with the number on it that will make 10. Eg teacher holds up 6 / says “6” and children hold up 4.
- U. Just using the digit sides of the tops -
- V. Take 1,2,3 or 4 bottle tops and arrange them to make a number.
- W. Rearrange to make largest/smallest number
- X. Use to generate calculations for written work (they could be placed on the grid side of the ‘Show Me’ board or on a desk to make a written calculation.)
- Y. Make given numbers and then perform operations on them. eg – ‘make the number 567. Now add 31 to it.’
- Z. Use open questions for making numbers (eg make a three digit number with more tens than hundreds)
- AA. Make sequences and find missing numbers.
- BB. Place in ascending order / descending order
- CC. Make calculations – eg children arrange the bottle tops to make correct calculations (eg $45+31= 76$) so use the bottle tops instead of writing.
- DD. Play a game – all bottle tops are in a bag – each group has a bag. One child pulls out a top and the children clap the number / count to the number etc. Repeat with other bottle tops. Or all children pull out 1 top each and then they order them (ascending / descending). Or teacher gives an example – eg biggest number. All children pull out a top and those with the biggest number have a point. Use different questions – eg odd numbers / even numbers/ number that adds to 6 to make 10 etc

Good tactile material

Easy to get for free.

It is often assumed that bottle tops are only any use for P1 but with careful choice of questions bottle tops with digits on can challenge everyone. For example – take four bottle tops with four different digits and arrange them to make the largest number possible (eg 9754) Now rearrange the tops to make the second largest number.

<p>Smiley face bottle tops for promoting a positive classroom</p> 	<p>Use marker and draw smiley faces on some bottle tops. Children love to be rewarded with a smile from their teacher and they love to earn a smiley face bottle top.</p>	<p>EE. Smiley face bottle tops to give as a reward for good work, good group work, good behaviour etc. FF. See which group / pupil has the most smiley faces at the end of the day. GG. Also use as a whole class behaviour reward. All bottle tops given as a reward are not kept by pupils but put into a communal jar and see how many the class have collected as a whole at the end of the day / week. Compare this with previous days / weeks. Praise the children who contributed.</p>	<p>Some children lack confidence with Maths. Using positive behaviour management and reward is an excellent way to boost self confidence and change children's negative attitude to maths.</p>
<p>General collection of bottle tops</p> 	<p>Wash and dry bottle tops. Store in a box or a bag. Make them easily accessible to the children so they can find them when they need them.</p> 	<p>HH. Counting II. Estimating – take a handful or two handfuls of bottle tops and children estimate how many they think are there. Then they count to see who is closest to the correct answer. JJ. Making patterns and sequences using colours KK. Use to 'draw' numbers or shapes LL. Use on grids ('Show Me' boards or paper) to make simple graphs following group or class surveys. (eg favourite sport)</p>  <p>MM. Use on grids (on 'Show Me' boards or paper) to make abacus numbers for place value lessons. NN. Use as counters for games (as described above in the Dice section)</p>	<p>Good tactile material</p>

5. Hundred square games with bottle tops



Use blank sided bottle tops and write clearly using marker. Numbers 1-100 (for example) Store in jars or tins. Put a few blank bottle tops into the container in the event of some numbers being lost. Make 100 square from paper or the inside of milk bags.



Bottle tops with digits can be used with smaller grids made from paper, card, milk bags or drawn on the 'Show Me' boards.



- Children work in groups and order the bottle tops (for example, 1-10, 1-20 and 1-50)
- Use a 100 square and match the numbers. Time the children to see how quickly they could do it or they can compete in teams and see which team finishes first.
- Once children are familiar with the 100 square (from other lessons) a good challenge is for them to place the digit bottle tops in the correct place on a blank 100 square. (ie a 10X10 blank grid) They should have an opportunity to repeat this at a later date as they with practice they will improve and having a clear mental image of a 100 square can help with mental maths agility.



- Using bottle tops and 100 square to find patterns with multiples is a great way to investigate times tables.



Milk bags - an excellent quality, strong and versatile material for teaching aids. They are foil lined and can be written on with markers and they can be wiped clean. In many schools thousands of milk bags are given out every week as part of the school feeding programme. Although washing them isn't a pleasant job- there is a massive supply



and as well as being free using them is good news for the environment.

6. Place Value resources

Flashcards of abacus numbers and digits (2,3 or 4 digits according to the level of the children



Place value flashcards (abacus)

A4 size and A6 group sets

Draw grids on A4 paper (class set) or A6 cards (group work)

Leave some blank for 'make your own numbers'

Draw 'beads' on some to make numbers and make corresponding digit cards (A5 and A7)

With blank grids use bottle tops. It is a good idea to use blank bottle tops with 1, 10, 100 and 1000 written on them.



A. Set of 10 A4 flashcards. Play 'Point to the Flashcard'. Place digit cards around the class, hold up one abacus card, give children thinking time then a signal (eg 1,2,3 POINT). Children point to the correct answer.



B. Give a flashcard or a digit card to a pair of children. Ask one pair to stand up and show their card. The pair with the 'answer' stand up. Class checks. Repeat with another pair. You can either show an abacus or a digit card.

C. Give out abacus cards. Give clues (open questions) – eg the number I want has 3 tens/more tens than ones/ is bigger than 4000 etc. Children with possible answers stand up. Class checks.

D. 10 pupils at the front, give 5 abacus and 5 digit cards the rest of the class help to match them up

E. Group work – pupils match the digit card to the abacus card.

F. Use just digit cards and children make the abacus with bottle tops and the blank grid.

G. Bottle tops on blank grids to show addition and subtraction (with exchange and carrying). eg 1234 plus 9. Add 9 bottle tops to the 4 ones. Then count ten and exchange for a bottle top in the tens. Use bottle tops with 1, 10, 100 and 1000 on them.

H. Use 'Show Me' boards (grid on the back can be used as an abacus grid). Show a digit card. Children work in pairs or small groups to draw the abacus. On teacher's signal children show and compare with the flashcard.

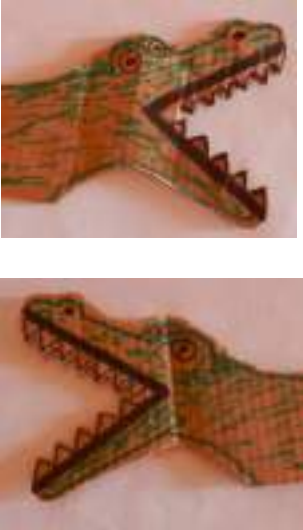



I. Look at a flashcard and teacher asks children to add or subtract a number. Draw the abacus on the 'Show Me' boards and write the new number in digits.

