A COMPARATIVE STUDY OF THE RESPECTIVE OUTCOMES STEMMING FROM TWO DISTINCT PATTERNS OF MATHEMATICS TEACHING

by

VIRGIE IRENE KEITH

Thesis submitted to the Graduate Faculty of the
Virginia Polytechnic Institute
in candidacy for the degree of

MASTER OF SCIENCE
in
EDUCATION

APPROVED:

Louis A. Pardue
Director of Graduate Studies

APPROVED:

Homer Howard
Chairman of Department and
Major Professor

August, 1958

Blacksburg, Virginia

TABLE OF CONTENTS

LIST OF TABLES

CHAPTER I

INTRODUCTION

This investigation stemmed from a desire to compare the respective outcomes of teaching beginning algebra by means of two distinct techniques: one consisting of highly individualized instruction and the other of lectures, recitations, and tests conducted in terms of groups rather than of individuals. Accordingly, when the study was organized, an attempt was made during one phase thereof to break away from traditional classroom procedures and introduce a pattern of teaching mathematics conducive to each pupil's proceeding at his own rate of learning. In order to do so, a pattern was used which conformed mainly to that of the Winnetka System, but modified in various respects in order to meet the needs of pupils who had had no previous acquaintance with teaching-learning procedures of that nature.

The general plan pursued during the study was as follows:

During the first semester of the 1956-1957 school session, non-individualized instruction in beginning algebra was given to certain pupils in the Blacksburg, Virginia, High School, in accordance with practices which had been in effect for some time in that school.

Then, during the second semester of the same school term, individualized instruction was given. In order to facilitate statistical comparison of the effectiveness of the two techniques of instruction, an algebra aptitude test was administered to the pupils at the beginning of the year, and an algebra achievement test at the end of each semester.

As the study was being launched, a number of questions tended to arise respecting individualized instruction, such as the following which have been stated by Washburne and others:

> What is the total effect in terms of knowledge, attitudes, habits, and skills of individual instruction as compared with group instruction? Does one type of instruction secure given results more effectively than the other? Since individual instruction implies differences in rates of progress, is the work so organized that the child is confronted at each level of advancement with units of work in all subjects that require the same degree of intellectual maturity? ... Certain problems of an administrative nature also arise. For example, (1) is the amount of retardation and acceleration greater in group or individual instruction? (2) how do pupils who have been taught by group methods compare with those of the same mental and chronological ages who have been taught by the individual methods?[1]

It was realized that all of the questions posed in the preceding quotation were significant to this study.

---

[1] Carleton W. Washburne, Mabel Vogel and William S. Gray, A Survey of the Winnetka Public Schools (Bloomington, Illinois: Public School Publishing Company, 1926), pp. 4-5.

However, for practical reasons, it was felt that its scope could not include a complete investigation of all the problems which might arise in connection with this piece of research; that it would be reasonable to limit it to a search for facts relative to some of the more important aspects of individualized instruction in high school mathematics. Thus, the questions which this study attempted to answer were: (1) In respect of beginning algebra, is an individualized pattern of teaching more efficient or less efficient than a relatively non-individualized pattern? (2) In beginning algebra, do pupils tend to make more progress or less, when working independently, than do those being taught by the more frequently encountered classroom method?

In order to provide at least partial answers to the foregoing questions, this study was organized along lines already indicated in this chapter and discussed more fully in later portions of this report, which appears as follows: Chapter II gives a description of the situation at the Blacksburg, Virginia, High School, where the experiment was conducted; Chapter III deals with the individualized plan of teaching used in the study; Chapter IV presents in detail and in chronological order the nature of the actual experiment, as well as the findings which resulted therefrom; and Chapter V summarizes and interprets those data.

CHAPTER II

DESCRIPTION OF THE SITUATION AT THE BLACKSBURG, VIRGINIA, HIGH SCHOOL

The purpose of this chapter is to describe the setting of this experiment, which was conducted at the Blacksburg, Virginia, High School during the 1956-1957 school term.

A) Socio-economic Conditions of the Blacksburg, Virginia, Community

At the time of this investigation, the Blacksburg High School was the only secondary school serving the Blacksburg District of Montgomery County, Virginia, a region comprising the northwestern third of the territory included in that County. As such, the District contained some 92,800 acres of which about 44,190 were included in farms.[1] The Town of Blacksburg, which was the seat of Virginia Polytechnic Institute, was near its center.

---

[1] Gwendolyn M. Graf, "A Study of the Implications for Education of Patterns of Family Living Found in the Blacksburg, Virginia, Community" (Unpublished report of a Master's project, Virginia Polytechnic Institute, 1955), pp. 19, 29.

According to data found by a committee appointed by the Virginia State Department of Education to study the high school and its environs, the Town of Blacksburg had, during the period of this study, a population of about 3,500, and the District of about 6,000; or approximately 2,400 families in all.[1] For some time prior to this writing, due to shifting educational and industrial conditions, the populations of both Town and the District had tended to be somewhat transient in nature.

According to the report of the committee, just quoted, the people living in the area were stratified into several socio-economic classes, patterned largely in terms of vocations pursued by family breadwinners. Most of them obtained their living in the following occupations: professional, clerical, or service activities related to the operation of Virginia Polytechnic Institute; farm work; coal mining; employment at the Radford Ordnance Works, or at the plants of the Instrument Corporation of America and the Poly-Scientific Corporation, respectively; and various other business or service occupations. Furthermore,

---

[1] "Blacksburg High School Evaluation, 1955-1956," (Unpublished report of the findings of a committee appointed by the Virginia State Department of Education, 1956), p. 33.

although the Blacksburg District was largely comprised of farm lands, it had been found that the parents of only some six per cent of the pupils enrolled in Blacksburg High School were engaged in agricultural pursuits. It seems that 27 per cent of the families represented in the High School had annual incomes of $999 and under; 26 per cent, $1,000 to $1,999; 33 per cent, $2,000 to $4,999; 13 per cent, $5,000 to $9,999; and one per cent, $10,000 and over.[1]

As a college town, Blacksburg seemed to have inhabitants possessing higher-than-average ability and leadership resources. On the basis of data gathered by the committee which studied the school in 1956, it appeared that 49 per cent of those 25 years of age and over had had some college education; 26 per cent had had formal educational training extending through high school; 14 per cent had attended school through the seventh or eighth grades; and 11 per cent had had under six years of schooling.[2]

---

[1] "Blacksburg High School Evaluation, 1955-1956," (Unpublished report of the findings of a committee appointed by the Virginia State Department of Education, 1956), pp. 28, 33.

[2] Ibid., p. 33.

B) Virginia Polytechnic Institute

The services of Virginia Polytechnic Institute were found to be classified under three major headings: resident instruction, research, and extension. In addition to its facilities for classroom instruction, it provided headquarters for the Virginia Agricultural and Engineering Experiment Stations and the Virginia Agricultural Extension Service.[1]

At the time of this writing, there were three schools or colleges of resident instruction at Virginia Polytechnic Institute: Agriculture, Engineering, and Applied Science and Business Administration.[2] The school of engineering was the largest since it included about 60 per cent of the entire student body. In the three schools, some 32 different curriculums were being offered, each of which led to the degree of Bachelor of Science. Work toward the degree of Master of Science was offered in all the curriculums; also, toward that of Doctor of Philosophy, in some. The Institute was the largest institution of higher learning in Virginia.[3]

---

[1] Virginia Polytechnic Institute, Catalog, 1956 (Bulletin, XLIX, No. 4, Blacksburg, Virginia: Virginia Polytechnic Institute Printing Office, 1956), pp. 60-67; 257-261.

