

**THE PUBLIC SCHOOL MENTAL
ARITHMETIC: BASED ON
MCLELLAN AND DEWEY'S
"PSYCHOLOGY OF NUMBER"**

Published @ 2017 Trieste Publishing Pty Ltd

ISBN 9780649684502

The Public School Mental Arithmetic: Based on McLellan and Dewey's "Psychology of Number"
by J. A. McLellan & A. F. Ames

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Edited by Trieste Publishing Pty Ltd.
Cover @ 2017

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THE PUBLIC SCHOOL
MENTAL ARITHMETIC

BASED ON

McLELLAN AND DEWEY'S "PSYCHOLOGY OF NUMBER"

BY

J. A. McLELLAN, A.M., LL.D.

PRESIDENT ONTARIO NORMAL COLLEGE

AUTHOR (WITH DR. DEWEY) OF "THE PSYCHOLOGY OF NUMBER," "APPLIED
PSYCHOLOGY," "ELEMENTS OF ALGEBRA," ETC.

AND

A. F. AMES, A.B.

HONOR GRADUATE IN MATHEMATICS; FORMERLY MATHEMATICAL

MASTER, ST. THOMAS COLLEGIATE INSTITUTE

SUPERINTENDENT OF SCHOOLS, RIVERSIDE, ILL.

New York

THE MACMILLAN COMPANY

LONDON: MACMILLAN & CO., LTD.

1907

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GRADUATE SCHOOL OF EDUCATION

May 8, 1930

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Set up and electrotyped January, 1899. Reprinted August,
1899 : September, 1901 : July, 1902 : May, 1904 : August,
November, 1905 : February, 1907.

PREFACE

It has recently been stated by a well-known college professor that "boys enter college or training school at eighteen, after having spent from one sixth to one fourth of their entire school life in studying mathematics. Yet they know very little mathematics. In their examination the asking of even three questions shows that they haven't the dimmest idea of what it is all about." This statement, if true, does not prove — as the professor seems to think it does — the justice of the Hamiltonian onslaught on mathematical study. It simply proves that the prevailing methods of teaching arithmetic are radically wrong. The serious defects in existing methods are mainly due to the fact that they take no account of the real nature of number, and of how the child's mind works in grasping the concepts of number and numerical relations. In other words, arithmetic has never been "psychologized." If there is a science of education and rational methods founded upon it, there must be a psychology of arithmetic, a psychology of language, etc. The one-sided theory that education is concerned only with fitting the child for existing civilization has made

the so-called "practical" aims and methods dominant in school work. These methods are, and ever must be, essentially defective, inasmuch as they are founded on a half truth; they take no account of the powers and capacities of the individual who is to be made an effective instrument in maintaining and perfecting this civilization into which he is born. The individual, indeed, lives and moves and has his being in society, and therefore there is a social side to education. Sociology must have something to say on the problem of education. But, on the other hand, society lives and moves and has its being only through the development of the individual; that is to say, education has its psychological side. While the social side, the idea of fitting the individual to play his part in existing civilization, may give a standard for the development of the powers and capacities of the individual, and may point out the subject-matter to be used in this development, it does not show how this development of powers, this adaptation, is to be secured. In other words, sociology indicates *what* is to be done with the individual, but fails to show *how* it is to be done. This is a question of psychology. The meaning of this is that we must have both a psychology of the individual mind and a psychology of the subjects through which it is to be developed.

On this principle the "Public School Arithmetic," the "Primary Public School Arithmetic," and the

“Public School Mental Arithmetic” have been prepared. It is believed that, by direct teaching and helpful suggestion, these books will, in some degree, contribute to the growth of a rational, and therefore economical, method of teaching. At all events, the series differs from all other text-books in being based on the Psychology of Number.

This “Mental Arithmetic” completes the series and completes the *method*. In the methods of the schools—speaking generally—the ignoring of mental arithmetic or the teaching of it in a haphazard, and therefore ineffective, way contributes very largely to the present unsatisfactory results, viz. “little mathematics and less training of logical faculty.” Mental arithmetic, systematically taught from a rationally prepared text-book, is the life and soul of rational method. There is constant adaptation to the normal mental action of the child. During the lesson the teacher is in vital touch with the child’s mind; sees the child’s personal self-activity in the making of images and in controlling their movements. There is hence the least possible waste for both teacher and pupil. The teacher takes care of the image, and then the concept takes care of itself. From long and varied experience, both in teaching the subject and inspecting the teaching of others, it is firmly held that, compared with “written” arithmetic alone, mental arithmetic, if systematically taught, will produce at least twice the KNOWLEDGE

and twice the POWER in a given time. The distinguishing features of the book are:

1. It is not a book of puzzles for ingenious analysis or of "conundrums"—to use a favorite question-begging epithet—for the exercise of a nimble fancy, but a book of ideas and principles for easy mastery by rational method. The subject-matter and the method are one.

2. Like the two books for written arithmetic, the "Mental Arithmetic" is based on the idea that number is the tool of measurement, and that measurement takes its rise in human activity satisfying human needs. Therefore all the processes have meaning for the pupil. They are connected with his own experience. The child, in the first lesson and in all lessons, is always learning with what he has learned; a primary idea unifying all and throwing light on all. This means that there is continuity. The very first question looks towards the very last. Every "new rule" deepens interest; for it is but common-sense application of a certain numerical *habit* to slightly novel conditions—to the acquisition of a new, but related, habit.

3. It keeps constantly in view the value of the image—imaging quantity and quantity relations. There is constant appeal to the child's imagination, and not merely to abstract reasoning power.

4. The important idea of "balance or equation" is frequently stated—made familiar to the pupil—

for the insight which it gives into the problem and its solution. This idea of balance, which results from measurement, is present in every problem in arithmetic. Its recognition by the pupil is essential to the economical solution of the problem. See "Psychology of Number," p. 41.

5. There is constant insistence on the clear apprehension and statement of the elements of the question. This is fundamental in the intelligent handling of problems; and the teacher should frequently test the pupil to see if, after reading the problem, he knows what is in it, and to train him to pay careful attention to what he reads.

6. From the gradual psychological development of the subject the *method* is given in the *presentation of the matter*. Matter and method and process of education are correlated. The teacher has not to trouble himself with books and articles on methods and devices. Every principle and process is presented as the natural movement of the mind demands. The best methods are followed by the best results; for matter, method, and results are a unity.

7. Number concepts are of gradual growth. The book is constructed to promote in the best way this normal growth. To secure this with the greatest certainty and economy all the questions and problems in the book are original.

It is hoped that the teacher will find the language which Dr. Dewey has used in characterizing "The