J. Hold up abacus flashcard and children make the number using the overlapping place value cards (working together in groups)

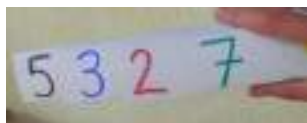
Easy to assess whole class with this versatile game.

If more than 40 in the class either make extra flashcards or give to a group of 3.

If resources are limited give half of a set to each group and they swap after they have finished.

<p>7. Teaching greater than or less than – visual aid</p> 	<p>Crocodile picture (double sided) drawn on cardboard with thick marker pen lines for the jaw to show $<$ $>$ Pictured here are both sides of one crocodile.</p> <p>Draw numbers in fish so the children get the idea that the crocodile will go for the bigger number of fish.</p> 	<p>A. Teach that the crocodile always faces the bigger number (bigger number of fish – you can demonstrate by writing the numbers and drawing a fish outline around them) B. Make the symbol with two fingers, hold up for a whole class assessment of understanding when 2 numbers written on chalkboard or held up on flashcards.</p> 	<p>Good visual aid to help with an abstract concept.</p>
<p>8. Flashcards 0-9 A4 teacher set and A6 group work sets</p> 	<p>Made using cardboard, thinner card or paper.</p> <p>Cut the card to size (A4 for whole class teaching and A6 or smaller for group work)</p> <p>Write the digits as large as possible – fill the space. Make them all the same size, neat and as thick as possible.</p>	<p>A. Use large sets for whole class work and games like Point to the Flashcard, Touch the flashcard, Ordering etc. B. Teacher holds up a flashcard – children clap the number C. Teacher claps a number and children hold up a small flashcard, point to a large flashcard etc. Make more challenging eg by clapping 4 and then say “times” clap 6 (children work out 6X4) or clap 10 say “subtract” and clap 2 (10-2) D. Small group flashcards, order, make numbers. E. Hold up a flashcard, ask ‘If this is the answer, what is the question?’ children suggest questions. eg if 9 is the answer it could be 10-1, 4+5, 63 :7 etc etc F. See the ideas from the dice section and bottle tops as many of those activities can be done using flashcards.</p>	<p>‘Touch the Flashcard’ – stick 6 flashcards to the chalkboard spaced out. A group of about 6 children stand behind a line drawn on the floor in chalk. Teacher asks a question, gives thinking time and the children run and touch the flashcard answer. Change the group after about 3 questions.</p>

9. Using the abacus for Place Value



An abacus can easily be made. 4cm wooden cube with hole drilled in one side and a brochette stick. Cut off the top of the stick so it is not sharp. Glue the stick into the hole.



Make holes in the bottle tops using a thick nail. If the holes split or close up and the bottle tops don't move freely on the sticks then use a nail heated in a flame to melt some of the plastic around the hole to make it permanently bigger. Put 9 tops per stick.



Use tape to label the cubes Th, H, T, U (or in the local language) Every cube has four labels – one on each side to make the abacus stick multifunctional – the children just turn the cube to have whichever side they need.

- A. Make given numbers
- B. Give out digit flashcards and children make the numbers on the abacus
- C. Use digit cubes. Children throw the cubes and arrange the numbers and then make them on the abacus
- D. Start with a number, make it on the abacus. Teacher gives an instruction eg add 21 or subtract 102 and children make the new number.
- E. Use overlapping place value cards or place value fans to make the numbers to show $1000+100+20+2 = 1122$ etc
- F. Make numbers on the abacus and write them in notebooks or on 'Show Me' boards.
- G. Use to demonstrate addition with carrying and subtraction with exchange.
- H. Play game – teacher or child (with teacher's help) chooses an abacus card (doesn't show it). The rest of the class guess the number by asking questions (answer YES/NO). eg are there 5 ones? (yes) Are there more tens than ones (No- therefore must be 1,2,3 or 4 in the tens) Discuss what they know from the answers to the questions. They make the number on the abacus in groups as they go along.
- I. The abacus can also be used as a simple counting stick for P1 / lower ability children for counting to 10.

Train children to store materials carefully and return them to the box / abacus when they have finished.

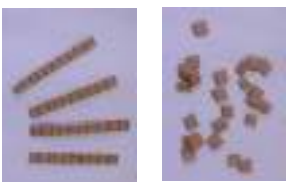
Show how when we reach ten on one abacus rod we exchange the ten beads for one on the next rod.

With this game the teacher will need to help to ensure they understand what the answers to the questions tell them.

When using the abacus for counting remove the labels Th H T U

10. More place value using concrete materials

thousands, hundreds tens and ones in cardboard blocks, squares, rods and small squares



Hundreds tens and ones using bamboo sticks



Different ways to teach place value are important to consolidate the children's understanding of number so it is good to use different types of materials to explain the same concepts.

Place value set from cardboard – cubes, rods and squares

These are all made from cardboard. The 'ones' are 1cm squares (it takes too long to make cubes although technically they should be 1cm cubes)

It is easier to draw the grids onto the cardboard before cutting (or folding to make a cube)

These can also be made from wood and 3D rather than 2D

ie ones are 1cm X 1cm X1cm

The tens rod is 10cm X 1cm

The hundred is a square 10cm by 10cm

The thousand cube is 10cmX10cmX10cm or can be a flat resource made of ten 10X10 squares

Use marker pen and a ruler to show all of the 1cm squares.

A. Make given numbers using the materials



B. Use to show addition with carrying and exchange



C. 1 ten = 10 ones



D. Add 29 to the number. You have 11 ones so ten ones can be exchanged for one ten

E. demonstrate subtraction with exchange



F. Hold up digit cards or write numbers on the chalkboard and groups make the numbers using the place value materials.

G. Children should have lots of opportunities to manipulate the various place value materials. Line up ten squares to see they make a ten rod.

If the 1000 cubes are too time consuming to make, 1000 can also be demonstrated with a grid



Can use a mixture of the materials in the same lesson (eg bamboo rods, abacus and cardboard materials)

Encourage pupils to look after the materials and return them to their storage boxes carefully. There are lots of very small bits.

Tip – if possible use the cheaper brochette sticks that are flatter. The more expensive ones are curved



Place value set (hundreds, tens, ones) from bamboo sticks

- 1 x H
- 1 x T
- 1 x U (unit = one)

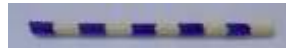
Cut 10cm lengths from brochette sticks. Lay a piece of tape sticky side up and turn the top and bottom over so it sticks to the table. Line up the ten cm rods on the tape so they are held in place.



