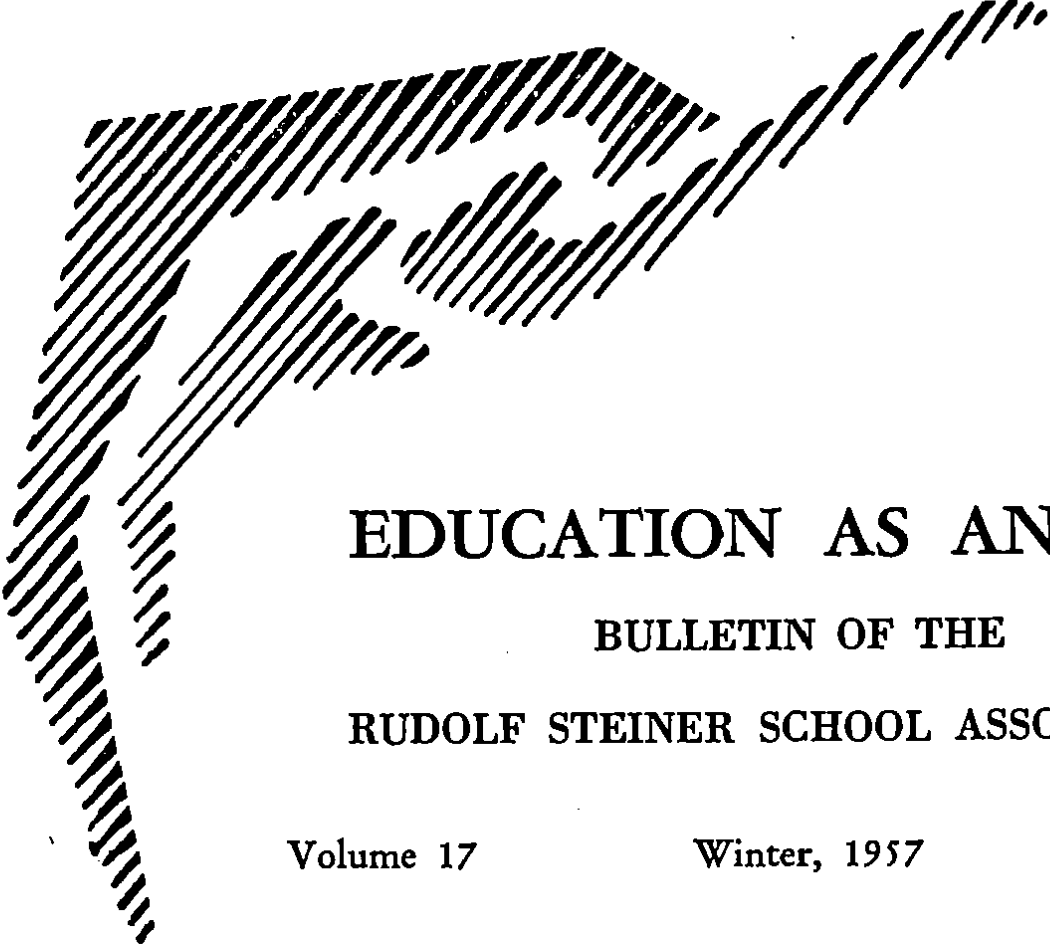




EDUCATION AS AN ART

BULLETIN OF THE RUDOLF STEINER SCHOOL ASSOCIATION

Volume 17

Winter, 1957

No. 4

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THE LIVING WORLD OF PLANTS*

*A book for Children and Students of Nature
by Dr. Gerbert Grohmann*

Translated by Virginia Field Birdsall
Kimberton Farms School, Phoenixville, Pa.

INTRODUCTION

It is a joy to see this book — “The Living World of Plants” — in Mrs. Birdsall’s fine translation, ready for the use of American children, parents and teachers. It is a gift to all of them.

Of course, there are many nature books for children. Most of them, however, couch a few fragments of information in fancy wrapping. They are written down to grade level. Grohmann has a greater aim. He knows what is wanted for children: a presentation of the plant kingdom in its genuine atmosphere, — truth in the raiment of beauty.

A description of the plant kingdom without its beauty would not be true. This is what Grohmann knows from his years of Nature teaching at a Rudolf Steiner School. He succeeds in keeping to truth without sacrificing beauty; and he lets this beauty speak without sacrificing the least bit of accuracy.

