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SAINT MICHAEL

Messenger

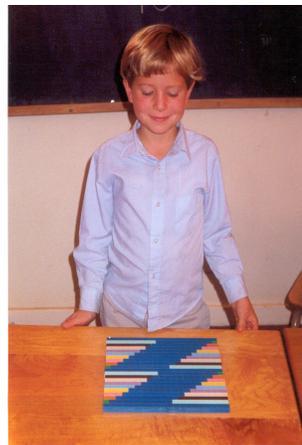
SAINT MICHAEL SCHOOL
Santa Rosa, California

Teaching Math Part II *From the Concrete to the Abstract*

Using Manipulatives to Understand Mathematical Patterns

Since mathematics is a language through which we can express the patterns and rhythms in creation, we have tried to find ways to demonstrate this to the children. Sometimes it is the children who show us. Several years ago, one of the second grade students was experimenting with some colorful manipulatives. With his teacher's permission, he put a sign on his classroom door which read "Arithmetic Laboratory, Do Not Enter." He was experimenting with various ways of arriving at a series of numbers through addition. The pattern which emerged was very clear and beautiful. Now we use his discovery as a means of showing "number families." The simple fact that a number, 7 for example, can result from adding many different combinations of numbers ($0+7$, $1+6$, $2+5$, etc.) is fascinating to young children.

The concrete approach opens the door to simple but meaningful discoveries.



Danny Foster (four years ago) with a product of his "Arithmetic Lab."

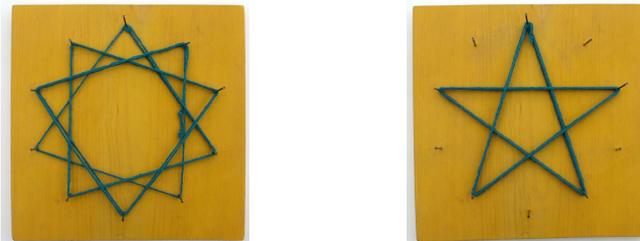
Having objects which provide visual and spatial experience and can be moved around by the children greatly enhances their understanding of simple arithmetic facts and makes learning these facts by heart much easier and more meaningful.

Rhythmic Activity as an Aid to Learning Multiplication Tables

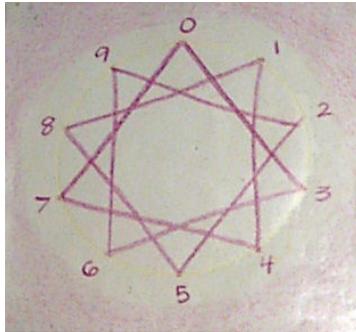
Since there is such an obvious rhythmical order to the multiplication tables, it is easy to incorporate rhythmic activity as a means of learning them. Even children who seem to have a good understanding of math in the abstract should be involved physically. Such activities serve to “fill in” any unclear areas and help to prevent problems later on. One very kinesthetic way we use to give our students the feel of multiplication is by jumping the times tables on a long number line. Jumping one number at a time, then two numbers at once, then three numbers, then four and five numbers at once gives them a very concrete experience of the difference between addition and multiplication. We also play many other active “arithmetic games.”

Peter T. Times’ Dance Floor

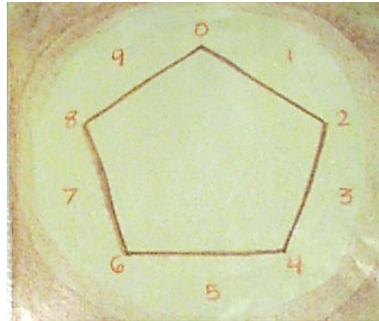
The times tables also make interesting visual patterns. The whole story is too long to tell here, but if Peter T. jumps his times tables on a special “dance floor,” he makes some wonderful designs. Drawing these designs has become a regular part of teaching multiplication.



Peter T. Times’ dance floor made of a wooden board, a circular pattern of ten nails, and yarn. On the left we see the pattern made by wrapping the yarn around every third nail; on the right, every fourth nail.



This drawing is an illustration of the multiples of three.



A drawing showing the multiples of two.

Introducing the Concept of Place Value

Once the children have been introduced to the four processes and have mastered to some degree simple addition and subtraction, we present the idea of place value. The concept of place value may seem elementary to adults, but to most young children, it makes no sense. To an adult mind the symbolism of place is significant, but to a child's mind (at least at the beginning) if the number looks the same, it should be the same. When you tell a child there is a difference, he may look at you as if to say, "If a 3 means 3 here, why does it mean 30 there?" The idea that the value of a number is dependent upon its location is a very abstract construct.

To help the children understand place value we have employed the aid of Chatty the Squirrel. Chatty was once a disorderly squirrel named Scatty (as in scattered) until she was given an important responsibility by Earnest Equal, King of the Numbers. Rather than leaving nuts all over the forest floor, she now keeps order by storing the nuts in various size trees. Chatty's smallest tree can store only nine nuts, so she stores the rest in various colored bags and puts them in larger trees. Her second tree is larger and can store nine blue bags of ten nuts; her next tree, larger still, can store nine red bags each of which contains ten of the blue bags. You probably get the idea.



