ELEMENTARY ARITHMETIC

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PREFACE

Probably there is no branch of school study in which the work to-day is more unsatisfactory than in arithmetic; and yet accuracy in number work lies at the very base of efficiency in business affairs. Since much of the inefficiency of the time is clearly attributable to vagaries in educational methods, the exploitation of theories sometimes fantastic and demoralizing, there is a wide and growing desire for a return to the efficiency of an earlier period, when sane and conservative counsels were followed; when the drill was sufficient to insure a ready command of arithmetical processes by the pupil, and the learner was practically trained for the business of life.

Truly conservative as this new series is planned to be, in reviving those features of the work which made for efficiency in the past, it is thoroughly modern in its adaption to the conditions of to-day. The obsolete is eliminated. An application is made to the life of the present time in both thought and environment. So many are the distinctive features of this series, and so definite and positive are the principles upon which it has been constructed, that a brief statement of some of the more important of these features should be made in advance, to give a clear idea of the plan and purpose of the books.

Since the ear as well as the eye is a potent means of fixing in the mind that which is to be committed to memory, there is every reason for *oral drill work* in the mastery of tables, etc.*

Why should fifty per cent of the child's God-given equip-

*See explanatory note on page 28.

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ment for storing the mind be discarded, and dependence be placed upon "visualization" alone?

The very general slighting of systematic "table work" in the schools of this country has proved a sad mistake. The combinations of simple numbers in the elementary processes are presented here in tabular form, and without disguise; and they are to be learned in an orderly way. The elimination of the multiplication tables from some arithmetics, and the half-hearted and almost furtive use of them in others, are not easily explained.

Teachers complain that much that is called *addition* in school work is really only *counting;* that the pupil who is to add together two simple numbers will begin with one of these, and mentally count through the units of the other. This evil is almost universal. But who is to blame for it? The pupil? No. *He has been taught to do that very thing.* Either he has not been taught the difference between adding and counting in combining two or more numbers, or no substitute for counting has been given him. In this series, addition in arithmetic is defined to be *"adding without counting;"* and in all sincerity and good faith the pupil is told that he must learn some combinations before he can add in this way. He is not first taught to "add by counting" and then reproved for doing what he was taught to do.

A feature characteristic of this series throughout is its showing of the progressive development of the science of numbers. No pupil who studies these books will share the popular illusion that arithmetic as a finished product was in some mysterious way, at a very remote period, delivered to men. Contrariwise, he will learn how the use of numbers and of figures has been developed by entirely human, slow, and irregular advances from crude beginnings as the needs of the people urged them from step to step. The child

accustomed to fairy tales should be led to make a clear distinction between the magical and the rational; and arithmetic will possess for him far more of human interest when it is presented to him without mystery as a science and art far from perfect, far from complete, and representing the results attained thus far by beings like himself.

Entirely consistent with the conservatism shown in the drill work in the mastery of combinations of simple numbers, etc., is the extended drill in abstract numbers, throughout the course. It is this practice that gives real efficiency, insuring readiness, accuracy, and speed. For the abundance of this work, which it is believed the pupil will enjoy if he be properly directed, no apology is offered. The need of the hour is for efficiency.

While the concrete problems are subordinated to the abstract as promoters of efficiency, they are yet of great importance. Care has been taken to render them interesting. Some characters of juvenile literature, historical or otherwise, and of folklore have been drawn upon. These are believed to be quite as admissible as the equally supposititious "Mary," "Clara," "John," "William," etc. of the conventional concrete problem. Further, the great mass of the concrete work deals with modern life and present environment; with the world's work; with the practical concerns of individuals and of peoples of this era. The concrete problems, therefore, possess an educative value apart from the number work involved in them. They have a cultural value and a vocational suggestiveness that should not be left out of account. They suggest, moreover, improvements, conveniences, and economic advances in home and neighborhood life.

In this first book of the series, fractions have not been presented in a technical way. Fractional parts of objects have been presented graphically to the eye, for comparison

with each other and with the whole; and they are dealt with by an application of the fundamental processes learned in the use of whole numbers.