These descriptions will hold good for later life. They are a large seedbed from which the maturing imagination of the students can always continue to draw its best forces. Even adults will feel this. Many have read this book as eagerly as any child, and have regretted that they were not taught this way when young.

*Further excerpts of this book will appear in subsequent numbers of the Bulletin

It is not yet sufficiently recognized how the difficult task of moral education is made easier by such nature study as is provided in this book. No moral "indocrination" is necessary if, as happens here, a deeper layer in the soul of the child is touched, opening the springs of creative morality for later life.

Herman Poppelbaum, Ph.D.

Alfred University
Alfred, N. Y. February 1943

FOREWORD

A wise man, who still knew the secrets of the origin of the world, related: "From a giant arose Heaven and Earth — from his bones the rocks and stones; from his blood the rivers, seas, and brooks; from his flesh the crumbly soil; from his hair the grass; the clouds from his thoughts; the wind from his breath. But from the heart of the giant arose the sun. Even today the giant body of the earth is sustained by the sun as by a warmth-giving and loving heart."

After listening to this tale, the children laughed and said: "That is a wonderful story. Tell us more!"

And the old man continued: "After man came upon the earth the plants were transformed. God willed that men should see as in a mirror a picture of themselves — the perfect as well as the imperfect — in the plants, which served them also for nourishment and healing. For this reason the plants have become so many and so different."

Dear children: In this book, which has been written for you, you will learn much that is beautiful about plants.

Of course all the plants in the world can not be included in this little book. But if you have first learned a few of them well, you will know how to understand others better. But you must make an effort to penetrate into the secrets of plant structure.

So you should read with great, great care what is written in this book, and read it often.

Then think over what you have read.

THE SUN AND THE EARTH

When the sun shines upon the earth, everything comes to life. The air, being warmed, begins to move; and in the water, too, all is astir. The sun-warmed earth steams, and its moist breath surges upward; the water rises, and the rain falls. Even the stones are taken hold of. Frost and heat burst them open, then the water dissolves them, and carries them along in its current. In this way the sun brings the elements — earth, air, and water — into activity.

But the sun can do still more when it works upon the earth. Its magic wand makes the plants spring forth in manifold colors, and each Spring we experience anew the great miracle.

The plants are the children of the sun, growing upon the earth. The sun gives them their stems and leaves, and forms finally the most beautiful part of all — the colorful, fragrant blossoms. Only the roots bury themselves in the dark ground, for they belong to the earth. But the blossoms lift themselves up into the light, whose creation they are.

FLOWERS AND INSECTS BELONG TOGETHER

When you consider a flower, you see at once that it belongs to the sun. Creations so bright and sweet-smelling can come forth only from the light and warmth. In bad weather, when the sun does not shine, or at night, most of the flowers are closed; only those remain open which cannot close again after having once opened. But those which can open and close their *petals* follow the sun exactly — even the common Daisy. Thus, you see, there is something in the flowers that seeks the sun — something that longs to give itself up to the sun.

But when you think of the flowers and the sun, you should think also of those creatures which belong to them — the honeybees, bumblebees, and butterflies. Naturally you should not forget, either, the beetles or the flies.

These insects — so they are called as a group — act just as the flowers do for they, too, love the sun. They fly about only when the sun shines, and if it is cold or rainy they hide themselves. Only certain distinct kinds fly on warm nights. These night-revelers belong to those flowers which, also, at night breath out a benumbing perfume.

Butterflies and flowers have a strong resemblance to each other. The wings of the butterfly are as delicate and fragrant as flower-petals. On the other hand, you could say that the flower petals seem like butterfly-wings grown fast to the stem. The coloring of the butterfly wings comes from a dust as fine as flower-pollen, so that you must be careful not to touch them for fear of rubbing off the delicate coating. The beetles, on the other hand, may be compared to the seeds of plants. They open their wings only in flight.

Butterflies and bees could not live at all without the flowers. They suck the sweet *nectar* from the blossoms, and can never take nourishment directly from the earth. The flowers must prepare the food for them. But the insects take *pollen* also for their nourishment. The bees gather it and feed their young with it, but they change only the nectar of the blossoms into honey.

One can compare still further the flowers and butterflies. The butterflies carry on their heads long feelers, with which they can sense the flowers even at a distance. Though they cannot see them at all, they still can find them.

You may think of the feelers of the butterflies as having become the *stamens* of the flowers.

Actually one must say that flowers and butterflies are so closely united that they are parts of one and the same. Both are children of the sunlight and are brought forth from it. It is only when the butterfly lays its egg that it comes nearer to the earth. In like manner the flower drops its ripe seed upon the ground.

