

THE TEACHING OF ARITHMETIC

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The teaching of arithmetic by David Eugene Smith

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DAVID EUGENE SMITH

**THE TEACHING
OF ARITHMETIC**

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PREFACE

This work has been prepared with a view to the needs of Teachers' Reading Circles and of those who are giving instruction or supervising the work in arithmetic in the elementary schools. The effort has been made to free it from the more difficult technicalities of mathematics as far as possible, and from that phraseology of the world of pedagogy that renders educational problems unnecessarily difficult. It is the author's desire to place before the large body of teachers of arithmetic, rather than the few who are interested in the technicalities of experiment, a brief summary of the development of the science and of the reasons for teaching it; a statement of the subject matter that may properly be selected for school purposes, and the arrangement of this matter in a course of study; a consideration of a few of the technical features of arithmetic; and a discussion of the work of the several school years. He feels it quite unnecessary, however, to repeat at length the simple explanations and devices that are found in any good textbook, believing that the teacher will usually find it advantageous in such matters to follow the book that she is using.

The problem of teaching arithmetic is not a particularly complex one. The world demands little of the school, hardly more than the four operations with integers, very simple fractions, and decimal fractions to two places; a small number of tables of denominate numbers; a few cases in mensuration; and the ability to find a given per cent of a number. In America the schools are commonly given eight years in

which to accomplish this work, and if they fail it is not for lack of time, but rather because they do not use this time wisely. If they introduce unnecessary features, such as obsolete tables or too elaborate explanations ; if they require business arithmetic that is beyond the understanding of the children ; and if they use hard methods of solving problems instead of simple ones, they cannot expect to bring the pupils to the standard that the world requires. This seems to be a part of the difficulty, but not all of it, and it is to assist teachers to find the difficulty, so far as it can be found at present, that this book is written.

If the author succeeds in making arithmetic more interesting to teacher and pupil, in making it touch more clearly the vital questions of daily life, in pointing out a line of work that is free from dangerous eccentricities, and in presenting a broad view of the subject as opposed to one in which small things obstruct the vision, the purposes that he has had in mind will be realized. It is with this hope that he submits this little work to his colleagues in the teaching profession.

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THE TEACHING OF ARITHMETIC

CHAPTER I

THE HISTORY OF ARITHMETIC

Of all the sciences, of all the subjects generally taught in the common schools, arithmetic is by far the oldest. Long before man had found for himself an alphabet, long before he first made rude ideographs upon wood or stone, he counted, he kept his tallies upon notched sticks, and he computed in some simple way by his fingers or by pebbles on the ground. He did not always count by tens, as in our decimal system; indeed, this was a rather late device, and one suggested by his digits. At first he was quite content to count to two, and generations later to three, and then to four. Then he repeated his threes and had what we call a scale of three, and then, as time went on, he used a scale of four, and then a scale of five. In measurements he often used the scale of twelve, because he found that twelve is divisible by more factors than ten, and particularly by two and three and four; but by the time he was ready to write his numbers the convenience of finger reckoning had become so generally recognized that ten was practically the universal radix. Nevertheless, there remain in our language and customs numerous relics of the duodecimal (scale of twelve) idea, such as the number of inches in a foot, of ounces in a troy pound, and of pence in a shilling, all influenced by the Roman inclination to make much use of twelve in practical computation.

The writing of numbers has undergone even more change than the number names. Not only was there usually a notation for each written language in ancient times, but some languages had several sets of numerals, as is seen in the three standard systems of Egypt, the two of Greece, and the somewhat varied forms in use in Rome. The Roman supremacy gave the numerals of these people great influence in Europe, and they were practically in universal use in the West until the close of the Middle Ages. The Romans themselves had no definite standard for their numerals. Whereas we write IV for four, IX for nine, and XL for forty, they usually wrote IIII, VIIII, and XXXX. Occasionally they wrote IIXX for eighteen, and they would have written the year 1914 as MDCCCXIII rather than MCMXIV. Soon after books began to be printed a slight effort was made to use Roman numerals in fractions, as in the following facsimile from a German work of 1514 :

I Diesse figur ist vñ bedēit ain fiertel von ainez
IIII ganzen/also mag man auch ain fūnfftail/ayn
 sechstail/ain sybentail oder zwai sechstail 2c. vnd alle
 ander brūch beschreiben/Als $\frac{I}{V}$ | $\frac{I}{VI}$ | $\frac{I}{VII}$ | $\frac{II}{VI}$ 2c.

VI Disß sein Sechs achtail/das sein sechstail der
VIII acht ain ganz machen.

IX Disß figur bezaigt ann newen ayilfftail das seyn
XI IX tail/der XI ain ganz machen.

XX Disß figur bezaichet/zwenzigt ainundreyß
XXXI sigt tail /das sein zwenzigt tail .der ains
 undreißigt ain ganz machen .

IIC Disß sein zwaihundert tail /der Sierhūn
IIIC.LX dert vnd sechzig ain ganz machen .