For expert advice in the proportioning of the work, and its adaptation to specific grades, and for sedulous care in the arrangement of its parts in supervising its make-up, acknowledgment is made to Mr. James C. Thomas, whose long and fruitful experience in schoolbook publishing qualifies him to be of the greatest service in all the innumerable details.

Credit is due to Mr. Charles L. Spain, Assistant Superintendent of the Detroit City Schools, for the valuable material supplied in the "Exercises for Practice" given on pages 221-236.

To educators who are seeking an arithmetic course prepared with a view to the practical efficiency of the pupil in all forms of number work, who desire that the pupil be interested in his work, and who have regard for the "by-products" of cultural development and for the training of the judgment in dealing with practical matters, this series is offered in a sincere and earnest effort to meet the needs of to-day.

CHARLES E. CHADSEY
HUBERT M. SKINNER

February, 1914

SUGGESTIONS TO TEACHERS

In entering upon the teaching of arithmetic, as in entering upon any other business, the first thing to be done is to *"take account of stock"*; to ascertain what knowledge of the subject the pupil possesses, to start with. The first test of the pupil's knowledge should be the test of counting. In all probability he has learned to count before entering school; but in any event this should be taken up first, as a test, for the following reasons:

1. It will not do to assume that *all* first-year pupils can count.
2. Even if they all can do this in a way, there may be foreign pupils who are not sure of the English names of some of the simple numbers, and who will be at a disadvantage if they are not set right at once.
3. Many native American pupils do not pronounce correctly. They will say *"for"* for *four;* *"leb'm"* for *eleven;* *"twunty"* for *twenty,* etc.
4. Counting by odd and even numbers separately is useful in locating street numbers in cities, and in other matters, and should be taught at the outset. Counting by even numbers, only, saves a great deal of time when many things are to be counted. The pupil should learn to take advantage of it.

The first recording of numbers should be by the use of tally marks. This simple device of centuries past belongs to the folklore of our race, and is useful for many purposes to-day in city and country alike. It should not be left to chance for pupils to learn it. Every school should teach it.

The invention of our convenient and beautiful figures marked an era in human history. The child should see how the figures came naturally, by an arrangement of marks or of sticks. They will then have for him more of interest and more of meaning.

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The decimal system in counting is based on the fingers of the human hand, and is best explained by the use of fingers as objects. "Once around" (10) explains tens' place of figures, and this explains all the others.

It is a mistake to teach the combinations of units and tens without first teaching both units and tens separately. Units are easily understood, and so are tens. The names of some of the tens, however, require some explanation; for they all have a *meaning*. *Eleven* and *twelve* and the *teens* are complex, and should be presented later. The meaning of *eleven* and *twelve*, and the construction of the *teens* should be made clear to the pupil.

The convenient modern plan of reading the tens first, and saying *twenty-five* instead of the old-fashioned *"five and twenty"* should be noted. In this economic age, even the little child should be taught economy of time and of effort by illustration.

The mastery of the *period of three places* is the basis of all notation and numeration. The mastery of *one* period will answer for *all* periods— for periods differ from each other in *name*, not in form. The old, bewildering series of *"orders"*—units, tens, hundreds, thousands, tens of thousands, hundreds of thousands, millions, tens of millions, etc., is not to be treated as a merely curious palindrome (backward and forward alike), but must be *completely reversed* with *great speed* in reading figures. The true series of places—*units, tens, hundrds, in each period*— is simple and intelligible.

When the pupil comes to addition, *counting must stop.* It is a common complaint that in many schools there is *no true addition at all;* the pupil simply counts from one number through the units of another. Neither he nor his teacher knows why the work is so poor and inefficient. The textbook has taught the pupil to learn the sum of two numbers in this way. The teacher who finds what the trouble is, works hard to stop it, but it is now too late. *Prevention is better than cure.* From the first illustration of addition, counting should be wholly absent. The combinations of simple numbers must be *learned.* The ear aids the memory. Oral repetitions of combinations, sometimes in concert, will