[2] Ibid., pp. 68-134.

[3] Clarence E. Lovejoy, Lovejoy's College Guide (New York: Simon and Schuster, 1956-1957), p. 237.

C) Schools of the Blacksburg District

At the time of this study, the elementary schools of the Blacksburg District included six public schools for white children, articulated with the Blacksburg High School. An additional elementary school was provided for Negro children which was associated with Christiansburg Institute, nearby in Montgomery County. Of the 49 classroom teachers[1] belonging to the respective elementary schools for white pupils, 39 held Collegiate Professional Certificates; one, Collegiate; three, Normal Professional; two, Elementary; one, a Local Permit; two, Emergency Licenses; and one, an unspecified certificate.

In addition to public facilities for education, there was a private school[2] in the Town of Blacksburg open to children in the sixth and seventh grades and taught by one teacher whose state of certification was not determined during this investigation.

The Blacksburg High School served the entire Blacksburg District; it was the only secondary school

---

1 Office records of the Montgomery County School Board, Christiansburg, Virginia.

2 Graf, op. cit., p. 38.

in that region and, during the 1956-1957 term, had an enrollment of 805 pupils who were served by 35 full-time teachers, one principal, and one assistant principal, who taught part-time.

Every member of the professional staff of the high school department was the holder of a Virginia certificate: two held Postgraduate Professional Certificates; 30, Collegiate Professional Certificates; and five, Collegiate Certificates. However, ten classroom instructors were teaching subjects which their certificates did not authorize them to teach.[1]

Of the instructional staff members who were not certified to teach mathematics, three were teaching eighth-grade arithmetic; two, ninth-grade general mathematics.

The mathematics teacher who conducted this experiment held a Collegiate Professional Certificate and was certified to teach mathematics in grades seven through twelve. Although she had been awarded a degree in education[2] and thus might be considered as informed

---

[1] R. T. Hale, Principal, Blacksburg High School, Unpublished Preliminary Annual High School Report to the Virginia State Department of Education, 1956-1957, p. 3.

[2] Refer to the Vita, p. 63.

concerning the various methods of teaching mathematics, she had, prior to the 1956-1957 school term, always resorted to a somewhat traditional method consisting largely of lectures and recitations. Therefore, she was inexperienced in the techniques of the highly individualized approach used in this study.

During the course of this investigation, it was found that the Blacksburg High School was certified as a "standard" high school by the Virginia State Department of Education, but was not affiliated with the Southern Association of Secondary Schools and Colleges. It appeared that the principal reasons for that lack of affiliation were as follows: the pupil-classroom ratio exceeded the maximum set by the Association; and the salary scale of beginning teachers in Montgomery County was below the minimum allowed by the Association for its member schools.[1]

Approximately 76 per cent of the enrollment of Blacksburg High School consisted of children from rural areas; about 68 per cent of the pupils were transported at school expense.[2]

---

[1] Telephone conversation held in July, 1958, with R. T. Hale, Principal, Blacksburg High School.

[2] Blacksburg High School Evaluation, op. cit., p. 30.

Data presented by Richards seemed to indicate that the better-educated parents of pupils in the high school tended to live closer to the school than did those having more limited schooling. Also, he found that there was a trend for more intelligent students to live near the school.[1]

Because data relative to the holding power of the school were deemed relevant to this study, information concerning withdrawals were gathered. Such data are supplied in Table I, together with the major reasons for pupils' withdrawing during the 1954-1955 and 1955-1956 sessions.[2]

---

[1] George G. Richards, Jr., "A Study of Certain High School Graduates in Relation to Their Elementary School Origins" (Unpublished Master's thesis, Virginia Polytechnic Institute, 1952), p. 41.

[2] Blacksburg High School Evaluation, op. cit., p. 25.

TABLE I

DISTRIBUTION OF FREQUENCIES OF PUPILS WITHDRAWING FROM THE BLACKSBURG, VIRGINIA, HIGH SCHOOL, DURING THE 1954-1955 AND 1955-1956 SCHOOL SESSIONS; ACCORDING TO MAJOR REASONS FOR WITHDRAWING

Reasons	Boys	Girls	Both	Per cents
Disciplinary difficulties	3	0	3	3.94
Entered military service	13	0	13	17.11
Financial reasons	0	0	0	0.00
Illness of pupil	0	3	3	3.95
Lack of interest in school	5	4	9	11.84
Marriage	0	6	6	7.90
Obtained work	2	3	5	6.58
Poor scholarship	4	3	7	9.21
Pupil's help needed at home	2	1	3	3.94
Transferred to another school	12	3	15	19.74
Unclassified	4	5	9	11.84
Unknown	2	1	3	3.95
Total	47	29	76	100.00

Table II presents data concerning the activities of the graduates belonging to the 1954-1955 senior class, Blacksburg High School, after leaving school. The information in this table was considered significant in view of the fact that, during their highschool careers, considerably more than half of the students enrolled in the Blacksburg High School were regarded as college-bound, and were pursuing college-preparatory studies; also, in the light of a finding to the effect that, within the memory of those in charge of the high school, no graduate who had ever applied for admission to college had been denied such entrance.[1]

---

[1] Blacksburg High School Evaluation, op. cit., pp. 26-27.

TABLE II

DISTRIBUTION OF FREQUENCIES OF MEMBERS OF THE 1955 GRADUATING CLASS, BLACKSBURG HIGH SCHOOL; ACCORDING TO THEIR RESPECTIVE POST-HIGHSCHOOL PURSUITS, DURING THE 1956-1957 SCHOOL TERM

Pursuits	Boys	Girls	Both	Per cents
Studying at college to earn bachelor's degree	24	25	49	51.04
Studying at school above the secondary level, other than the above	1	5	6	6.25
Doing professional, technical, or managerial work	0	5	5	5.20
Doing clerical and/or sales work	6	7	13	13.54
Doing service-type work, such as filling station attendants	3	0	3	3.13
Doing agricultural, marine, or forester's work	0	0	0	0.00
Doing mechanical work	0	0	0	0.00
Working as unskilled laborer	2	6	8	8.33
Homemaking (Married)	0	3	3	3.13
Unemployed	2	2	4	4.17
Unknown	0	5	5	5.21
Total	38	58	96	100.00

Sequential mathematics courses, at the time of this writing, were available in grades nine through twelve; however, only Eighth-Grade Mathematics was required of all students in the Blacksburg High School. The mathematics curriculum consisted of the following courses: Eighth-Grade Mathematics, General Mathematics, Commercial Mathematics, Beginning Algebra, Intermediate Algebra, Plane Geometry, Solid Geometry, and Trigonometry. In addition to meeting the eighth-grade requirement, each candidate for graduation from high school was required to earn one Carnegie unit in mathematics, which could be a credit in General Mathematics, Commercial Mathematics, or Beginning Algebra. Having an average of "C" in Eighth-Grade Mathematics was a condition for enrolling in Beginning Algebra in the ninth grade.