Measure 1cm lines and draw right down the sticks. Use marker and colour every other cm.



These are the tens rods.



For the ones, cut 1cm lengths.



- H. Line up ten 1cm pieces of stick alongside the ten stick to see they are the same.
- I. Give out a handful of ones and ask children to estimate the number of ones there are. Count them and group them in tens. Exchange each ten for a ten stick. Draw pictorially on paper or on the 'Show Me' boards and write the corresponding number.
- J. For subtraction make a number (eg 12 using a ten stick and two ones) as the children to take away 4 ones. They cannot do it so ask them how they can make more 'ones' By 'chopping up' a ten stick (ie exchanging)

K. Measurement

- L. The tens sticks, ones sticks, tens rods and ones squares are all in centimetres so can also be used as a resource for measuring.
- M. As well as for practical work they can also be used for conversion of centimetres to decimetres to metres as this is also dependent on an understanding of place value.
- N. Examples of practical tasks for pairs or groups
- O. Use the tens stick and find three objects smaller / bigger than 10cm.
- P. How many tens sticks do you need to measure the width of the desk. How much is that in centimetres?
- Q. Use tens rods to measure your notebook. Find the length and width.
- R. Estimate the length of your pen in cm. Now use the apparatus to measure it.

and will roll on the children's sloped desks. Or cut sticks and flatten the sides by peeling with a knife.

Practical work is most important with developing an understanding of place value, subtraction with exchange and addition with carrying.

Tie or group bundles of 10 ten sticks to make a hundred



Overlapping place value numbers

Make numbers 1-9999



Overlapping cards

To make the 'stand up' overlapping place value numbers fold A4 paper in half and cut. Fold in half again. Write 1000 on the paper equally spacing out the digits (make a guide by folding paper the same size into quarters). Repeat making numbers 2000 – 9000.

To make the tens you repeat the process for 1000s but fold the paper in half again.

To make 100s and 1s fold paper again and cut it so that one piece is three quarters and the other a quarter.

Mark the right end corner of all pieces using marker.



This is the same resource but the cards are not 'stand up' and are usually made from thin cardboard.

Cut 9 cards of 16cm by 4cm and write 1000 – 9000 on them.

The hundreds cards are 12cm by 4cm
Tens cards 8cm X4cm
Ones cards 4cm by 4cm.

S. This resource is useful to help children understand how to write larger numbers. $1000 + 400 + 60 + 5$ is written 1465 but this can be very confusing. Children often put in all or some of the zeros. These cards show the zeros and the children can see where they go when they make a number.

T. For example

U. Ask 4 the children to come and find $1000 + 400 + 60 + 5$ from the numbers and stand them in a line at the front of the class. Take the 1000 and overlay the 400 taking care to line up the mark in the right hand corner. Repeat with the other numbers. You can lift the numbers to show where the zeros are. Overlap the cards to show how the numbers are made up and how the zeros are covered (ie to help with the common error of writing 1004 for 104)



V. Also demonstrate that if you are missing one of the numbers the zero will stay visible. eg if there are no hundreds 1065 – the zero is the one written on the 1000s card.

W. Use with other materials (eg abacus, 'Show Me' boards to make numbers)

X. Use these cards alongside the other place value apparatus and when the children make the numbers using the concrete materials they also make the numbers with the overlapping place value cards.

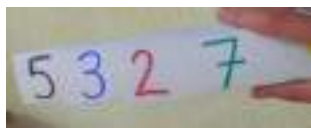
It is very important to make sure the numbers are written spaced out (in their own quarter) or when the pieces are overlapped they may not line up correctly. The easiest way to ensure this is to fold a piece of paper into four and use as a guide.

This resource is quick and easy to make and requires only 13 pieces of paper.

Make sure children know to overlap the numbers at the right end (line up the marks or cut off the corner)

9000	900	90	9
8000	800	80	8
7000	700	70	7
6000	600	60	6
5000	500	50	5
4000	400	40	4
3000	300	30	3
2000	200	20	2
1000	100	10	1

Place value fan



Cut the right hand corner off so there is a guide for the cards to line up or mark each right hand corner with marker as with the 'stand up' cards

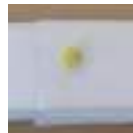
A place value fan is made of overlapping place value cards linked together so the cards can't be lost and it is easy to use. Make a large one from scrap card such as the back of a flipchart.

Draw lines 5cm wide. (for example)



- 9 cards 25cm
- 9 cards 20cm
- 9 cards 15cm
- 9 cards 10cm

Write the numbers on the cards being careful to space them out. Each digit should be inside the 5cm square. Start from the lefthand side and leave the final square blank on the right (for the knot) Make a hole in all of the cards in the right hand side in the same place. Thread string through the holes making sure the numbers are in the correct order. Tie the knot tightly and melt to make a secure stud.



Smaller versions for pupils can be made using less card (eg chalk boxes) Also make 2 and 3 digit versions just using the 1s, 10s or 1s, 10s and 100s cards as required.

Y. Use in exactly the same way as the overlapping place value cards described above

Z. Use for making any number from 1-9999

AA. Make given numbers in groups

BB. Ask a child to make a number and show it using the place value fan.

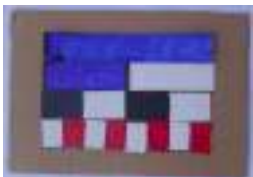
CC. Other children in groups use place value materials to make that number or draw it in abacus form on 'Show Me' boards or make it using the overlapping place value cards.

DD. Use to answer questions in groups (hold up answers – in the same way as the number fans)



The place value fan is a fantastic resource numbers 1-9999 all in one place and tied together so you can't lose any digits. Simple to make and simple to use.

11. Fraction boards and circular fractions



Fraction strips (not cut up)



Rotating fraction tubes

Use cardboard from boxes.
Carefully measure rectangles and divide into the grid as shown.
Colour alternate sections so they stand out.
Cut strips of cardboard to make 'jigsaw' pieces.

For the circular fraction boards draw around a circle (eg a small plate or a tin). Make a baseboard to fit the pieces in and a small cardboard cylinder that can be used to store the pieces.



Make in the same way as the fraction boards but don't cut up the pieces.