A chalkboard drawing of Chatty the Squirrel's trees, used to explain place value and regrouping.

Practice with borrowing and carrying (re-grouping) is done through many story problems, sometimes acted out in costume.

A Favorite Game for Learning Multiplication Tables

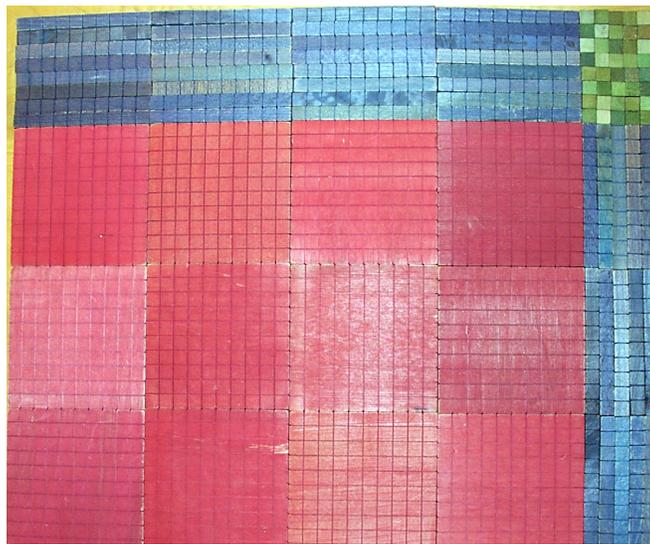
The children generally memorize their multiplication tables by playing *Up the Hill*. This game uses dice and specially dyed wooden



Playing Up the Hill

base ten blocks. The units are small cubes dyed green, tens are bars dyed blue, hundreds are flats dyed red, and thousands are large cubes dyed green. The object of the game is to be the first player to reach a predetermined number of blocks. A child working on his two-times tables would roll the dice, add them and multiply the sum by two. He would then take from the supply of manipulatives the appropriate number of blocks. Initially the children use the “number family” blocks to count by twos, threes, fours, etc. The rules of the game are such that children working on various times-tables can play at the same time and have an equal opportunity to win. Variations of the games allow for practice with adding, subtracting, re-grouping and more complicated multiplication. They enjoy the game and would play it every day if we allowed it.

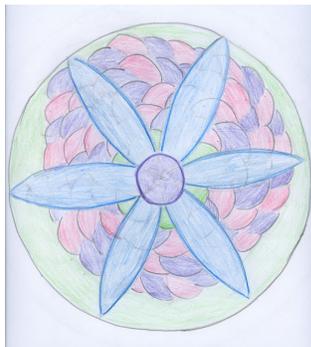
These same manipulatives are used to teach column or multi-place multiplication, e.g. 45×38 . The manipulatives are very helpful in teaching column multiplication because the children can actually see the reasons for all the steps required. The colors of the blocks show the place value.



Math manipulatives showing the multiplication of 45×38 .

Teaching Geometry from the “Concrete to the Abstract”

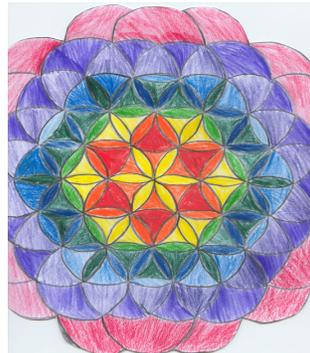
We have tried to continue the principle of “from the concrete to the abstract” in the middle and upper grades. When it came time to start studying the basics of geometry, we looked at various curricula and found one we liked that is published by Key Curriculum. Rather than concentrating on all the theorems and proofs of geometry, this curriculum takes a much more intuitive approach. The first of the eight workbooks starts out slowly, perhaps too slowly, but by the time the students are working on the seventh and eighth books, they are inscribing and circumscribing various polygons in and outside of circles. The entire course is completed using a compass and a straight edge—just like the ancient Egyptians. The course is an excellent preparation for the study of theorems and proofs in the future.



Aneliese Ramsay’s work with a compass.



Camden Ramsay’s design



Danny Foster’s design

High LIGHTS



Our Morning Opening

Each morning we start our school day with prayer. Then we read various psalms, poems and songs until we learn them by heart. During the fall and winter months, we recite a long Celtic prayer to our patron saint, the Archangel Michael. In spring, we replace that prayer with one composed by one of our favorite saints, St. Patrick, Enlightener of Ireland. The prayer is called “The Lorica” or sometimes “The Deer’s Cry.”

The latter name comes from the incident during which St. Patrick composed the prayer. After the magician of the High King of Ireland had been roundly defeated by St. Patrick, the king asked him to come to Tara where he promised to formally yield to St. Patrick. The invitation was, however, part of a plan to kill Patrick, for the king had actually planned an ambush. The king’s soldiers, hiding in the bushes, did not see St. Patrick and his disciples pass by. They saw instead a small herd of deer.