A total of 606 pupils were enrolled in mathematics courses during the 1956-1957 school year. They were distributed as follows: 248 in Eighth-Grade Mathematics; 60, General Mathematics; 74, Commercial Mathematics; 114, Beginning Algebra; 22, Intermediate Algebra; 56, Plane Geometry; 16, Solid Geometry; and 16, Trigonometry.[1]

---

[1] R. T. Hale, Principal, Blacksburg High School, Unpublished Preliminary Annual High School Report to the Virginia State Department of Education, 1956-1957, p. 3.

The Blacksburg High School was found to have certain guidance facilities which were used to counsel pupils in respect of their election of courses. Thus, those who showed competency in mathematics and needed mathematical skills and understandings in order to carry out their educational and vocational plans were encouraged to take additional work in that field in the ninth grade and beyond. However, it had been found that many capable students had shied away from mathematics for fear of receiving low marks in such courses, and had insisted on taking less rigorous studies in order to assure themselves of higher grades. Hence, the counselors and teachers found it difficult to overcome negative attitudes on the part of pupils, detrimental to their mathematic careers. On the other hand, certain pupils would frequently insist upon taking algebra and other advanced courses in mathematics who were known to be poorly endowed for such undertakings. In such cases, provisions were made for their reassignment to other mathematics courses when they and their parents had seen the desirability of their doing so.[1]

---

[1] Information obtained from Mrs. Virginia Hester, Guidance Director, Blacksburg High School, in a conversation, October, 1956.

A further finding, deemed relevant to this study, was to the effect that, while courses in chemistry and physics were available to pupils who might have specialized needs for such work, only a few would elect them. During the 1956-1957 term, there was one class each in chemistry and physics with respective enrollments of only 17 and 14.

* * * *

After making a study of the teaching-learning situation at the Blacksburg, Virginia, High School, with special regard for the work being pursued there in mathematics, consideration was given to certain plans for giving individualized instruction, in order to set up an experiment in the teaching of beginning algebra. Chapter III presents that phase of the investigation.

CHAPTER III

INDIVIDUALIZED INSTRUCTION: A BRIEF REVIEW OF THE WINNETKA AND DALTON PLANS; TOGETHER WITH A DESCRIPTION OF THE PLAN USED IN THIS STUDY

The purpose of this chapter is primarily that of orientation. Certain relevant information concerning individualized methods of instruction is reviewed; moreover, the plan employed in this study is discussed.

The Winnetka and Dalton Plans represent efforts to break out of the rigid instructional framework that had been forcing schools to treat all pupils as though they had the same abilities, interests and needs. Thus, each of those plans was designed to provide freedom for the pupil to progress at his own rate; also, to a limited degree, to emphasize studies within the area of the individual learner's interests and aptitudes.[1]

---

[1] I. N. Thut and J. Raymond Gerberich, Foundations of Method for Secondary Schools (New York: McGraw-Hill Book Company, Inc., 1949), p. 204.

A) The Winnetka System

According to Risk, the first public school system definitely to undertake the individual method of instruction was that of Winnetka, Illinois. The technique of teaching and learning which came to be known as the Winnetka System was put into effect there in 1919.

The point of view underlying the Winnetka System is expressed thus by Carleton Washburne:

> Those subjects which we want each child to master must be 'individualized'--- there is no other effective way of getting widely differing children to attain a common standard.[1]

The Winnetka System classifies such subjects as mathematics under the category, common essentials, a designation for those knowledges and skills deemed essential for every pupil to master. Furthermore, the System provides that progress in learnings of that nature shall be strictly in terms of the individual.[2]

In each subject, specific "goals" or units of achievement are established. Each pupil proceeds, unit by unit, irrespective of the progress of the

---

[1] Quoted by Thomas M. Risk, Principles and Practices of Teaching in Secondary Schools (New York: American Book Company, 1947), p. 424.

[2] Ibid., p. 424.

other pupils, as rapidly as he attains 100 per cent mastery of the work included in the respective units.[1]

Self-instructive practice exercises are prepared for each unit. Self-instructive and self-corrective teaching materials are a vital part of the Winnetka plan, because each student must, to a considerable degree, learn by himself. Diagnostic practice tests are prepared for each goal in case the pupil needs further help in restudying. Diagnostic mastery tests for each goal are available for subsequent testing, following restudy, if a pupil fails to pass the first mastery test. Assignment booklets are prepared for use with textbooks which have not been written for individual instruction.

Each pupil has a "goal" card on which is recorded the date of his completion of each goal he has reached. There are no grades, or school marks; either the goal has been reached or it has not. Progress in school is based upon achievement in the "common essentials."

The individualized study proceeds under the supervision of the teacher, who helps the individual pupil. However, the teacher may present a topic to an entire

---

[1] J. G. Umstattd, Secondary School Teaching, (Chicago: Ginn and Company, 1953), pp. 166-169.

class when such a procedure is considered economical. The pupil follows the printed instructions which the teacher gives him, in proceeding from goal to goal.

The pupil corrects his daily work according to written instruction, but the teacher checks the mastery tests. The progress of each pupil is carefully watched so as to provide him with necessary help and guidance in the process of learning and in budgeting his time.

B) The Dalton Plan

Under the Dalton Plan, often referred to as the contract plan, subjects like mathematics are designated as "major subjects".[1] There are laboratories equipped with the necessary materials, charts and books to further the work of a particular subject under consideration at any given time.

Each assignment covers a prescribed amount of work which is to be accomplished in one school month, representing one-eighth to one-tenth of the entire work of the school year.

---

[1] W. D. Reeve and Homer Howard, A Handbook On Student Teaching In Mathematics For Student Teachers and Their Supervisors (New York: Department of Mathematics, Teachers College, Columbia University, New York, 1947), p. 18.

Each unit of work has a carefully planned procedure for the pupils to follow: it includes work sheets, practice materials and check tests.[1] When the student completes a given unit, he takes a mastery test; if his performance on it is satisfactory, he proceeds to the next assignment.

The teacher's work under the Dalton Plan is in large part that of preparing the units of instruction or "contracts" and seeing to it that the subject-matter laboratories are equipped adequately for carrying on pupils' activities, as well as checking the mastery of each individual contract. The teacher also directs the pupils in their laboratory work or study.

C) The Individualized Unit Plan Used in This Study

The individualized unit plan which was employed in this investigation was a modified form of that used in the Winnetka System. Specific goals were established, related to successive topics in beginning algebra, and each pupil was directed to proceed, topic by topic, at his own rate of progress. Printed assignment sheets[2] for

---

[1] Gerald A. Yoakam and Robert G. Simpson, Modern Methods and Techniques of Teaching (New York: The Macmillan Company, 1949), p. 341.

[2] Refer to Appendix "A."

each topic were prepared for use with the state-adopted texts, which had not been written especially for individual instruction. Self-instructive practice exercises and diagnostic practice tests were available. Such devices, patterned along highly individualized lines, were regarded as crucial to this plan.