Fraction tubes are simple and fun. Make from toilet roll tubes stuck together. Cut the inner tube and stick it so the diameter is smaller and it will slide into the outer tube. Draw fractions and a choice of answers. Cut windows in the outer tube and rotate so the windows show the correct answer.







- A. Match the pieces to the whole rectangle / circle drawn on the base boards.
- B. Give out the pieces and ask children to work out what type of fraction they have. Come and match.
- C. Just use the fraction strips to compare. How many halves to make 1, how many eighths are the same as a half etc.
- D. Use the 'Show Me' board to draw and shade different fractions.
- E. Link to real life – think of sharing – eg a biscuit.
- F. Simple comparison of fractions that are equivalent – eg how many quarters are the same as a half.
- G. Think about which is bigger- Ask children would they prefer on eighth or one quarter of a biscuit. Demonstrate using a biscuit or a cardboard circle.
- H. Link the shapes to the numbers on the written fraction. The number at the bottom (denominator) is the total number of pieces the whole shape is cut into. The number at the top (numerator) is how many of those pieces you have.
- I. Fraction strips (not cut up)
- J. Give out the fraction strips to the group ask them to explain what fraction they have and how they know.
- K. Match strips to the boards.
- L. Make another set cut up and line them up with the fraction strips to show how many make a whole.
- M. Fraction tubes
- N. Children work in groups to play with the tubes. Turn the outer tube to show a shape with a fraction coloured. Give it to another child who rotates the other tube to find the correct number fraction to match the shape. Repeat.



Ensure children return the pieces to the storage.



<p>12. 1-10 number fan digits one side, dots on the other</p>  	<p>Cut out fan shapes from card or milk / juice cartons.</p> <p>Make a hole at the bottom of each piece and thread string through the hole.</p> <p>Use marker to write numbers clearly at the top of the fan.</p> <p>On the other side stick some tape and draw dots to correspond to the number on the other side.</p>	<p>A. Individual or pairwork- count the dots on one side and turn over to check the digit on the other</p> <p>B. Use as a reference for children who struggle with numbers. When writing numbers they can check the fan to confirm.</p> <p>C. Teacher asks a question, children hold up the answer.</p> <p>D. Use for number bonds to ten. Teacher says a number, children hold up the number that pairs with it to make ten. Or play as a game in pairs.</p>	
<p>Number fan – 1 – 9999</p> 	<p>Make in the same way as the other number fan but tie together four sets of numbers written using different colour marker pen so that it is easier to find the digits when it is being used. Tie and melt the knot to make a stud.</p>  <p>To make a 4 digit number fan (ie 1-9999) use 1 set of 1-9 and then 3 sets of 0-9 numbers</p> <p>To make a 3 digit number fan use 1 set of 1-9 and 2 sets of 0-9 numbers</p> <p>To make a 2 digit number fan use 1 set of 1-9 and 1 set of 0-9</p>	<p>A. Use like the 'Show Me' boards, teacher calls out a question and pupils (after being given thinking time) hold up the answer using the fan after the teacher has given the signal (eg 1,2,3 'Show me')</p> <p>B. Examples of questions – “Make the number....”, “what is ... plus?” “How many sides on four rectangles?”, “What is half of?” “Make a number where the number of tens is bigger than the number of hundreds”</p> <p>C. Making 1,2,3 or 4 digit numbers. Hold up to show the answer</p> <p>D. Can use for any number work.</p> <p>E. Could be used for assessment (eg after exercises written in notebooks the teacher can ask answers to be made using the fans)</p>	

13. Shapes



Very simple to make – cut circles, squares, rectangles and different types of triangle from cardboard. Make varying sizes.

Large shapes can be used for teacher demonstration and whole class activities and small sets can be used for group work.

Shape Dice



Shape dice

(see dice section for how to make)

Shape boards

Use paper (eg outer wrapping of toilet paper twists easily)



Twist the paper tightly and use glue to stick onto the cardboard base to make the shape.

Flashcards of shape names and properties written on paper or card.

These raised shapes are good for visually impaired/ tactile learners. A quicker and easier version is just to draw the shapes

using marker.



Shape boards.



- A. Use as flashcards to teach names and properties of shapes
- B. Give out one shape to each child. Ask those with the same type of shape to stand in a group / stand up / hold up the shape.
- C. Smaller shapes can be templates to draw around and label.
- D. Play 'Point to the Flashcard'. Display different shapes around the room and ask children (following teacher's signal eg 1,2,3 POINT) to point to the shape. Vary questions using name of shape or properties (eg point to the triangle/ point to the shape with three sides. 'Point to the shape with four sides' Questions with more than one answer make the children think)
- E. 'Show Me' boards. Children draw shapes and hold them up.
- F. Put a selection of shapes into a bag. Child puts hand into bag and feels the shape (without looking at it) – describes the shape to the others and guesses what it is.
- G. Play 'I am thinking of a shape'. Teacher / child thinks of a shape and the others have to guess by asking about the properties.
- H. Use tape measures, rulers or string/banana fibre to measure the sides, perimeter, diameter, radius of the shapes.
- I. Give out a variety of shapes to groups and sort them into the different types. Can they sort them in a different way? (eg all with straight sides, all with four corners etc)
- J. Sort out the triangles from the others and then discuss ways of sorting the triangles. Teach the different triangles.
- K. Give out triangles – eg isosceles, equilateral and scalene and ask them to sort or match labels.
- L. Shape boards – children match the name and properties to the shape. Some have the same properties (eg square and rectangle both have 4 sides). Make three or four flashcards for each shape so if one shape ends up with more they have to decide which flashcard could be moved to another shape.
- M. Shape boards are very tactile because the shape edges are raised. Good for visually impaired children. Can also be used with all children feeling the outline of the shape and guessing it without looking.

14. Measuring weight and capacity



Collect a variety of different sized containers.
Some can be labelled with the size (in ml or litres)
Keep in sets in paper bags - clearly labelled so they can easily be given to groups.
If the containers are filled with water they can also be used as weight resources as 1litre = 1 kilogram



Capacity activities:

- A. Ordering the containers ascending / descending according to how much water they could hold.
 - B. Sort into those bigger / smaller than a litre / 500ml etc
 - C. Use water and known sized bottles to measure the capacity of different containers (eg use a 500ml and a100ml container to find out how much water can fit in an unlabelled bottle of 800ml)
 - D. Use a 1.5litre bottle and a 1 litre bottle and mark a litre line on the 1.5litre bottle which can then be used for measuring which containers hold more / less than 1 litre.
 - E. Use tiny containers to show how small one ml is. Make a cube 1cmx1cmx1cm with the top missing so they can fill it with water. Empty it onto your hand to show 1ml. Use the 1ml cube to fill a small object (eg a spoon). Use a straw and dip it in a cup of water. Put your finger over the end to trap the water. Mark lines on the straw to show 1ml (it will be about 1.5cm depending on the size of the straw) the children can experiment with straws to measure in ml.
- F. Weight activities:**
- G. Fill bottles with water and use for ordering just by feeling them (using hands like scales) (or use the beam balance if available)
 - H. Use stones, fill containers with mud / stones etc and use them to order, sort greater/less than 1kg etc.