At first we gave the children an edited version of the prayer, thinking the entire prayer was too long. When somehow they discovered what we had done, they insisted we let them memorize the whole prayer. They still recite the part we initially withheld with especial relish!

The Prayer of St. Patrick



I arise today
Through a mighty strength -
the invocation of the Trinity
Through belief in the Threeness,
Through confession of the Oneness
Of the Creator of Creation.

I arise today
Through the strength of Christ with His Baptism,
Through the strength of His Crucifixion
with His Burial,
Through the strength of His Resurrection
with His Ascension,
Through the strength of His descent
for the Judgement of Doom.

I arise today
Through the strength of heaven;
Light of sun,
Radiance of moon,
Splendour of fire,
Speed of lightening,
Swiftness of wind,
Depth of sea,
Stability of earth,
Firmness of rock.

I arise today
Through God's strength to pilot me,
God's might to uphold me,
God's wisdom to guide me,
God's eye to look before me,
God's ear to hear me,
God's word to speak for me,
God's hand to guard me,
God's way to lie before me,
God's shield to protect me,
God's host to secure me,
Against snares of devils,
Against temptations of vices,
Against inclinations of nature,
Against everyone who shall wish me ill,
Afar and a near,
Alone and in a crowd.

I summon today all these powers between me and these evils:
Against every cruel and merciless power that may oppose my body
and soul,
Against incantations of false prophets,
Against black laws of heathenry,
Against craft of idolatry,
Against all manner of spells,
Against every knowledge that endangers man's body and soul.

Christ to protect me today
Against poison, against burning,
Against drowning, against wounding,
So that there may come abundance of reward.

Christ with me, Christ before me,
Christ behind me, Christ in me,
Christ beneath me, Christ above me,
Christ on my right, Christ on my left.
Christ where I lie, Christ where I sit,
Christ where I arise.
Christ in the heart of every man who thinks of me,
Christ in the mouth of every man who speaks of me,
Christ in every eye that sees me,
Christ in every ear that hears me.

I arise today
Through the strength of the love of Cherubim
In obedience of angels.
In the service of archangels,
In hope of resurrection to meet with reward.
In prayers of patriarchs,
In predictions of Prophets,
In preachings of Apostles,
In faiths of Confessors,
In innocence of holy virgins
In deeds of righteous men.

I arise today
Through a mighty strength -
the invocation of the Trinity
Through belief in Threeness,
Through confession of the Oneness
Of the Creator of Creation.
Salvation is of the Lord.
Salvation is of the Lord.
Salvation is of Christ.
May Thy salvation, O Lord, be ever with us.



Student Reports

As part of our science studies with the fifth and sixth grade this year, we used our microscopes to examine amoeba, paramecium, euglena, hydra and planaria. The planaria were the favorites. The following is a group composition.



Examining planaria

We studied planaria which are in a group of animals called Platyhelminthes. Platyhelminthes means “flat worms.” Planaria are fresh water animals that live in streams and ponds. They come in black, brown and white. Planaria average about $\frac{3}{8}$ of an inch long and about $\frac{1}{16}$ of an inch wide. Two of our planaria were named Ivory and Arrowhead; they measured about $\frac{1}{2}$ inches long.

Planaria have two eye-spots on their head which are light sensitive but cannot see images. These eye-spots are placed toward the middle of the head so planaria look “cross-eyed.” We nicknamed them “cross-eyed flat worms.” A planarian’s mouth is not located in the head, as you might think, but it is located on

Student Reports



the ventral, or under-side, of the body.

Each of us chose a planarian to feed and take care of. One morning a student said she had two planaria. At first the teacher thought the student had mistakenly taken two planaria, but a few days later another student said he had two planaria.

After doing some research, we discovered that planaria reproduce by mating or simply splitting. Sometimes planaria split themselves in half. The back part “rebels” by attaching itself to the surface. The front part attempts to keep on going. The result is that the planaria splits. The back part usually does not move for a few days. We also discovered that planaria can regenerate missing parts of their body. Eventually the back part will grow a new head and the front part will grow a new tail.



This planarian has been stained to show the digestive system.



Student drawing of a brown planarian.

Remember that the intellect is the servant of the heart, which is our life; if it leads the heart to truth, peace, joy, and life, then it fulfils its destination, it is the truth; but if it leads the heart to doubt, disturbance, torments, despondency, darkness, then it does not fulfil its destination and is absolutely false (“science falsely so called,” 1Tim. 6:20).

St. John of Kronstadt, My Life in Christ



ST. MICHAEL SCHOOL is a ministry of the Holy Dormition Orthodox Church, Santa Rosa, CA, under the Bulgarian Eastern Orthodox Church, and His Very Most Reverend Metropolitan Joseph of the Diocese of U.S.A., Canada, and Australia. Fr. Dcn. James Hughes, Headmaster, Tel. (707) 545-0861, e-mail: jkhughes@infostations.com.