When a pupil had completed the work designated under one topic, he would submit to a teacher-made mastery test.[1] One hundred per cent mastery of each topic was required before he would be permitted to proceed to the next topic. Therefore, if a pupil failed the first mastery test, he would then restudy the topic, using additional exercises, and then report for subsequent testing following his restudying.

However, in a few cases, an exception would be made to the rule. If a very slow learner was unable to give evidence of having mastered a topic completely, after having taken at least three mastery tests in succession, he would then be permitted to proceed to the next topic.

Each pupil had a "goal" card[2] on which his progress was recorded. Since school marks or grades

---

[1] Refer to Appendix "B."

[2] Refer to Appendix "C."

were required by the school where this study was undertaken, each pupil was given a letter grade at the end of each six-week period and at the end of the semester. Such marks were based upon achievement and individual progress of the student.

The individualized study proceeded under the day-by-day supervision of the teacher. At times she would help individual pupils and at other times would present a topic to the entire class when such a procedure was considered economical. Often verbal or written explanations were made to small groups of pupils who were ready for a new topic of study. The pupils followed the printed instructions in proceeding from topic to topic.

The pupils checked their daily work; the teacher checked only the mastery tests. The progress of each pupil was watched carefully in order that each one might receive the necessary help and proper guidance in learning and in budgeting his time.

CHAPTER IV

THE NATURE OF THE EXPERIMENT AND THE DATA ELICITED THEREFROM

As was stated in the introductory chapter, this investigation was an attempt to secure information relative to the effectiveness of two distinct patterns of instruction in beginning algebra. Hence, this present chapter presents the nature of the experimental situation, the method of attack, and the findings which resulted from the investigation.

A) The Subjects of the Study

This study, conducted in the Blacksburg, Virginia, High School, over a period of nine months from September, 1956, to June, 1957, had as its subjects certain pupils who comprised three sections of the course, Beginning Algebra; all taught by the person making this study. Two of the classes were scheduled for the first two periods of the school day, beginning at 9:10 a.m. and 10:05 a.m., respectively; and the third for the last period, commencing at 2:20 p.m.

Of the 67 pupils in the three sections under consideration, 53 were classified as ninth graders;

12, tenth graders; one, an eleventh grader; and one, a twelfth grader. All of the pupils belonging to the ninth grade and three others were studying algebra for the first time. However, the remaining 11 pupils had studied beginning algebra previously and were repeating the course at the time of the experimentation.

In order to form some notion regarding the mentality of the pupils, their intelligence quotients were obtained from permanent records on file in the highschool office. Thus, it was found that their I. Q.'s ranged from 69 to 126 and had an arithmetic mean of 109. The percentile ranks of the pupils' scores of tests measuring the reading abilities also were procured from their permanent records, and were found to range from seven to 100 and to have an arithmetic mean of 70.58.[1]

B) The Two Periods of Instruction, Traditional and Individualized, Respectively, Provided for the Subjects

The pupils of the three beginning algebra sections received traditional instruction during the first semester of the school year, beginning in September,

---

[1] A table showing the percentile ranks of the pupils' scores on reading tests appears in Appendix "D."

1956, and ending in January, 1957. The teaching-learning techniques used consisted principally of lectures, explanations, recitations, out-of-class assignments, quizzes, and a final semester examination.

During the second semester, which began in January, 1957, and ended in June, 1957, the same three groups of pupils were taught in accordance with the modified form of the Winnetka System, which is discussed in Chapter III.

A basic beginning algebra textbook[1] which had been used by the mathematics teachers of Blacksburg High School for a number of years was employed during both periods of instruction.

C) Instruments Used to Measure Subjects' Achievement

In order to obtain data concerning the achievement of the pupils during the two periods, it was deemed desirable to use valid and reliable measuring instruments. Those selected were the Iowa Algebra Aptitude Test, the Seattle Algebra Test, and the Lankton First-Year Algebra

---

[1] Walter W. Hart, A First Course In Algebra (Boston: D. C. Heath and Company, 1947).

Test; the first named for the purpose of predicting the achievement of beginning students, the second to measure their achievement after one semester's instruction, and the third to measure achievement after two semesters' teaching.

The reliability of the Iowa Algebra Aptitude Test was given by the publishers of the instrument as .87. Two validity coefficients were given (.66 with algebra grades and .76 with the Columbia Research Bureau Algebra Test), as well as intercorrelations and validities for two other unidentified "prognostic tests" which, according to Buros, had a lower validity.[1]

As for the second test, the Seattle Algebra Test, Durost states that, in selecting material for its final form, consideration had been given not only to statistical evidence concerning suitable difficulty and validity, but also to the construction of a test which would represent a balanced coverage of objectives. Inasmuch as this test is essentially a power test, its reliability coefficient of .89, reported by the publishers, was regarded as a good indication that the instrument was both reliable and valid.[2]

---

[1] Oscar Krisen Buros, The Fourth Mental Measurement Yearbook (Highland Park, New Jersey: The Gryphon Press, 1953), p. 396.

[2] Walter N. Durost, General Editor, Manual of Directions, Seattle Algebra Test (Yonkers-on-Hudson: World Book Company, 1951), p. 2.

The Lankton First-Year Algebra Test, the third instrument used, appeared to be well balanced with respect to content, coverage of objectives, item difficulty, and item validity. Corrected split-half reliability coefficients of .87 and .84 indicated that the reliability of this test was at least moderately high.[1]

At the opening of the school session in September, 1956, the Iowa Algebra Aptitude Test was administered to the pupils in the three sections of Beginning Algebra, in order to measure the algebraic capabilities or aptitudes of the students under consideration, before beginning the period of traditional instruction.

At the end of the period of traditional instruction, and before commencing the individualized phase of the experiment, the pupils were given the Seattle Algebra Test. Then, at the conclusion of the experimental period, they were given the Lankton First-Year Algebra Test. As has been stated, those tests were designed to measure progress and achievement in first-year algebra at the end of the first half year and at the end of the full year, respectively.

---

[1] Buros, op. cit., p. 394.

D) Findings Resulting From Use Of Measuring Instruments

In order to make inferences concerning the outcomes of the two kinds of instruction provided for the subjects of this study, the data were obtained from three measuring devices, listed above, and treated statistically. Next, the mean, median, and standard deviation of the pupils' scores on each of the three tests were computed; also the standard error of the mean. Furthermore, the following Pearson product-moment coefficients of correlation were computed: (1) between the scores resulting from administering the Iowa Algebra Aptitude Test and those from the Seattle Algebra Test; and (2) between the scores from the Seattle Algebra Test and those from the Lankton First-Year Algebra Test.[1] The results of those computations appear in Tables III and IV. As an additional aid to studying the three sets of test scores, graphical representations were made of their respective percentile ranks, in the form of frequency polygons plotted on the same axes, which appear herewith on p. 37. The actual data resulting from administering the tests appear in Appendix "D."

---

[1] Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Company, 1953), pp. 32-34; 36-39; 52-54; 134-139; 182-183.

