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Alas! Oh!—
1. An Interjection.
2. Reflective,—expressing a feeling confined to the mind of the speaker.

Hush—
1. An Interjection.
2. Imperative,—expressing a command, or wish with reference to something apart from the speaker.

NUMBER.

A COURSE OF LESSONS PREPARATORY TO THE USE OF A TEXT-BOOK ON ARITHMETIC.

IV.

SECOND STEP.

NOTATION.

HITHERTO the several numbers have been represented to the eye solely by objects or strokes; the expression of the higher numbers by these means will already have become inconvenient. The pupil must now be introduced to the more simple and practical method afforded by the Arabic* numerals.

Object.—1. To make evident the need of some brief and ready method of expressing the value of numbers in writing; to teach the form and power of the ten numeric signs, 1, 2, 3, 4, 5, 6, 7, 8, 9, 0.

2. To make the children familiar with the meaning of the words *more* and *less*,† with the algebraic signs + and —, as respectively expressive of the operations of addition and subtraction; and also with the sign = as expressive of equality or result.

Plan.—This, as it regards carrying out the first object, will be gathered from the following suggestions to the teacher:

1. In order to illustrate the need for the use of figures in expressing to the eye the value of numbers, let the children suppose a case in which it is required to state some high number in writing; as, for instance, the age of an old man. They will at once see that the doing this by means of strokes would occupy so much time and space as to be most inconvenient, and that to avoid this must be most desirous. Various illustrations will suggest themselves,

When the perception of the want has been awakened, the teacher may communicate the numeric value of the several numeral characters by means of groups of strokes, each group having written over it the figure which has been adopted as its unvarying symbol; thus:

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 1      2       3        4
 |     | |    | | |    | | | |
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This should be carried as far as the number *nine.*

When these groups of strokes and their representative figures have been thoroughly scrutinized, the children should be led on to apply them for themselves. The teacher may write any one of the figures on the slate, and require a child to place against it the number of strokes or units it represents, while the other children of the class determine whether this is correctly done. To vary the exercise, the teacher may make any definite number of strokes, not exceeding *nine*, upon the slate, and require the children to apply the right numeric sign; or, for variety, the teacher may present a definite number of objects, requiring the children to express the number, both by the utterance of the name of the number, and by the formation of the corresponding figure on the slate. They ought to acquire familiarity with the nine numerals in two lessons.‡

2. The children having acquired the knowledge of nine figures by which the nine lowest numbers are briefly expressed for convenience of calculation, may now be led to see that the word *two* and the sign 2, the word *three* and the sign 3, &c., have an unchangeable, or *absolute* value, which may be used to qualify any objects whatever; so that we may say, two elephants or three elephants, two flies or three flies, two ones or three ones; the number being always the same number, however different the objects to which it is applied.

3. The teacher may now introduce the words *more* and *less*, and the algebraic signs of addition, subtraction, and equality or result. First, let the teacher write a column of numbers to be added, on the school slate. This may be done in different modes:

1 and 1 are 2	1 more 1 are 2
2 and 1 are 3	2 more 1 are 3
3 and 1 are 4	3 more 1 are 4
&c.	&c.

Then let the teacher write on the slate the same numbers as before, connecting them by the signs of addition and equality, as in the margin; or the words may be erased, and the signs substituted. The sign + should not be made in a careless manner, and attention should be called to the fact that the one line is exactly vertical, the other exactly horizontal, in order that this sign may be the better distinguished when that which indicates multiplication is hereafter presented.

$$1 + 1 = 2$$
$$2 + 1 = 3$$
$$3 + 1 = 4$$
$$4 + 1 = 5$$

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* They are, in fact, Indian in their origin, though we have received them through the Arabians.

† If the children are advanced, the Latin words *plus*, for more, and *minus*, for less, may also be taught.

‡ It would be a useful lesson for the children themselves to make the figures indicating opposite to each of them, by the proper number of strokes, the number of units it expresses.