15. Measuring – length using tape measures, and measuring sticks










Make a measuring stick from a 1 metre length of bamboo and mark in 10cm sections. The sections can be coloured with marker, covered in tape or the bark peeled to make them stand out.



- A. Use the metre stick to find objects longer/shorter than 1m
- B. Use the stick to measure different objects – length or desk, height of child etc.
- C. Measure objects with variety of tapes – children select the best tape for the job 1-10cm, 1-20cm and 1-100cm.
- D. Use for measuring the edges of shapes



The tapes can also be used as number tracks for counting as an aid to addition (counting on) or subtraction (counting back)

  	<p>Measuring tapes can be made from paper (the front cover of a flipchart is strong and glossy) milkbags and milk cartons are also good as are old toothpaste tubes. Paper tapes can be 'laminated' with transparent tape.</p> <p>Draw columns 1 cm wide on the paper/milk bag etc. Colour every other column. Draw lines across the desired width of the tape (eg the ruler width). Cut the pieces and stick them with tape. Write the numbers with marker. Make a variety of lengths.</p>	<p>E. Metre and dm sticks (from place value sets) can be used for estimating and measuring lengths.</p> <p>F. Draw lines of given lengths on the 'Show Me' board.</p> <p>G. Draw around your hand on the 'Show Me' board and measure using a tape or a dm stick.</p> <p>H. Encourage children to always estimate before they measure.</p> 	<p>Metre sticks can also be used as counting sticks</p>
<p>16. Rice sack posters and charts.</p> 	<p>Posters and charts make great teaching aids and also are good to be on permanent display in the classroom for reference. When copying always measure carefully and draw guidance lines in pencil and ensure that writing is neat and letters the same size.</p> 	<p>A. Display the poster and ask children questions.</p> <p>B. If there are questions on the poster children can answer them in pairs / groups.</p> <p>C. Use as a resources for group work (eg 1 group can work on the place value poster while others are using place value equipment and then rotate)</p> <p>D. Eg – pictogram chart. Children answer questions and then use the chart as an example to do their own survey and either draw their own pictogram or make one using a blank grid and bottle-tops or the 'Show Me' board.</p> 	

17. Time – digital and analogue clocks.



Use thick cardboard to make a circle. Draw around a plate or use a piece of string with a pencil tied on the end. Hold the string in the centre of the cardboard and pull the string tight. Holding the centre firmly, draw a circle keeping the string tight to the pencil all the way around. Make the circle as big as the card will allow.

Write numbers 1 – 12 clearly in marker. Do 12,3,6,9 first at the quarters. Then evenly space the other numbers in between.

Make two 'hands' for the clocks – a longer minute hand and a shorter hour hand. Colour them so they stand out if they are the same colour as the clock.

Make holes in the centre of the circle and at the bottom of the hands with a nail.

Thread string through and tie tightly. Melt both sides of the knot to make a secure stud.

Small clocks can be made for pupil activities and a larger one for the teacher or whole class activities.

Digital clocks can be made by cutting slits in cardboard and threading through a long strip of paper with times written on them (the cover of a flipchart is good paper to use as it is shiny and strong) or make flashcards that sit in clear plastic pockets that are stuck onto a piece of cardboard using transparent tape.

Activities for clocks, flashcards and time dice

- A. Use the clocks (digital or analogue) like flashcards – change the times and ask the children to say the time.
- B. Give the clocks to the children and ask them to show a given time.
- C. Show a time on the analogue clock and ask children in pairs or groups to write the time on the 'Show Me' boards (either in words or as a digital time)
- D. Repeat but this time using the digital clock and the children draw an analogue clock
- E. Give groups small clocks to make given times. They can ask each other to make different times or use textbook exercises for ideas.
- F. Groups make different times on the clocks. A representative from each group comes to the front and the times are put in order.
- G. Play 'Point to the Flashcard'. Put large flashcards around the room showing different times (either analogue or digital) and ask the children to point to the answer.
- H. Hold up a large flashcard (either digital or written in words) and ask the children to make the time on their small clocks or use the small flashcards.
- I. Group work – time cubes matching activity. Roll the dice and match the flashcards to the clock face on the cube. Also matching the time written in words. If not sufficient for group work share the resources between three groups and then swap when they have completed.
- J. Whole class activity – give out either a cube or a flashcard to pairs of children. The children with the cubes come to the front and stand in a line. One child reads the time from their flashcards and the children with the cubes have to find the correct clock face. Swap roles.



A fun large clock can be made using plastic water bottles and flashcards with numbers 1-12. Write 'minute' on one hand and 'hour' on the other – or the local language. (stick on a paper label). Children can move the hands to make different times.

Time dice can be made by drawing clock faces on cubes. Can make analogue digital and written times on them.

A time fan can be made (in the same way as the place value fan) and a circular digital clock using bottle tops and a piece of bamboo.

K. Play a game. Give one dice to each group. One person in each group rolls the dice. The others say the time or write it on the 'Show Me' board

L. The large clock using water bottles stuck together to make hands can be a team work challenge for a group of children to try and make a clock and to then make different times on it.






M. They can make it on the floor or make one to show the class














N.



Show the difference in length between the words iminota (minute) and isaha (hour) (or the local language) and help children remember – long word – long hand. short word – short hand.