TABLE III

MEANS, STANDARD ERRORS OF MEANS, MEDIANS, AND STANDARD DEVIATIONS OF PERCENTILE RANKS OF SCORES MADE BY CERTAIN BLACKSBURG, VIRGINIA, HIGH SCHOOL PUPILS ON THE IOWA ALGEBRA APTITUDE, SEATTLE ALGEBRA, AND LANKTON FIRST-YEAR ALGEBRA TESTS, RESPECTIVELY, DURING THE 1956-1957 SCHOOL YEAR

Test	Mean	Standard Error of Mean	Median	Standard Deviation
Iowa Algebra Aptitude	55.53	2.75	59.25	22.50
Seattle Algebra	32.82	2.75	29.08	22.50
Lankton First-Year Algebra	38.57	3.24	38.25	26.50

TABLE IV

COEFFICIENTS OF CORRELATION BETWEEN PERCENTILE RANKS OF SCORES MADE ON CERTAIN TESTS ADMINISTERED TO BLACKSBURG, VIRGINIA, HIGH SCHOOL PUPILS DURING THE 1956-1957 SCHOOL YEAR; SHOWN IN CONJUNCTION WITH DIFFERENCES BETWEEN MEANS OF PERCENTILE RANKS, STANDARD ERRORS OF DIFFERENCES, AND OTHER INTERPRETIVE DATA

Tests Correlated	Coefficient of Correlation ($\underline{r}$)	Confidence Level of $\underline{r}$	Difference Between Means (D_m)	Standard Error of Difference ($S.E._D$)	Critical Ratio (C. R.) ($D_m/S.E._D$)	Confidence Level of C. R.
Iowa Algebra Aptitude and Seattle Algebra Tests	0.649	0.01	22.71	3.89	5.84	0.01
Seattle Algebra and Lankton First-Year Algebra Tests	0.711	0.01	5.75	4.25	2.48	0.02

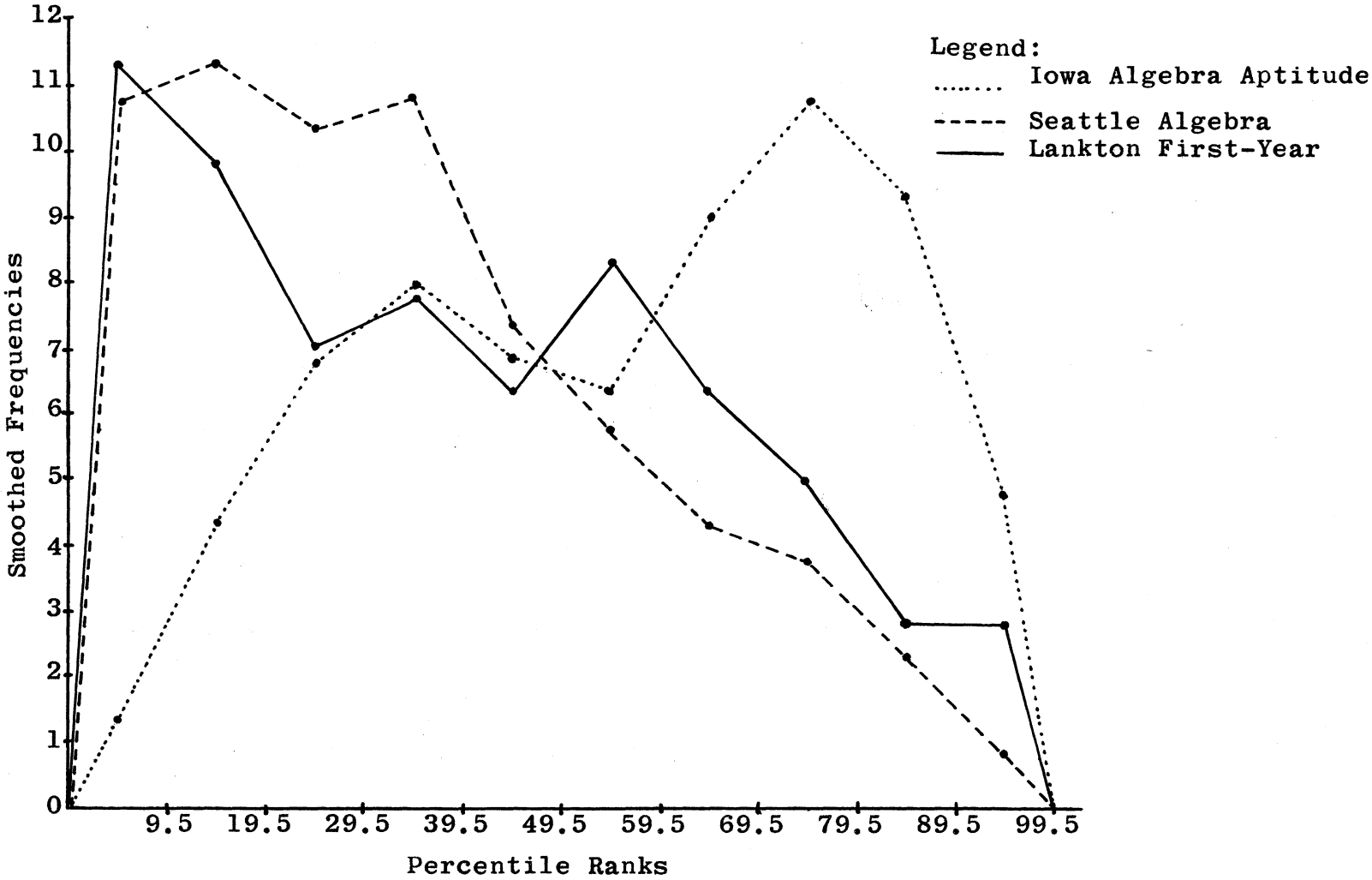

FIG. 1 - Smoothed Frequency Polygons Showing Distributions of Percentile Ranks Corresponding to Certain Pupils' Scores on Three Tests

When the data obtained from the three tests were studied, it was observed that the percentile ranks of pupils' scores resulting from taking the Iowa Algebra Aptitude Test tended to be somewhat above the national norm; that the mean and median of their percentile ranks were 55.53 and 59.25, respectively.[1] However, during the period of so-called traditional instruction, the subjects of this investigation did not measure up to the prognosis resulting from taking the aptitude test. After a semester of such teaching, their Seattle Algebra Test scores, converted to percentile ranks, had a mean of 32.82 and a median of 29.08. On the other hand, after a semester of individualized instruction the mean and median of their percentile ranks of Lankton First-Year Test scores were 38.57 and 38.25, respectively. Thus, it appeared that their achievement was considerably nearer the national norm at the end of the year than it was at the end of the first semester.