The process is the same with the sign of subtraction, columns of some length being first constructed, with the use of words, afterward exhibiting the superior simplicity and utility of the signs:

2 less 1 is 1	2 — 1 = 1
3 less 1 are 2	3 — 1 = 2
4 less 1 are 3	4 — 1 = 3
5 less 1 are 4	5 — 1 = 4

THE DEVELOPMENT OF THE NUMBERS ELEVEN TO ONE HUNDRED, AND THE EXTENSION OF NOTATION.

Object.—This Step is but an extension to higher numbers of the principles already laid down, and the extension of the power of numeric notation to the expression of such numbers.

To explain the nature of the *local* value of figures, as distinguished from their *absolute* value.

Plan.—I. Develop the perception of the numbers eleven to one hundred, on the plan proposed in the development of the numbers one to nine, tangible or visible objects being still used with the lower numbers. The number ten should be much employed as a means of classification, and as a help both to the eye and to the mind in the comprehension of the higher numbers.

Teach the children to enumerate simply by combinations of tens and units before using the common contractions; for example, saying after 10, one ten and one, one ten and two, &c., up to one ten and nine; then two tens and one, two tens and two, &c., up to nine tens and nine; thus learning the meaning of the terms, *fourteen*, *twenty-one*, and being enabled to see more clearly the plan of numbering by ten, and that the highest number is merely a repetition of ten units.

II. Communicate the names of each of these numbers, and test the children's attainments as already recommended and illustrated, concluding with simple ascending and descending enumeration.

III. Illustrate the powers and names of these numbers when used as ordinals.

IV. When a clear perception of such numbers has been attained, the children may be introduced to the effort of expressing them in numerals. To do this, they must be led to see the necessity for changing the numerals in the second, or tens' place of figures from 1 and 2, as hitherto used in the numbers 11, 12, and in 21, 22, &c.; to 3, in 31, 32, 33, &c.; to 4, in 41, 42, 43, &c.; up to 99.

This subject is important, not at this stage of instruction only, but throughout the whole range of number. It introduces the mind to the perception of a new feature in numerical *notation*—that of the *local value* of the ten figures (inclusive of 0, which indicates the absence of number); for it is to these *figures* or signs alone, and not the *names* of numbers, that this property of local value belongs.

In the first place, lead the children to feel the need of some brief mode of expressing the value of numbers more than 9.

To do this, the teacher may once more form groups of strokes on the slate, from one to ten, requiring a child to place over each stroke or group of strokes its representative numeral. This will be easy as far as 9. When the child has reached the group containing ten strokes, and is at a loss for a numeral by which to express it, the teacher may communicate the fact that only nine numeral characters (exclusive of 0) have been invented for the written expression of all numbers, how large soever they may be.

Having reached this point, the mind of the children should be led to think out this fact of local value. With a view to this, the teacher may draw two columns on the school slate and write at the top of each of them the name of some familiar object, as in the margin; telling the children to call the column on the right the *first* column,* that on the left the *second*. Any numeral say 4, may then be written in the first column. What does it mean? It means *four* of boys. What would it mean if written in the *second* column? It would then mean four of *men*. Write 3 in the first column, 8 in the second. How will you read these figures? *Eight* of men and *three* of boys. Transpose them and how will you read them now? Three of *men* and eight of *boys*. Diversify both names and numbers for further exercise.

Again, draw two columns on the slate, and at the top of the first column, write "ones," at the top of the second "tens," as in the margin. Place the numeral 1 in the first column. What does it mean? It means one *one*, or one unit. Remove it to the next column. What does it mean now? Now it means one ten. Write the same numeral in both columns. What does it mean now? Now it is one *ten* and one *one*, Have you learnt any name for one ten and one one, or for ten more one? Yes; ten more one is called "*Eleven*." The teacher may then successively change the figure in the *first* colr. ..t to two. What is it now? One ten and *two*. Its name. *Twelve*. To three. What is it now? One ten and three. Its name. *Thirteen*. And so on to nine. What is it now. One ten and nine. Its name? *Nineteen*.

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* This order is important as a right beginning, the "place of figures" being always enumerated from right to left.