<p>18. Using money in a real life context</p> 	<p>Make different foods using cardboard. Draw and colour and cut out. Write prices on the back or make a separate rice sack chart.</p> <p>Money can be made from scrap paper and bottle tops. Use different coloured bottle tops to represent different coins.</p> 	<p>A. Discuss costs of different foods and drinks and put prices on the chart or write on the chalkboard.</p> <p>B. Children work in groups and choose something to buy. One can role play the seller and they use 'money' to buy.</p> <p>C. Group work on a variety of problems – eg the cost of the three most expensive / cheapest items. Choose any three and work out change. Draw your change on the 'Show Me' boards.</p> <p>D. Work out the total cost if you bought everything.</p> <p>E. Worded problems such as "You have 1500 FRW – what could you buy? What would your change be?" etc</p> <p>F. "I bought 2 of the same items and it cost 1000FRW" – what did I buy?</p>	<p>Good opportunity for varying the problems to suit the differing abilities of children in the class</p>
<p>19. Multiplication tables game</p> 	<p>Draw grids onto paper, card or milk bags. Write multiplication questions in each square (one grid per times table)</p> <p>Write answers on bottle tops, small pieces of card, paper, milk bags etc.</p>	<p>A. Times tables matching activity. Each group has a different tables grid and they match the answers. Swap over to complete a different one. Challenge the children to get faster every time.</p> 	
<p>20. Hundred Square</p> 	<p>Draw a grid 10X 10 and write numbers clearly using marker.</p> <p>Make using paper, cardboard or milk bags, milk cartons.</p> <p>Blank hundred squares are also useful (just a 10X10 grid).</p> <p>Make a large hundred square on a rice sack.</p>	<p>A. Match bottle tops with numbers 1-100 on the squares</p> <p>B. Place a counter or bottle top on a given number. Add ten by counting on and place a second counter or bottle top on the new number. Repeat with other starter numbers. Encourage children to discover that to add ten the counter moves down 1 row, to add one they go one square to the right. Subtract ten is up one row and subtracting 1 is one square to the left. It is important that children <i>discover</i> this and are not just told. Use the hundred square for addition and subtraction progressing to counting on and back in tens.</p> <p>C. Cover some numbers on the hundred square and children work out the missing numbers.</p> <p>D. Place bottle tops or counters on multiples to see the patterns in multiplication tables.</p>	

		<p>E. Play games with dice (see earlier). Throw dice or number cubes. Add, subtract, multiply (and sometimes divide) to make numbers on the hundred square. Who can cover the most with one throw of the dice? Who can make the biggest / smallest number with one throw of the dice? Play two teams with one square using different coloured counters and see who can cover the most/ get three or four in a row/make a cross with four bottle-tops/ etc</p> <p>F. Blank hundred squares – fill the gaps with numbered bottle-tops, time to see how quickly they can do it or race each other to see who finishes first.</p> <p>G. Point to a square on a blank square and children work out what the number is.</p> <p>H. Find pairs of numbers on the square that add up to 100 or another target number.</p> <p>I. Play 'Race to 100'. Each player has a counter. Throw 2 dice and add them. Move onto that number. Next throw (eg 3 + 4) move on another 7. Keep playing until someone reaches 100. Can play with dot-dice or number cubes. Extension using multiplication. Or start on 100, use subtraction to move backwards to reach 1.</p>
<p>21. Matching boards</p> 	<p>Make from a piece of cardboard. Write a question on the left side and the answer on the right but they must not line up. eg $20+21$ is at the top on the left and the answer is written further down the board on the right. Make a hole by the question and thread and knot a piece of string (or banana fibre) Next to the answer cut a slit or small triangle. Make sure the string is long enough to reach the answer. Can be used for any maths topic.</p>	<p>A. Work in pairs or small groups match the answer to the question by using the string. A great way to do matching as they resource can be used over and over (whereas when lines are drawn in pen the resource can only be used once)</p> <p>B. Make a whole variety of cards – eg fractions, shape, addition, subtraction, time, multiplication and division.</p> <p>C. Great for revision of topics. Children can use different cards and swap (there is no need to make the same cards many times)</p> <p>D. Also easy for differentiation – make some more challenging.</p> <p>E. An ideal time filler when children have finished a task or before a lesson starts.</p>
<p>22. Plastic bottles</p>	<p>Make labels in paper written in marker and stick onto waste bottles. Store in paper bags (fold down the paper to make the bag stronger) and label.</p>	<p>A. Use like flashcards. Children can come out the front of the classroom and arrange the numbers in order, choose the largest number, choose the smallest number, choose two bottles that add to make 12 etc</p> <p>B. Use for group work – bottle with digits on can be used like flashcards or bottle-tops.</p> <p>C. Play "Skittles". Put all of the skittles together in a group. A child stands a short distance away and throws a ball at the skittles. Another child picks up the skittles</p>

	<p>Labels can be digits, fractions, shapes, time, days of the week, months of the year etc etc</p>  <p>To make bottles reusable make a pocket out of plastic on the outside of the bottle that a label can be put into the pocket and changed according to the topic.</p>	<p>D. that were knocked over and the group can add them up, say the numbers on the bottles. Or give one bottle each (that has been knocked over). The child holding the bottle claps or jumps the number of times on the bottle.</p> <p>E. Matching activities – bottles with shapes and words, fractions, times written in words, digital or analogue clocks etc.</p> <p>F. Give one bottle to each child (with digits) they have to stand in a line in order. Or ask those with odd numbers to stand up/ hold up their bottle. Vary the questions eg bigger than 10, smaller than 16. Similar activities can be done with bottles with different labels. (eg time – say a time and the children with the digital time, analogue time and time in words stand up / group together).</p> <p>G. All children with a bottle. One child stands up and the teacher asks “What do we need to add to this number to make” the child with the correct bottle stands up. The class checks</p>	
<p>23. Tactile numbers Numbers that are raised and can be ‘felt’. Pictorial and abstract</p>   	<p>Write a number in pencil on a flashcard. Twist paper (the wrapping paper on toilet rolls is ideal for this) tightly to make a ‘string’. Glue in place using the pencil number as a guide.</p>  <p>Screw up small pieces of paper and glue in place to make raised dot flashcards.</p>  <p>Draw a 5X2 grid on cardboard. Use bottle tops with holes in them and thread them onto the cards (1-10)</p>	<p>A. Give children lots of opportunities to play with these resources exploring and discovering for themselves.</p> <p>B. Matching activities – pictorial with abstract</p>  <p>C. Count the bottle top flashcards and match numbers</p> <p>D. Discover number bonds to 10 with the bottle top cards (what is missing to make 10?)</p> <p>E. Used the raised numbers for children to trace over with their fingers to help them when learning to write numbers.</p>	<p>Very useful for lower ability children, visually impaired and those that are tactile learners.</p>