In order to use statistical techniques for the comparison of test results, the difference between the respective means of test scores were divided by the

---

[1] The mean of percentile ranks of scores used in setting up norms for this test would, of course, be 50.

standard error of that difference. The resulting quotient was then used as a measure of the significance of the difference.[1]

The difference between the means of percentile ranks obtained from the Iowa Algebra Aptitude and Seattle Algebra Tests was observed to be 22.71, which was found to be significant at the .01 level of confidence; moreover, the difference between the means of percentile ranks on the Seattle Algebra and Lankton First-Year Tests was 5.75, which was viewed as significant at the .02 level of confidence.[2]

As already stated, two coefficients of correlation were computed, in order to determine (1) the relationships existing between the percentile ranks of the pupils on the aptitude test and on the first achievement test given, and (2) between their ranks on the two achievement tests. Thus, the coefficient of correlation between the Iowa Algebra Aptitude Test percentile ranks and those of the Seattle Algebra Test was 0.649; the coefficient of correlation between

---

[1] Henry E. Garrett, op. cit., pp. 52-54; 61; 182-185; 213-216; and 225-228.

[2] Ibid., pp. 213-217; 427.

the Seattle Algebra and Lankton First-Year Algebra Tests was 0.711. Both were regarded as highly significant since they were found to be at the 0.01 level of confidence.[1]

* * * *

In the following chapter the meaning of the findings will be interpreted, and inferences drawn.

---

[1] Henry E. Garrett, Statistics in Psychology and Education (New York: Longmans, Green and Company, 1953), pp. 199-201.

CHAPTER V

SUMMARY AND INTERPRETATION OF FINDINGS

In general, the findings resulting from this study seemed to support the following statement by Stokes:

> The simultaneous development of educational psychology and educational tests furnishes the accumulation of a fund of information on the differences that exist among individuals in abilities, capacities, and interests. Experimentation has shown that the needs of pupils differ in the kind of instruction and the amount of drill required for mastery of fundamentals.[1]

* * * *

To recapitulate, it may be said that this study constitutes an effort to test the efficacy of a pattern of teaching based squarely upon a recognition of the differences to be found among pupils, by comparing such a method with more commonly encountered classroom approaches to learning which make little provision for the varying needs of individuals. Thus, in the foregoing chapters, the teaching techniques

---

[1] Claude Newton Stokes, Instruction in Ninth-Grade Mathematics (New York: Henry Holt and Company, 1931), p. 118.

used during two semesters of a certain school year have been described and certain findings have been noted, related to the problem under investigation. The present chapter is an attempt to interpret the meaning of those findings and to draw inferences regarding the comparative effectiveness of two patterns of teaching mathematics.

A) The Nature of the Findings

The data presented in Chapter IV indicate differences in favor of the individualized instruction used, deemed worthy of consideration. It appeared, from a study of the graphical representation of the frequency distributions of the pupils' percentile ranks derived from test scores, that the pupils achieved greater results from the individualized instruction given them than from the traditional approach. According to the frequency polygons presented on p. 37, a greater number of pupils made higher scores on the achievement test administered at the end of the period of individualized instruction than was the case respecting their scores on the test administered at the end of the period of traditional instruction. A reference to the graph revealed a massing of frequencies,

in the case of the test given at mid-term, at the low end of the scale, whereas the frequencies belonging to the test given at the end of the second semester were seen to be more normally distributed.

In contrast with the distributions to which reference has just been made, it was noted that the ranks corresponding to scores obtained from administering the aptitude test at the beginning of the year were massed at the high end of the scale. Thus, the graph portrays in striking manner the differences in the results obtained from giving the two achievement tests in respect of those obtained from the aptitude test. Apparently, the pupils did not progress in accordance with their algebraic abilities, as predicted by the Iowa Algebra Test, during either of the two semesters under study.

The achievement test ranks indicated that pupils having very low aptitudes for algebra progressed but little during both periods of instruction, whereas those pupils whose aptitude was found to be superior made greater progress during the second period of instruction than during the first. In connection with those findings, it was recalled that the achievement tests were given in order of difficulty and according to the advancement level of the pupils. In other words, the Seattle Algebra Test was designed for pupils

who has just completed one semester of algebra; the Lankton First-Year Algebra Test, for those who had finished two semesters. Therefore, a pupil whose ranks on both tests were the same would nevertheless have given evidence of having made a full semester's progress in algebra.

From data previously presented in this report, it was seen that the mean of the aptitude test percentile ranks was significantly greater than that belonging to ranks resulting from the first achievement test, given at the end of the period of traditional instruction. Statistically speaking, its significance was found to be at the .01 level of confidence. Therefore, the null hypothesis[1] was rejected on the ground that not more than once in 100 trials would a difference of that size have occurred if the true difference between means were zero.[2] In other words, the scores on the aptitude test and those on the first achievement test given, while highly correlated, were nevertheless significantly different.

---

[1] According to Henry E. Garrett, op. cit., pp. 213 and 247, the null hypothesis asserts that the true difference between two statistics is zero, and that whatever difference may be found between any such two is, therefore, accidental and irrelevant.

[2] Henry E. Garrett, op. cit., p. 217.

A further observation, relative to the aptitude test and the first achievement test, was to the effect that the mean of the percentile ranks corresponding to the aptitude scores was somewhat above the national norm while the mean of percentile ranks for the achievement scores was considerably below. At the same time, it seemed evident that the mean of the percentile ranks of the scores from the second achievement test was significantly greater than that of the ranks belonging to the first achievement test. That view was supported by a finding to the effect that the critical ratio of the difference[1] was such that in only two out of 100 instances would critical ratios as large as that found be likely to occur were the true difference equal to zero.

In respect of the two coefficients of correlation reported in Table IV, there seemed to be indication of considerable interdependence between the pupils' algebra aptitude and their achievement in algebra during the first semester; also between their achievement during the first and second semester, respectively. In both cases the null hypothesis[2] was rejected, since it

---

[1] Refer to Table IV on page 36.

[2] Henry E. Garrett, op. cit., pp. 200-201.

appeared that only once in 100 trials would a coefficient of correlation as large as either of those computed be likely to arise from chance.

After establishing the significance of the findings, as indicated in the foregoing paragraphs, consideration was given to the broader implications of the study. When that was done, it seemed that whatever interpretations might be made of its findings would have to be subject to the following considerations:

(1) This undertaking constitutes only a small part of the over-all evaluation of methods of teaching mathematics in the secondary school which need to be made.

(2) The findings from this study are indicative rather than conclusive, due to the manner in which it was set up.

(3) Even though its findings may point to various truths, it still leaves unsolved many problems relevant to the teaching of algebra.

(4) Although this study may point to some redirection of mathematics teachers' efforts, it does not support a categorical claim to the effect that the individualized pattern of instruction is the correct type.

(5) The inexperience of the teacher in the techniques of highly individualized instruction may have

impeded the achievement of the pupils during the second period; on the other hand, her four years of experience with traditional techniques may have enhanced the effectiveness of the approach she made during the first period.

However, despite the limitations inherent in these findings, it seemed safe to make the following statements:

B) Statements Relative to the Findings

1. The percentile ranks corresponding to the aptitude scores tended to be somewhat above national norms. Thus, it seemed that, other things being equal, the so-called traditional teaching done in connection with the study could be regarded as ineffective; as conducive to the tendency of pupils' scores to fall below national standards, when tested at mid-term.
2. Pupils having low aptitudes for algebra progressed very slowly during both periods of instruction; while those pupils possessing superior aptitudes for algebra made more progress during the second period of instruction than during the first.

