

**AN ELEMENTARY
ARITHMETIC**

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An elementary arithmetic by G. A. Wentworth

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G. A. WENTWORTH

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ELEMENTARY ARITHMETIC.

BY

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PREFACE.

TEACHERS who have the power of putting themselves in the mental attitude of their pupils possess a most important gift. In the first stages of mental growth, as the mind works unseen, it is hard to realize the difficulties encountered, and to decide what assistance can be judiciously given. There is no royal road to the knowledge of arithmetic, but the steps can be made short and easy. The little learner need not be wearied, if the exercise is not too long continued. He may also have the consciousness of effort, as in learning to walk, and above all, the pleasure of succeeding. This result can be secured only by observing the following fundamental principles :

1. All elementary teaching of arithmetic must be begun by the pupils observing and handling objects.

It is surprising that school authorities in many places decline to furnish the money, however small the amount is, to purchase the simple apparatus required for each Primary School. They assert that they got on well enough without such aids when they were children, and they seem to be quite unconscious of the weakness of such an argument. The question is not whether children can do well without the aid of objects, but whether they can do better with them. Our fathers did well enough in travelling on horseback and in coaches, but we do better with our express trains. Children may be able to grasp abstract ideas, after sufficient time, without the aid of concrete examples. It

is certain, however, that they grasp these ideas more firmly and more quickly if they are led to them by easy steps through objects that can be seen and handled.

Besides, the use of objects saves children from the *bondage of rules*. With 6 blocks they can learn to add 4 and 2, to subtract 4 from 6, to multiply 3 by 2, to divide 6 by 2, without suspecting the existence of the fearful rules to be found in our text-books of arithmetic. They can also be taught to find $\frac{1}{2}$ of 6 or $\frac{2}{3}$ of 6, without even hearing of the terms, fraction, numerator, or denominator.

2. A knowledge of the processes of arithmetic should be acquired by using small numbers; and each number should be treated in all its variations before the next higher number is considered.

In the treatment of each number we must rely upon the *sight* of the pupil, and not upon his *hearing*. Furthermore, we must rely upon his *activity*. He must *do* as well as *see*. Listless repetition of 4 and 3 are 7, or the sing-song 4 times 3 are 12, makes no impression upon him. The next day he is quite likely to tell you that 4 and 3 are 6. If he is required to put 4 pegs in one row of the counting-board and 3 in another row, and to learn in this way that 4 and 3 are 7, he will remember it. This method of teaching has the very great advantage of keeping the child's interest in his work fully alive, and of giving to the study of arithmetic the peculiar distinction that the learner can discover for himself, in case of doubt, whether his answer to any question is right or wrong, and can find the true answer, if he has given a wrong one.

3. Repetition is to be regular and systematic, combined with suitable variation.

It cannot be too strongly urged that the first requisite of good teaching is repetition, the second requisite is repetition, and the third requisite is repetition. The interest of

the pupil must be kept up *by varying the application of the question*. To find the sum of 3 horses and 5 horses is not the same thing to the child as to find the sum of 3 tops and 5 tops. Hence a lesson may be given as many times as may be necessary by properly varying the questions.

A table of different things, given opposite the first page of this book, will be found of great use in suggesting a suitable variety of questions. Care must be exercised to have the variation of a kind to *fix* knowledge. To ask the number of 3 ducks and 4 ducks, of 3 times 4 ducks, and $\frac{1}{3}$ of 12 ducks, in succession, is a variation, to be sure, but of a kind to distract the child's mind, as he cannot quickly pass from one conception to the other. The questions in Part I. of this book are specimen questions, which it is expected the Teacher will supplement by a great number and variety of other questions.

4. Lessons should be short, answers required should be simple, and the power to deal with numbers in the abstract should be acquired through concrete examples by regular gradation.

Number work should be discontinued the moment the pupil's attention flags. It is far better to divide the time daily allotted to arithmetic into two or more lessons. Only simple, direct answers should be required. Of course, if objects are named in the question, they should be named in the answer. The answer to 5 birds + 3 birds should be 8 *birds*, and not simply 8.

A knowledge of numbers in the abstract is obtained only by a comparison of different things. The child learns the number 5, for instance, by seeing and handling 5 familiar objects, by observing number pictures of 5 on the black-board or on cardboard, by answering questions about 5 familiar but unseen objects, and lastly about 5 in the abstract.

5. The child must not be required to read questions that are difficult for him to read, or to solve problems that are difficult for him to analyze.

The intention is to put this book into the hands of young pupils, *but only for them to copy and do the numerical exercises.* The other examples, usually called *clothed* examples by way of distinction, must be read by the Teacher, and *only* the answers be required of pupils. No child can become interested or successful in arithmetic if his mind is *distracted* between the *reading* of a problem and the *numerical calculation* required for its solution. He can learn the simple processes of arithmetic while quite young; he can learn to be accurate and reasonably rapid in these processes; he can learn to be neat and orderly in the arrangement of his work; and his interest will constantly increase, *provided he is kept master of his field of operations.* At this early stage he cannot be exercised in logical analysis, and it is a great mistake to put problems before him that require too great an exercise of the reasoning faculty. Later he will form the habit of close attention, learn the meaning of logical inference, and acquire the power of sustained and continuous thought. Arithmetic rightly taught furnishes the very essence of intellectual training, and deserves the name of "The Logic of the People."

G. A. WENTWORTH.

EXETER, N.H.