The seed sprouts; but what emerges does not in any sense resemble the blossom. The green plant must first grow and with many plants this is a long process. The blossom comes last of all, only after the sun has worked a long while.

So a new butterfly does not emerge at once from the butterfly-egg. First a little caterpillar creeps out. It is often green and must grow as a plantlike sprout. It also subsists upon leaves. Finally it changes into a *pupa*, or *chrysalis*, which is like a bud. Out of this chrysalis, after a while, a gaily-colored butterfly is hatched, like a flower opening from a bud.

The stages of development of butterfly and plant may be placed side by side in the following way:

<i>Plant</i>	<i>Insect</i>
Flower	Butterfly
Bud	Chrysalis
Sprout	Caterpillar
Seed	Egg

Many flowers appear at a glance as butterflies bound to the earth. The colored butterflies, again, can be likened to liberated blossoms, flying freely about in the sunlight.

A Secret of Nature

Behold the plant!

It is the butterfly bound fast to the earth.

Behold the butterfly!

It is the plant set free by the universe.

—*Rudolf Steiner*

MULTIPLICATION TABLES CAN BE INTERESTING

Mastery of the multiplication tables is an indispensable tool for the student of arithmetic. Unfortunately, the learning of the tables is often a drudgery for the child and for this reason is frequently the cause of a deep and lasting dislike for everything dealing with mathematics. While it is easy for some children to memorize the tables, it is very hard work for others. Why does an adult know that $7 \times 8 = 56$, with the same certainty that a child knows $2 \times 2 = 4$? It is simple to visualize $2 \times 2 = 4$, but it is much harder to follow consciously the process involved in the multiplication 7×8 . However, it would be time wasted if every time we multiply 7×8 we had to go through a conscious process of visualization. We are so sure of the correct answer because long experience has traced it into our memory. It is also through manifold experiences that the child gradually will be able to conquer the tables.

Memorizing the tables abstractly is tiresome, especially for those children to whom the world of numbers is yet strange. When the tables are memorized abstractly as one memorizes historical dates divorced of meaning or understanding, the material becomes a burden and usually is forgotten as soon as the memorizing process stops.

There is actually no reason why the learning of tables should be a drudgery to any child. Every mother who observes her child knows of the joyful, untiring activity of counting when he begins to learn his numbers. It is not an accident that so many nursery rhymes deal with numbers and with counting. Keeping alive this natural joy and desire in rhythmical counting is an old and successful method of working with the tables. It has been abandoned by modern educators probably because it has degenerated into a meaningless drill. But in the grades of a Rudolf Steiner school the tables are a part of the arithmetic lessons throughout the elementary department. The most interesting way of reciting the tables can become dull if excessively used without variation. If, however, the teacher succeeds in vitalizing the old method by filling the old basket continuously with new and attractive fruit, the rhythmical recitation of the tables will be the very activity which is whole-heartedly enjoyed by the children.

When the little kindergarten child recites his nursery rhymes, he satisfies a natural desire. When he reaches the grades he can recite the tables and find in them the same sort of natural, satisfying activity; as, for instance, in

three is *one* times three
six is *two* times three
nine is *three* times three, etc.

And when the recitation is accompanied by physical movements it also becomes a pleasurable and effective exercise.

Of the many possible ways of working with the tables, only a few can be mentioned. In practicing the three table, for example, the children walk in a circle, counting 1, 2, 3; 4, 5, 6; - - - ; taking one step to each count and clapping their hands with each step. Doing it over again the 3, 6, 9, etc., are more accented than the rest of the numbers, the steps on them are firmer, and the claps louder. Finally after several rounds, the spoken counting of 1, 2; - 4, 5; - 7, 8; etc., is left out entirely or done silently while the clapping and stepping are rapid and light. Only the 3, 6, 9, . . . etc., are spoken; the movement stops so that the children experience a slight shock as they come to each number in the three table.

In another exercise of the three table one can make use of a eurythmy exercise,—the short, short, long rhythm, for instance,—in which two short steps are followed by one long one.

