

Using the

Number Family

Manipulatives

One of the guiding principles we use at St. Michael's School is "from the concrete to the abstract". Abstract thinking is indeed important, but too often educators forget that the ability to think abstractly is founded on concrete experience. What is obvious to an adult is not necessarily obvious to a child. We have many years of life experience behind our ability to easily understand that $4 + 7$ is the same as $7 + 4$, or to determine whether to add, subtract, multiply, or divide in a particular story problem. The child has not yet had that experience.

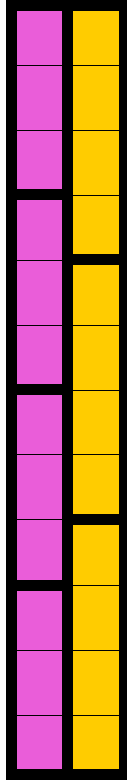
The use of story, even acting out simple math stories, and the use of manipulatives gives the child a chance to experience, in a concrete way, the principles of mathematics. This concrete experience is what leads to understanding.

The use of games is also very productive. Every child is ready for a game. It is interesting to note that the Latin word *ludus*, means both school and game.

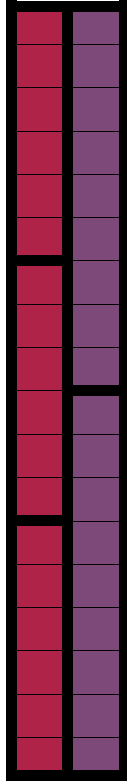
Worksheets have their place in re-enforcing the mechanics of arithmetic, but it is the concrete experience which produces a depth of understanding.

Using The Number Family Manipulatives
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second frog jumps to the fourth. The first frog jumps to the sixth; the second frog jumps to the eighth. The first frog jumps to the ninth; the second frog jumps to the twelfth. The first frog jumps to the twelfth. This is the first time both frogs landed on the same lily pad.



Finding the least common multiple of six and nine results in this.



There are probably many other uses of these manipulatives that we have not yet discovered.

You may also be interested in the “Up the Hill” manipulatives. These are used to play games which are very helpful in teaching place value, the times tables, and two-place multiplication.

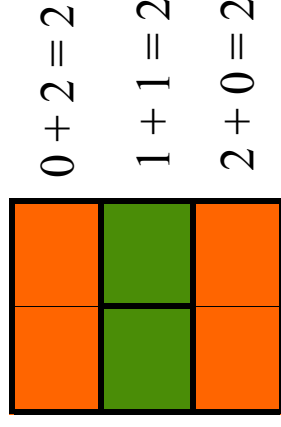
USING THE “NUMBER FAMILY” MATH MANIPULATIVES

These colorful math manipulatives can be used in a number of different ways. The following are the ways we have used them at St. Michael’s. You may discover additional uses.

I. Showing various “Number Families”

When the children are learning about addition, the manipulatives can be used to show the various ways of arriving at certain numbers through addition. These simple exercises open a door of discovery for the child and help him to see the many patterns that are part of mathematics.

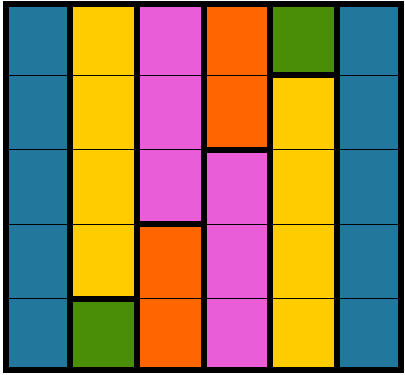
The simplest demonstration is the number family for 2, yet there are three ways to get to 2.



Although the first and the third rows look the same, they are qualitatively different. Perhaps you had no money and then someone gave you two dollars. That is the first situation. Perhaps you had two dollars and neither spent nor gained any more. That is the third row.

The fact that the length of each line is the same physically demonstrates the truth of the abstract symbols.