3. The results of administering the second achievement test, at the close of the period of highly individualized instruction, seemed to give evidence to the effect that all pupils except those having very little aptitude for algebra had made considerable progress during that time.
4. The pupils appeared to have achieved more nearly in accordance with national norms when subjected to an individualized pattern of teaching than they did when taught in a traditional manner.

In view of these four statements, it was inferred that, in respect of beginning algebra, a pattern of teaching involving a highly individualized approach is probably more conducive to children's learning than is a pattern of teaching organized along lines of lectures, recitations, and tests, all conducted in terms of groups.

C) Recommendations

1. Individual differences in respect of ability to achieve and of best ways of learning exist among pupils, even among those who seem to be equally well endowed mentally. Such differences should be recognized in the organization of instruction, especially in the field of algebra, so that success for each pupil may be facilitated.

2. Differences in pupils' rates of learning exist to such an extent that provision should be made in classroom procedures to encourage each individual to proceed at his maximum rate.
3. Those pupils who are capable of doing more than the prescribed amount of work in one year should be motivated to do special or advanced work in algebra, not merely to work more and more mathematical exercises.
4. In order that the teaching of algebra may be more nearly adapted to the individual needs of the pupils, attempts should be made to organize classes in that subject in as homogeneous a manner as possible; furthermore, those pupils with very low mathematical abilities should be steered away from algebra and encouraged to pursue other mathematical studies better suited both to their capacities and needs.
5. Further studies should be made to test the relative merits of group and individual instruction in secondary mathematics.

ACKNOWLEDGEMENTS

For whatever merit this study may possess, the author is deeply indebted and sincerely grateful to Homer Howard, Professor of Philosophy and Education, Radford College, for his unstinted assistance, constructive criticism and worthy guidance in the planning and execution of the entire experiment. She is also grateful to Robert Nixon Pendergrass, Associate Professor of Mathematics, Radford College, for statistical advice and for suggestions as to possible interpretations of data.

She wishes to express her appreciation to Raynard T. Hale, Principal of Blacksburg High School, for the privilege of conducting the experiment in that school and for his cooperation in supplying needed information; also, to Charlotte Sowers, Clerk of the Montgomery County School Board, for supplying certain useful data.

Finally, she is chiefly indebted to her parents, Greene T. and Ocie E. Keith, for their unerring encouragement, forbearance and understanding throughout the undertaking.

BIBLIOGRAPHY

"Blacksburg High School Evaluation, 1955-1956," Unpublished report of the findings of a committee appointed by the Virginia State Department of Education, 1956.

Buros, Oscar Krisen. The Fourth Mental Measurement Yearbook. Highland Park: The Gryphon Press, 1953.

Durost, Walter N., General Editor. Manual of Directions: Seattle Algebra Test. Yonkers-on-Hudson: World Book Company, 1951.

Evaluative Criteria, Section D-11, Mathematics. Washington: Cooperative Study of Secondary-School Standards, 1950.

Garrett, Henry E. Statistics in Psychology and Education. New York: Longmans, Green and Company, 1953.

Graf, Gwendolyn M. "A Study of the Implications for Education of Patterns of Family Living Found in the Blacksburg, Virginia, Community," Unpublished Master's project, Virginia Polytechnic Institute, 1955.

Hale, R. T., Principal. Preliminary Annual High School Report. An unpublished report submitted to the State Department of Education. Blacksburg: Blacksburg High School, 1956-1957.

Hart, Walter W. A First Course in Algebra. Boston: D. C. Heath and Company, 1947.

Lovejoy, Clarence E. Lovejoy's College Guide. New York: Simon and Schuster, 1956-1957.

Office Records. Blacksburg High School, Blacksburg, Virginia.

_____. Montgomery County School Board, Christiansburg, Virginia.

Reeve, W. D., and Howard, Homer. A Handbook on Student Teaching in Mathematics for Student Teachers and Their Supervisors. New York: Columbia University, 1947.

Richards, George G., Jr. "A Study of Certain High School Graduates in Relation to Their Elementary School Origins," Unpublished Master's thesis, Virginia Polytechnic Institute, 1952.

Risk, Thomas M. Principles and Practices of Teaching in Secondary Schools. New York: American Book Company, 1947.

Stokes, Claude Newton. Instruction in Ninth Grade Mathematics. New York: Henry Holt and Company, 1931.

Thut, I. N., and Gerberich, J. Raymond. Foundations of Method for Secondary Schools. New York: McGraw-Hill Book Company, Inc., 1949.

Umstattd, J. G. Secondary School Teaching. Chicago: Ginn and Company, 1953.

Virginia Polytechnic Institute Catalog. Bulletin, XLIX No. 4, Blacksburg, Virginia: Virginia Polytechnic Institute Printing Office, 1956.

Virginia State Board of Education. Certification Regulations for Teachers and Qualifications for Administrators and Supervisors. Vol. XXXIII No. 1. Richmond: State Department of Education, 1950.

Washburne, Carleton W., Vogel, Mabel, and Gray, William S. A Survey of the Winnetka Public Schools. Bloomington: Public School Publishing Company, 1926.

Yoakam, Gerald A., and Simpson, Robert G. Modern Methods and Techniques of Teaching. New York: The Macmillan Company, 1949.

APPENDICES

APPENDIX "A"

(Assignment Sheet)

EQUATIONS OF THE FIRST DEGREE
(Two Unknowns)

All references are to Hart, Walter W., A First Course In Algebra. Boston: D. C. Heath and Company, 1947.

A. Two Unknowns
   1. Study page 162 and page 165.

B. Mathematical Graphs
   1. Study pages 163 and 164.

C. Preparation for Graphical Solution
   1. Study page 166.

D. Vocabulary of Mathematical Graphs
   1. Do exercises 1-10 on page 167.*

E. The Graph of an Equation
   1. Study page 168.

F. Short Way to Draw a Graph
   1. Do exercises 1-18 on page 169.

G. A Pair of Linear Equations
   1. Study page 170.

H. Graphical Solution of Two Equations
   1. Do exercises 1-12 on page 171.

I. Computing the Solution
   1. Study page 172.

J. Elimination by Addition or Subtraction
   1. Do examples 1-20 on page 173.

K. The Standard Form
   1. Do examples 1-18 on page 174.

L. Elimination by Substitution
   1. Do examples 1-18 on page 175.

APPENDIX "A"
(Continued)

M. Problems Having Two Unknowns
   1. Form the necessary equations and then solve problems 1-21 on pages 176 and 177.

N. Problems About Mixtures
   1. Do problems 1-6 on pages 178 and 179.

O. Our Whole Numbers
   1. After studying page 180, do exercises 1-9 on pages 180 and 181.

P. Miscellaneous Problems
   1. Form the necessary equations and then solve problems 1-22 on pages 182 and 183.

Q. The Formula for a Table
   1. Do exercises 1-13 on pages 184 and 185.

R. Dependent and Inconsistent Equations
   1. After studying page 186, do exercises 1-3 on that page.

S. The Relation $y = ax$
   1. After studying page 187, do the two exercises at the bottom of the page.

T. Review of Two Unknowns
   1. Do exercises 1-13 on page 188.

U. Tests on Two Unknowns
   1. Do "Test on Computation" on page 189.
   2. Do "Test on Problems" on page 189.

V. Short-Answer Review
   1. Do exercises 1-22 on page 190.

W. Written Review
   1. Do exercises 1-15 on page 191.

---

* Pupils who could grasp the algebraic concepts with a limited amount of drill were not required to do all exercises.