<p>24. Markers for counting sticks or fraction sticks</p>	<p>Old markers that no longer work can be covered in paper or tape. Draw lines or numbers on them to make counting sticks or divide into sections for fractions.</p>	<p>A. Mini counting sticks B. Mini measuring sticks if marked in cm C. Use to show fractions and equivalence of fractions eg line up half & quarters sticks to show how many quarters make a half D. Give blank old markers to children and they can make their own counting sticks etc.</p>	
<p>25. Markers as speaking sticks</p>	<p>To encourage everyone in a group to participate use a 'speaking stick' Made from an old marker. Put tape or paper on it and colour so it doesn't just look like a marker!</p>	<p>A. To ensure children take turns during an activity use a 'speaking stick'. It is passed around the group and the person who has the stick is the one to have a turn (eg a game) or to have their say. Useful with groups with dominant or shy children. You can also use it with the whole class when choosing a group to report back for an example. It is a good way of getting the whole attention of the class as you choose the group. One group can then choose the next group to give the speaking stick to.</p>	

GAMES: Games are a fun way for children to consolidate learning and to practise mathematical skills without even realising they are doing maths. There are many games already introduced in this guide. Sometimes it can be difficult to know when to introduce games and sometimes teachers are concerned that if children are playing games they are not learning. Games can be used as part of an activity within a lesson. Once games are taught children can play them over and over. Children could play if they finish an activity or they are an ideal time filler when lessons are delayed because children are late coming to school and it will be a good way of encouraging children to come on time – those that arrive early / on time can play games while they wait (although I would encourage teachers once they have even a few children to start the lesson. Children who do arrive on time shouldn't be penalised and miss out on their education because others are late.) Games need to be stored in an easily accessible place so the children can get them without disturbing the teacher.

There are thousands of different games that children can play and they should be encouraged to make up their own games. Below are just a few simple examples.



Board with numbers represented pictorially (dots). Lids with numbers written on them with marker. Always a good idea to have one or two spare, blank lids in the event of some being lost.

- Simple matching activity dots to numbers. The children can race against each other or they can be timed and try and beat their own time.
- Turn the lids upside down so the numbers cannot be seen. Children turn over one lid and find the matching drawing. Children take it in turns around the group.
- One child points to a drawing and the others have to find the lid with the correct number and hold it up. The child confirms if they are correct and the child that was correct keeps the lid. Repeat until all lids are gone. The one with the most lids is the winner.
- Teacher led game. Each group has the resource pictured. The teacher asks a question and the children find the answer on the board and the lid and match. Eg 5 plus 5, or how many legs on 3 cows and 2 hens, 20 divided by 4, what do I need to add to 6 to make 17.
- Guess the number. Teacher (or a child) comes to the front of the class and says “I am thinking of a number and it is not” the children then place the number lids that it is not.. on the board until only one number is left. First team to hold up the remaining lid is the winner. Once demonstrated the children can play this in groups themselves. EG “I am thinking of a number and it is not an odd number” (Children then place lids on all of the odd numbers), “I am thinking of a number and it is not 16 – 6” (Children place a lid on 10) “I am thinking of a number and it is not bigger than 12”. Children place lids on 14,16, 18 and 20. And so on until only one number is left.



Lids with numbers 1 – 20 written clearly using marker.

- Simple ordering – to make it more fun time the children or they race against another group. Can do ascending or descending order.
- Order in multiples of 2,3,4 or 5 (ascending or descending order)
- Pair up to make number bonds to 10 (using the 1-10 lids) (can also add in an extra lid with 0 on it) or to 20 using all lids. Look at which lids you cannot use (eg 5 because you need an extra 5)
- Muddle up the lids but keep them face up. One child takes a number when the others aren't looking. The others have to work out which number is missing.
- Children ask each other questions where the answer is between 1&20. The answer is held up.
- Guess the number game above will also work without the matching to a board.



Two boards with numbers 0 – 10 written on them.

Two dice made from waste cardboard with numbers 0 – 5 written on them. Children can work in pairs or small groups divided into two teams. Each team has a board. No more than 3 or 4 in a team.

Bottletops

- Roll the two dice and add the digits. Place a bottletop or stone on your card. Keep going until all numbers are covered. First to achieve this is the winner. Extension – use other operations (so the player can choose to add, subtract, multiply or divide the numbers). You can even make this more complex by allowing the numbers to be used as many times as possible. So for example if you throw 2 and 3 it could be $2 + 3 = 5$, or $2 \times 3 = 6$, or $2+3+3=8$, or $2 \times 2=4 +3=7 - 2=5$ etc etc.
- Play a game with one board and two players (or two teams of two players). One person chooses a number on the board and puts a bottletop on it. The two players / teams take it in turns to throw the dice and try and make that number. If they succeed they remove the bottletop and keep it. They then choose a number on the board and put a fresh bottletop on it. The teams play to make that number – when they have it they keep the bottletop. Play for a set amount of time. The winners are the ones with the most bottletops at the end.



Two boards with numbers 0,6,7,8,9,12,13,14,15,16,17,18 written on them.

Two dice made from waste cardboard with numbers 0,0,6,7,8,9 written on them. Children can work in pairs or small groups divided into two teams. Each team has a board. No more than 3 or 4 per team.

Bottletops

The games above will work in the same way.



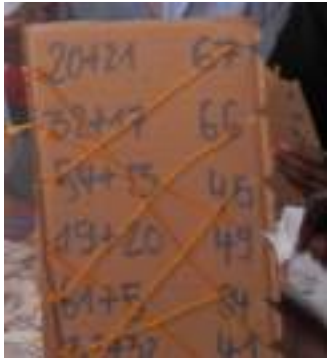
Small envelope (made from paper or an old milk packet) or a small box for storing and bottle caps with numbers 0-9. If you add a 10 and an extra 5 you can use for number bonds to 10

- Guess my number. All of the bottle caps are placed face up. One child (or pair) thinks of a number and writes it down secretly. The other child (or pair) has to try and guess what the number is by asking questions using calculations. For example is the number 16 take away 12?. If they are not correct they remove that bottle cap (4) so they know the answer is one of the remaining bottle caps. Once the answer is guessed they score a point for each of the bottle caps left. So if they guess on the first go they will score 10 points. If they take three goes then 3 bottle caps will have been removed so they score 7. To add variety introduce four bottle caps with the operations symbols + - x / written on them. Place them upside down and before each go the players turn over an operations bottle cap and they have to use that operation in their calculation question.
- I am thinking of a number – game above will work with these bottle caps too.



100 square made from cardboard or milk bags / cartons. Bottle caps with numbers 1-100 written on them.

