ARITHMETICAL ABILITIES AND SOME FACTORS DETERMINING THEM

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Arithmetical Abilities and Some Factors Determining Them by Cliff Winfield Stone

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CLIFF WINFIELD STONE

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and

Some Factors Determining Them

BY

CLIFF WINFIELD STONE, Ph. D.

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TABLE OF CONTENTS

PAGE

Acknowledgments 5
Part I. Purpose and Method of the Study .....
The Purpose of the Study 7
The Method of the Study 7
Schools Tested 7
Explanation of key 9
Method of securing data 9
Purpose and content of tests 9
The tests as given 10
Arrangement of problems 12
Conditions under which given 13
Directions to pupils 14
How the scores were computed 15
Precautions to make scores accurate 18
What the scores measure 19
Part II. Arithmetical Abilities—Their Variability and Relationship
The Problem—The nature of the product of the first six years of arithmetic work 19
Phases of the problem 19
The Data 20
Achievements of the systems as systems 21
Measured by scores made—Tables III–VII with sample readings 21
Measured by mistakes made—Tables VIII and IX with sample readings 26
Achievements of pupils as individuals, Tables X and XI .. 29
Variability 33
Of abilities among systems and individual pupils—Table XII with sample readings 33
Of abilities among boys and among girls—Tables XIII and XIV with sample readings 35
Relationship 36
Of abilities among systems—Tables XV and XVI with sample readings 37
Of abilities among individual pupils—Tables XVII and XVIII with sample readings 40
Summary 42
Factors determining abilities 43
Part III. Arithmetical Abilities and Time Expenditures .....
The Problem—The relation of time expenditure to arithmetical abilities 46
The problem analyzed 46

Part III. Arithmetical Abilities and Time Expenditures—*Con.* PAGE
Time expenditure 47
Previous related studies 47
Data blank and its uses 50
Amounts and variabilities in twenty-six systems, Tables XXI to XXIV with sample readings 52
The relation of time expenditure to abilities produced, Tables XXV to XXVII with sample reading 58
Some factors in time expenditure 62
Distribution among grades 62
Use within a grade 65
Summary 69
Suggestions for determining time allotment 69
Part IV. Arithmetical Abilities and the Course of Study .....
The Problem—What is the relation between arithmetical abilities and the Course of Study 70
Steps toward solution of the problem 70
Securing Courses of Study 70
Securing ratings of Courses of Study 71
Relation of excellences of courses and excellences of results. 73
Drill and Concreteness in Courses of Study 74
The Courses of the nineteen Public Schools in relation to abilities 78
Phases of excellences of Courses in relation to each other 78
Courses of Study and Time Cost 79
Samples from Courses of Study 79
The Course of Study Situation 86
General Conclusions 89
Appendix 94

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No school system will appear by name in the body of this study, but any one whose system is represented will be cordially provided with its key, of which three copies will be preserved—one by the author and two at Teachers College, one in the Office of Elementary Education and one in the Bryson Library.

Dr. Rice's study of arithmetic and other helpful works are noted and briefly summarized in the appendix, page 96, or throughout the study in connection with related topics.

PART I.—PURPOSE AND METHOD

The central *purpose* of this study, broadly stated, is to make one more contribution to exact knowledge of the relation between distinctive educational procedures and the resulting products. "What is the relation between the theories and the products of education?" is one statement of the question which prompted the author to attempt a research thesis. Specifically, the portions of the larger question on which this study has bearing are: (1) What is the nature of the product of the first six years of arithmetic work? (2) What is the relation between distinctive procedures in arithmetic work and the resulting abilities?

The *method* of this inquiry may be briefly characterized as the application of the statistical method to mental measurements.[1] The three principal measurements made are the arithmetical abilities of 6A (high 6th) pupils,[2] the time expended and the course of study materials used in securing these abilities.

Sources of Data

The sources drawn upon for data with which to answer the questions above stated were twenty-six school systems. These were selected after a somewhat close examination of the arithmetic courses of study and time allotments of a large number of city and individual schools scattered over practically the entire United States. The bases of selection were distinctiveness of practice and geographical accessibility.

Through the courtesy of superintendents, principals and teachers the data were gathered in the following twenty-six systems:[3]

Batavia, New York.
Decatur, Illinois.
Elwood, Indiana.

[1] For a full exposition, see Thorndike's *Mental and Social Measurements*.

[2] In such of the smaller systems as had less than one hundred 6 A's, tests were used from equal numbers of 6 B's and 7 B's.

[3] The author personally gathered the data from each system, securing course of study material from each of the twenty-six superintendents, and time expenditure data from each of seventy-five principals, and conducting the tests in each of the one hundred and fifty-two classes. See p. 13. Conditions under which the Tests were given. The single exception is the Ethical Culture School where, because of the author being known to the children, Mr. J. L. Stockton, to whom the thanks of the author are due, gave the tests after careful preparation.

Ethical Culture School, New York City.
Francis W. Parker School, Chicago.
Horace Mann School, Columbia University, New York City.
Indianapolis, Indiana.
Jersey City, New Jersey.
Kokomo, Indiana.
Linné School, Chicago.
Medford, Massachusetts.
Montclair, New Jersey.
Muncie, Indiana.
Natick, Massachusetts.
Observation School, State Normal, Providence, R. I.
Passaic, New Jersey.
Providence, Rhode Island.
Rochester, New York.
Schools No. 40 and No. 50, Manhattan, New York City.
Speyer School, Columbia University.
Syracuse, New York.
Training School, State Normal, Hyannis, Massachusetts.
University Elementary School, University of Chicago.
Waltham, Massachusetts.
Waukegan, Illinois.
Yonkers, New York.

It will be noted that of these twenty-six systems there are seventeen city public systems—Batavia, Decatur, Elwood, Indianapolis, Jersey City, Kokomo, Medford, Montclair, Muncie, Natick, Passaic, Providence, Rochester, Syracuse, Waltham, Waukegan and Yonkers; three schools in city systems—Linné, School No. 40 and School No. 50; four training schools—Observation School, Speyer School, Hyannis Training School and University Elementary School; and three private schools—Ethical Culture, Francis W. Parker and Horace Mann.

According to geographical location these schools may be grouped as follows:

Six in New England, namely Medford, Natick, Observation School, Providence, Training School and Waltham; eleven in the Middle East, namely Batavia, Ethical Culture, Horace Mann, Jersey City, Montclair, Passaic, Rochester, Schools No. 40 and No. 50, Speyer School, Syracuse and Yonkers; and nine in the