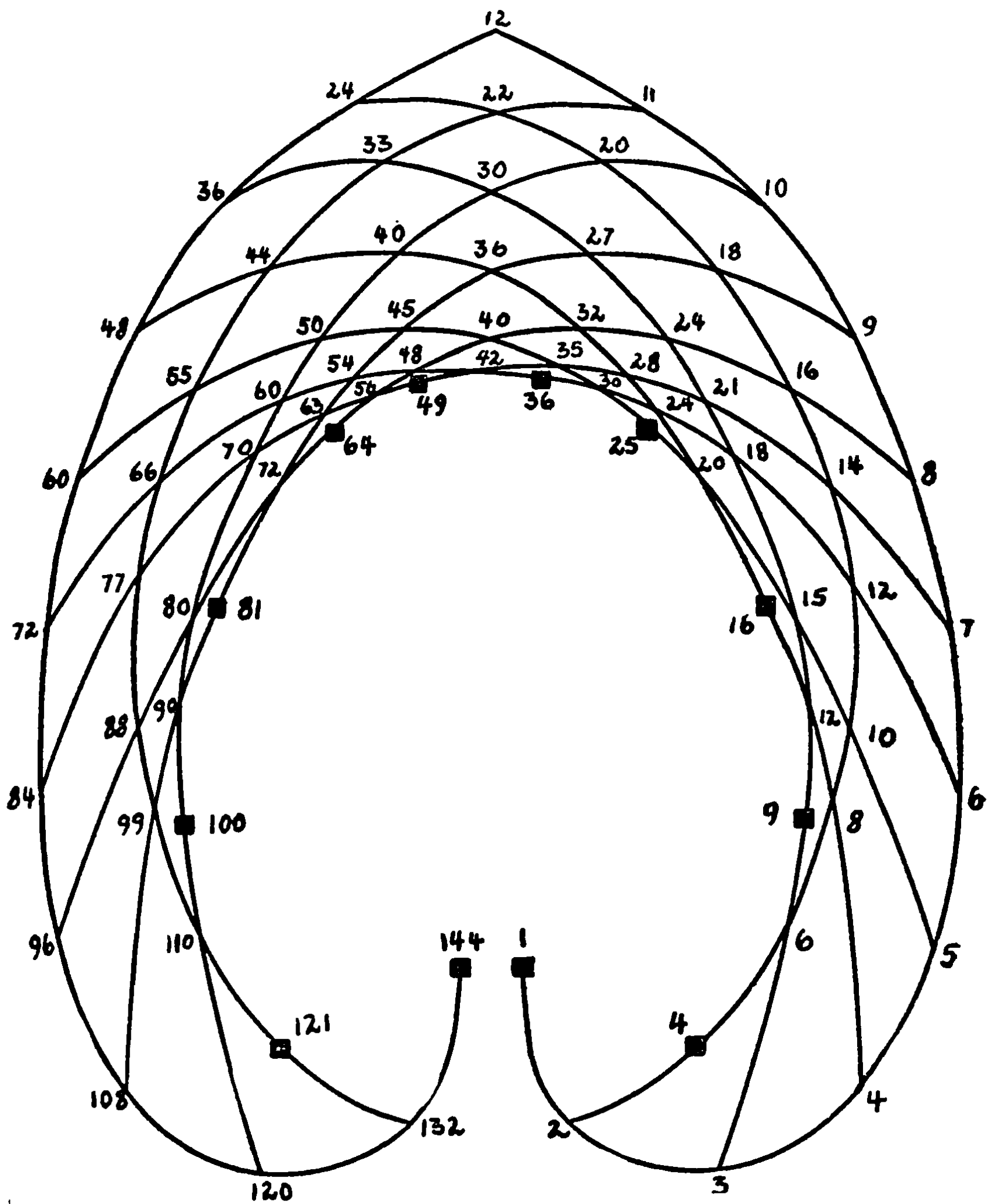
Still another excellent exercise can be used with any one of the tables. Taking, for example, the eight table; the children run swiftly and lightly for eight steps, stop suddenly for a moment and then continue as before, up to 16, then to 24 and so on.

When such exercises are thoroughly enjoyed, the tables do not become a burden in the storage house of the brain. One can say they actually become part of the child because his whole being has been used in the learning process.

Instead of doing these exercises in a circle they can be arranged along the sides of geometrical figures which are, first, drawn on the floor and then just imagined. For the three-table, the basic form is the triangle; for the four-table, the square; for the five-table, the pentagon; etc. This opens up a great wealth of most interesting combinations and possibilities for geometrical forms and transformations. Thus the child not only learns to know the tables, but also becomes intimately acquainted with geometrical forms. This lays the foundation for a natural understanding of geometry in later years.

Working with the tables as described so far, however, only partially completes the work. There is another side which must not be neglected. The mentioned activities make use of the child's will impulses and his desire to express himself rhythmically. In contrast to the very active "doing" of the tables, a more quiet way should also be used to bring about a balance.