- Matching – use the bottle cap numbers and match them onto the hundred square
- Once children are familiar with the 100 square use a 10X10 blank grid and children have to put the bottle cap numbers in the correct place. Time them and they try and beat their own time. Or different teams can race against each other.
- Play games using dice. Throw the dice and use addition / subtraction / multiplication / division to make different numbers. Place a bottle cap on the answers. Team to win is the one with most answers covered. Can play on separate hundred squares or the same one and each team has different coloured bottle caps (or one team plays with upside down bottle caps)
- Similar to the above game but teams have to place their bottle caps to make four in a row.
- Place bottle caps on multiples to see the patterns.
- Race to 100. (or race to 1) throw dice – (2,3 or 4 dice) add the numbers and move the counter to that number. Keep going taking it in turns until you reach 100. Or start at 100 and subtract to race to 1. Could also use other operations to work out how many spaces to move (eg throw 2,3,4 either add and move 9 or multiply 2X3X4 and move 24.



Cardboard matching game. Questions and answers are linked by string. String is knotted one side and a notch cut for the string to fit into on the other side.
These can be made for many different topics. The use of string (or banana fibre) means they are reusable.

- Ideal time filler for when children finish their work, arrive early or for any free time in a lesson.
- Great for revision – different groups can have different ones and they swap.
- Children can make their own.



Class set – small boards made from milk cartons/bags or cardboard, dice made from card (dots 0-5) counters with numbers (1-9) written on bottle tops/ corks.

Each pair (or individual) has a board and a set of 1-9 counters. Each group has two dice. One pair throws the dice and adds up. They put a counter over the corresponding number. Keep going until all numbers are covered. If they throw 2 X blank (ie 0) they can either throw again or choose a number on one of the dice. (This can make them think about which number they need)

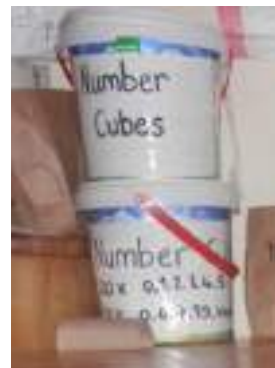


Cardboard or milk bag boards with tables written on them. Separate numbers written on cardboard, milk bags or bottle tops.

- Matching game. Turn over a number and match it to the calculation on the board. Try and be as fast as you can.
- Turn all the numbers upside down. Someone chooses a calculation and the others take it in turns to turn over one number at a time until the answer is turned over and placed on the board. Repeat with another person choosing a calculation. Vary it by someone saying a number and they have to work out which calculation to place it on.
- Different groups can do different tables (differentiation)

Storage of materials is very important. It takes a lot of time and effort to make the resources so encourage teachers to look after them and label them so they can find them easily.

Ideas for storage – paper bags, tins, jars, bottles, boxes, envelopes from paper or milk bags,



Freely available materials.

Manufactured resources cost a lot of money but there are so many materials in the environment and waste materials that we can use freely. An added bonus is that using them helps the environment as many of these waste materials end up being thrown away and polluting our land. Sticks, stones and beans are already used in most schools but here are some ideas of other materials you can encourage teachers (and children) to collect.

- Plastic bottles
- Jars
- Tins
- Bottletops
- Milk bags
- Plastic containers
- Milk and juice cartons
- Scrap paper
- Card boxes (eg chalk, pens)
- Cardboard boxes
- Tissue wrapping (eg around toilet rolls)
- Scrap plastic
- Flipchart covers
- Toilet roll tubes
- Toothpaste tubes
- Empty rolls (eg tape)
- Finished markers
- Pen lids
- Old cables
- Old innertubes
- Scrap wood
- Old bags

Raw materials and tools needed for making resources



Materials that need to be bought

There are a few vital materials / tools that you need to make the resources in this booklet that will need to be bought.

- Scissors
- Tape
- Markers
- Ruler
- Eraser
- Pencil
- Pen
- String
- Glue
- Hammer
- Nails
- Candle
- Matches
- Black paint
- White paint
- Chalk



A Few Final Tips...

All of the resources in this booklet were made while on a VSO placement using materials that are readily available. Many of the raw materials are of no cost being waste products such as old cartons, bottletops, plastic bottles etc. This has the added bonus of being good for the environment because we are reusing materials that would otherwise end up littering the landscape. Some of the raw materials shown may not be readily available in all countries but there will be alternative materials that can be used. It is important to be creative with the resources available. Natural materials from the environment have not been used much in this booklet but things like bamboo, banana fibre, mud and clay, beans, seeds and fruit stones, sticks and stones can all be used effectively.

In order to make best use of the ideas in this book the following tips are useful:

- Take time to make the resources well so they look appealing and they will be more long lasting. Take care when writing or drawing that numbers and letters are clear and the drawings look professional. Old, tatty, carelessly-made materials will not be valued or looked after by the children who use them and even worse, if numbers are not legible, it may lead to confusion. Use a ruler (or a straight edge) and pencil to draw guidelines, make sure numbers are all the same height and evenly spaced. Make numbers / letters etc as large as possible.
- Make enough resources for the classes they are being used with. It is no use if teachers just make one sample that they show the children. Most of these resources are meant to be manipulated by the children. If classes are large use a split/share/swap method. (Divide one set of resources between groups, share them out and when the group has used them they swap with a group so they will end up using all of the materials)
- Storage is vital. Ideally store resources in a container (box, bag, bottle, carton etc) in sets – enough for a group or the whole class and clearly label it so the children can find the resources. Carefully stored materials will last for years.
- When giving out resources use group representatives who are responsible for collecting and returning kit. This saves time for the teacher and also is likely to mean the resources are looked after properly.
- Try and make generic resources that can be used for different lessons. For example, bottletops with numbers can be used for many different maths lessons. Eg a set of 0-9 can be used simply for ordering single digit numbers or using to make 4 or 5 digit numbers.
- Encourage children to make their own resources by collecting materials from home. They can show their parents how to use them and in this way parents who may be reluctant can become involved in their children's learning.
- Always have materials available and encourage children to use them. Avoid the idea that children progress beyond needing such materials.
- Ask local businesses, shops, bars, hotels etc to collect raw materials for you. You may even find older children and parents will help you to make the resources. Resource making takes a lot of time so utilise any help you can.
- Try out resources with other teachers so you fully understand how they can be used before trying with the children.
- The resources and activities in this booklet are not exhaustive. As you use them you will come up with ideas of your own. Write them down and share them. We can all learn from each other.

I hope you have found the ideas useful. This booklet is part of a wider resource available on <http://www.meshguides.org/>