The pattern for the 5 Number Family looks like this.



$$0 + 5 = 5$$

$$1 + 4 = 5$$

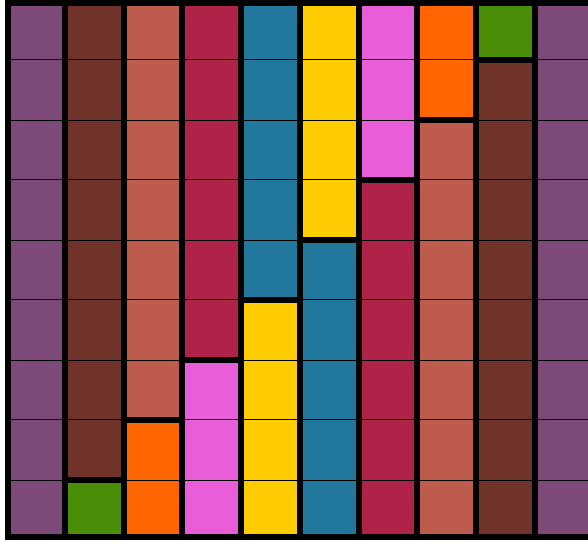
$$2 + 3 = 5$$

$$3 + 2 = 5$$

$$4 + 1 = 5$$

$$5 + 0 = 5$$

The Nine Number Family looks like this.



$$0 + 9 = 9$$

$$1 + 8 = 9$$

$$2 + 7 = 9$$

$$3 + 6 = 9$$

$$4 + 5 = 9$$

$$5 + 4 = 9$$

$$6 + 3 = 9$$

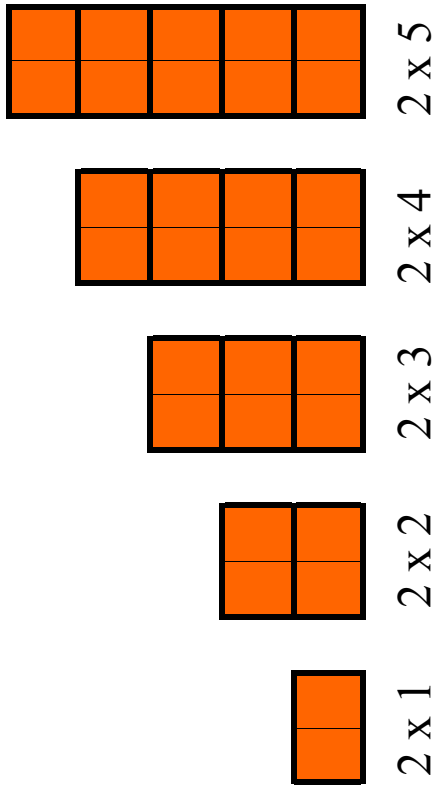
$$7 + 2 = 9$$

$$8 + 1 = 9$$

$$9 + 0 = 9$$

The blocks would look like this, the columns showing the progression. His column would look like the last one here as he was saying "ten."

If the child is not sure about the next number in the sequence, he can simply count the blocks as he adds to his pile. The same procedure is used for all the times tables.

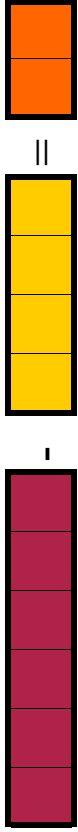


IV. Demonstrating the Idea of Least Common Multiple

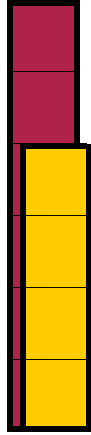
When children study fractions, they need to understand the idea of the Least Common Multiple. These manipulatives can be used to give a visual presentation of this idea. We usually start teaching about this with a story about two frogs jumping from lily pad to lily pad across a pond. One frog can jump far enough to use every third lily pad and the other can jump farther, enough to use every fourth lily pad. Both frogs start on the shore and start jumping. What is the first lily pad upon which both frogs will land? The answer, of course, is the twelfth lily pad.

Simply lay out the manipulatives next to each other as you relate the story. The first frog jumps to the third lily pad; the

The same pattern can be used to demonstrate various simple or subtraction facts. $6-4 = 2$ looks like this.



In this case the answer is found by placing the smaller block on top of the larger one. In this case, two parts of the larger block are still showing.



Sometimes the cup could be placed on the answer and sometimes on one of the other blocks.

Once again, be sure to take turns telling stories about the numbers. Until students can express their understanding by telling simple stories about these simple equations, they have not quite grasped the main concepts and are still guessing.