APPENDIX "B"

(Mastery Test)

EQUATIONS OF THE FIRST DEGREE
(Two Unknowns)

Beginning Algebra Test A*

I. Solve algebraically:

1. $x - 2y = 3$
   $3x + 2y = 17$

2. $r = 2s$
   $r + s = -6$

II. Form the necessary equations and then solve:

1. How many pounds of 56-cent candy and how many pounds of 42-cent candy must be used to make a mixture of 35 pounds to sell at 50¢ a pound?

2. The sum of the digits of a two-digit number is 8. If 36 is subtracted from the number, the digits are reversed. What is the number?

3. The difference between two numbers is 16. The larger number is 5 less than 4 times the smaller. Find the numbers.

III. Find the formula connecting y and x in the following table:

x	=	-4	-2	0	2	4
y	=	5	6	7	8	9

IV. Graph the following pairs of equations and tell whether they are simultaneous, inconsistent, or dependent. Find the solutions of those pairs which are simultaneous.

1. $x - y = 7$
   $x - y = 3$

2. $3x - 2y = 4$
   $6x - 4y = 8$

3. $3x - y = 9$
   $x + 2y = 10$

---

* Test Forms "B" and "C" were available for those pupils who did not obtain 100 per cent mastery on Form "A."

APPENDIX "B"
(Continued)

V. On one set of axes, draw the graph of the following and give the slope of each graph:

1. $y = 4x$

2. $y = -4x$

APPENDIX "C"

(Goal Card)

Pupil Bg-44

Topic	Mastery Test A	Mastery Test B	Mastery Test C
EQUATIONS OF THE FIRST DEGREE (One Unknown)	63%	100%	
EQUATIONS OF THE FIRST DEGREE (Two Unknowns)	100%		
PRODUCTS AND FACTORING (Quadratic Equations)	100%		
ALGEBRAIC FRACTIONS	100%		

Comments:

APPENDIX "D"

READING, APTITUDE AND ACHIEVEMENT SCORES

Pupils	Iowa Silent Reading Test	Iowa Algebra Aptitude Test	Seattle Algebra Test	Lankton First Year Algebra Test
Ab-1 *	93	38	40	44
Ab-2	97	72	40	40
Ab-3	18	17	Below 1-	0
Ab-4	96	80	48	69
Ab-5	**	75	48	28
Ab-6	42	20	1-	1-
Ab-7	99	87	77	69
Ab-8	72	42	19	10
Ab-9	**	76	19	2
Ag-10*	72	70	33	28
Ag-11	64	63	21	40
Ag-12	66	44	30	16
Ag-13	50	60	30	31
Ag-14	56	40	33	21
Ag-15	56	70	19	2
Ag-16	82	55	48	35
Ag-17	90	68	64	93
Ag-18	97	84	64	61

APPENDIX "D"
(Continued)

Ag-19	75	58	11	31
Ag-20	69	34	8	24
Ag-21	90	70	40	61
Ag-22	30	46	21	16
Ag-23	69	17	11	13
Ag-24	48	28	30	16
Ag-25	97	78	74	77
Ag-26	91	91	36	69
Bb-27*	42	70	56	57
Bb-28	48	36	33	44
Bb-29	42	32	21	16
Bb-30	39	48	13	1
Bb-31	100	70	60	61
Bb-32	**	87	16	65
Bb-33	77	53	44	77
Bb-34	22	34	4	40
Bb-35	30	27	8	21
Bb-36	66	84	52	92
Bb-37	99	87	25	65
Bb-38	39	65	40	6
Bg-39*	66	19	21	35
Bg-40	80	32	8	6
Bg-41	91	68	64	44

APPENDIX "D"
(Continued)

Bg-42	7	17	8	13
Bg-43	91	50	21	65
Bg-44	99	90	77	90
Bg-45	66	44	86	40
Bg-46	69	53	25	6
Bg-47	82	73	44	44
Bg-48	91	83	81	73
Bg-49	95	72	33	65
Cb-50*	98	84	71	69
Cb-51	86	72	52	92
Cb-52	82	70	21	21
Cb-53	91	23	4	8
Cb-54	80	46	25	53
Cb-55	88	84	71	57
Cb-56	98	73	56	73
Cb-57	11	27	25	16
Cb-58	53	21	21	28
Cb-59	37	27	4	28
Cg-60*	80	27	4	4
Cg-61	50	28	1	6
Cg-62	86	44	8	2
Cg-63	94	79	25	57

APPENDIX "D"
(Continued)

Cg-64	90	73	25	48
Cg-65	61	32	11	8
Cg-66	97	80	36	48
Cg-67	61	68	21	31

* "A", "B", and "C" signify the sections of algebra students; "b" and "g" signify "boy" and "girl", respectively; and the numeral denotes the number assigned to the individual pupil.

** Data unavailable.

The two page vita has been removed from the scanned document. Page 1 of 2

The two page vita has been removed from the scanned document. Page 2 of 2

A COMPARATIVE STUDY OF THE RESPECTIVE OUTCOMES STEMMING FROM TWO DISTINCT PATTERNS OF MATHEMATICS TEACHING

an

Abstract of a Thesis Presented by

VIRGIE IRENE KEITH

to the

Graduate Faculty

of the

Virginia Polytechnic Institute

in

Candidacy for the Degree of

MASTER OF SCIENCE

in

EDUCATION

August, 1958

KEITH, VIRGIE IRENE, A COMPARISON OF THE OUTCOMES OBTAINED FROM USING TWO DISTINCT PATTERNS OF MATHEMATICS TEACHING. Thesis, M. S., 1958. Virginia Polytechnic Institute. Pp. 64. Library, Radford College, Woman's Division, Virginia Polytechnic Institute, Radford, Virginia.

Purpose: To make a comparison of two distinct patterns of teaching mathematics in the Blacksburg, Virginia, High School; one pattern based on the Winnetka System involving a highly individualized approach, the other organized according to a more traditional plan consisting largely of lectures and recitations.

Method: Three groups of pupils in beginning algebra were selected and given the Iowa Algebra Aptitude Test at the beginning of the 1956-1957 school term. All three sections were taught in a traditional manner during the first semester of that term, after which the Seattle Algebra Test was administered, in order to discover the amount of progress the pupils had made since the beginning of the term. During second semester, all three sections were taught in accordance with the Winnetka pattern, and were given the Lankton First-Year Test at the end of that period of time.

A comparison of the respective outcomes obtained from the traditional and the Winnetka patterns was then drawn on the basis of the progress made in algebra by the pupils in the three sections under the two kinds of instruction, as revealed by the tests.

Findings and Interpretations: After the test data had been tabulated and interpreted statistically, it appeared that the pattern of teaching which involved a highly individualized approach was considerably more effective than the pattern of teaching which was organized on along traditional lines; that in beginning algebra, pupils made more progress when working independently than when they were being taught as a group.