The young students are eager to write down what they have learned, especially if it can be arranged in a chart. Here again there are many possibilities, and the children should be encouraged to invent charts of their own. Table charts offer opportunities to practice the tables by appealing to the pupils' reasoning capacity and sense of discovery, thus sharpening and developing these powers.



In the chart opposite, the lines of the tables are drawn in such a manner that each table appears only once and yet each line crosses all of the others. The drawing we arrive at is pleasing in its symmetric and harmonious construction. It offers opportunities for many interesting arithmetical exercises, which fascinate the child, and awaken and stimulate his powers of observation. The children are very curious and expectant as the teacher draws the lines of the tables on the board—beginning with the one-table and the twelve-table—and each line in a different color. After all lines are drawn the pupils are eager to help place the numbers. They soon discover that there is no crossing of lines for 2×2 ; 3×3 ; etc., and we mark these places with special little squares. When they see that all the squares line up in a definite order on the inside of the chart, they are happily surprised. The table for the little squares is new and we name it the “square table”. It does not take long until they know it by heart.

Now continuing our exploration along the chart, one child discovers that the numbers in the middle on the top of the drawing are all even numbers, 42, 40, 36, 30, 22, 12. The adjacent rows of numbers to the right and left alternate, even and uneven:

36, 35, 32, 27, 20, 11
and 49, 48, 45, 40, 33, 24

The row on either side is again even:

30, 28, 24, 18, 10
56, 54, 50, 44, 36

A little hint from the teacher makes the class see that by taking the difference between the number in sequential order, we find, in all the rows of even numbers, the following differences, beginning with the lowest number:

Center row—		First even row to right of center—	
42 — 40 = 2	or	30 — 28 = 2	etc.
40 — 36 = 4		28 — 24 = 4	
36 — 30 = 6		24 — 18 = 6	
30 — 22 = 8		18 — 10 = 8	
22 — 12 = 10			

In the rows that alternate even and uneven numbers, we have:

Beginning with square right of center		Beginning with square left of center	
36 — 35 = 1	or	49 — 48 = 1	etc.
35 — 32 = 3		48 — 45 = 3	
32 — 27 = 5		45 — 40 = 5	
27 — 20 = 7		40 — 33 = 7	
20 — 11 = 9		33 — 24 = 9	

By subtracting the corresponding numbers on the right and left sides of the chart, we obtain the thirteen-table, as follows:

24 — 11 = 13	33 — 20 = 13	40 — 27 = 13
36 — 10 = 26	44 — 18 = 26	50 — 24 = 26
48 — 9 = 39	55 — 16 = 39	60 — 21 = 39
60 — 8 = 52	66 — 14 = 52	70 — 18 = 52
etc.		

By adding corresponding numbers as, for instance, $144 + 1 = 145$, and $132 + 2 = 134$, and then subtracting the sums, we always get the same answer provided we follow sequential order. This time we begin at the bottom of the chart.

$ \begin{array}{r} 144 + 1 = 145 \\ 132 + 2 = 134 \\ \qquad \qquad \qquad - 11 \\ 120 + 3 = 123 \\ \qquad \qquad \qquad - 11 \\ 108 + 4 = 112 \\ \qquad \qquad \qquad - 11 \\ \text{etc.} \end{array} $	or	$ \begin{array}{r} 132 + 2 = 134 \\ 121 + 4 = 125 \\ \qquad \qquad \qquad - 9 \\ 110 + 6 = 116 \\ \qquad \qquad \qquad - 9 \\ 99 + 8 = 107 \\ \qquad \qquad \qquad - 9 \\ \text{etc.} \end{array} $
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These are only a few of the interesting discoveries which the children make by studying this chart. It is not a device for learning the tables because it can hardly be introduced before the fourth grade, when the children should be familiar with the tables at least up to the six-table. Rather, it is a device to show the tables in a new light, which also reveals many interesting relationships between them. Exploring this and other charts helps to make the tables not only interesting but captivating and from these first simple steps the study of mathematics becomes a real experience to the children.

Working with the tables in the indicated manner is never drudgery and never dull. It offers ample opportunity to keep the quick, alert, young mathematicians on their toes and at the same time keeps the slow ones constantly interested and alert.

William Harrer

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Membership in the Association, including the quarterly Bulletin,
 is \$2.00 per year. Single copies of the Bulletin, 25¢ each.