III. Learning the Multiplication Tables

When children are learning the multiplication tables, they learn how to count by 2's, 3's, 4's, etc. They hear the times tables when they do this, but with these manipulatives, they can see what they are saying. Another window to learning and understanding, the eyes, is opened.

If a child is learning the two times table, have him gather all the tangerine colored two's. As he counts 2, 4, 6, 8, etc., have him place the two-blocks on top of each other, so the number represented by the blocks reflects the number he is saying.

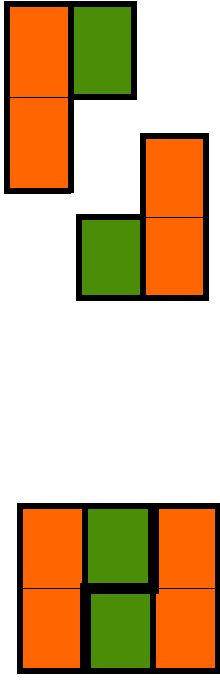
Part of learning mathematics is recognizing the many patterns contained in counting. The children could be helped make a book with a picture of each number family from one through twelve.

Do you see the number patterns on these pages? What we take for granted, the children see as great discoveries, making learning exciting.

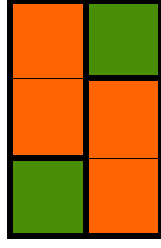
II. Developing a Number Families from the Previous One

One day a student was playing with these manipulatives (children learn so much through play) and discovered that the number families could be developed by moving the previous one in a certain way.

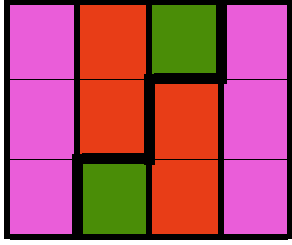
Let us start with the number family for 2.



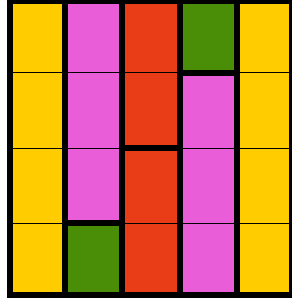
Separate the blocks along the heavy line, then move the bottom section to the left and up, resulting in this configuration.



Now we have a portion of the 3 Number Family. We complete the family by placing a 3-block on the top and on the bottom, resulting in the following configuration.



To progress to the 4 Number Family, follow the same procedure. Separate along the heavy lines, move the bottom portion to the left and up, then add a 4 block to the top and bottom. The result will be as follows.

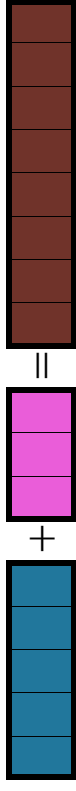


The pattern can be repeated as many times as you like. Children soon notice that sometimes there is a solid color in the middle and sometimes not. What is the pattern?

III. Playing “Under the Cup”, a Game for Addition and Subtraction

Play a game called “Under the Cup” to help a child with basic addition and subtraction facts. All you need is a cup, three small pieces of paper, (or dice) one with the + sign, one with the - sign and one with the = sign and the Number Family manipulatives.

In its simplest form, a problem in “Under the Cup” might look like this, with the answer (8) under the cup.



To find the answer the child places the 5 block and the 3 block next to each other (end to end) sees that the total is 8. If the child is not sure of the answer, show him the block which is under the cup and then put the five and the three on top of the eight to demonstrate that three added to five is, indeed, the same as eight. Using manipulatives as these keeps arithmetic concrete and practical.



It is very good for the teacher and the student to take turns making up “problems” and telling simple stories about the numbers being used. In real life, we never encounter a math problem floating in the air, waiting to be solved. Therefore, especially at the beginning, arithmetic lessons be taught in terms of situations, real or made up, that can be answered through numbers. What is a simple story involving five and three?

The next level of difficulty involves having not the answer (the last block) covered, but one of the previous blocks. In the example above, perhaps the five or the three could be covered. The child would need to determine what amount, added to five, results in eight, or what amount, increased by three, equals eight. It is very important that children develop this type of mental flexibility in simple arithmetic, but it is very difficult for them to do so with only abstract numeric symbols. If they are able to use their eyes and sense of touch, (as well as the enjoyment of playing a game), they can understand arithmetic in a concrete way, not simply in rote memorization.