METHODS AND MATERIALS OF A MATHEMATICS PROGRAM FOR THE DISADVANTAGED AND UNDERACHIEVING CHILD

Thesis for the Degree of Ed. D.

MICHIGAN STATE UNIVERSITY

E. Leona Hall

1966

This is to certify that the

thesis entitled

METHODS AND MATERIALS OF A MATHEMATICS PROGRAM FOR THE DISADVANTAGED AND UNDERACHEVING CHILD

presented by

E. Leona Hall

has been accepted towards fulfillment
of the requirements for

Ed.D. degree in Education

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Major professor

Date September 23, 1966

ABSTRACT

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by E. Leona Hall

Statement of the Problem

In general terms the purpose of this study was to learn more about the disadvantaged child. Specifically the purposes were: (1) to determine if the "concept" method of instruction is effective in mathematics with disadvantaged and underachiving children; (2) to learn if attitudes toward mathematics could be significantly changed in a positive direction; and (3) to explore the relationship between achievement in and attitudes toward mathematics.

Procedures

Ninety-seven children from the greater Saginaw area were identified as disadvantaged and underachieving by their classroom teachers in the spring of 1965. These children were given a summer camp experience through the cooperative efforts of the Michigan Department of Classroom Teachers, the Michigan Education Association, and the Organization of Economic Opportunity. The camp was held at St. Mary's Lake at Battle Creek, Michigan, and extended for five weeks du

the summer of 1965. The dates of the experience were from June 27 to July 31. The ages of the children included those 8 through 12.

For the mathematics experience, upon which this study is based, the children were divided into four groups--two fourth-grade groups and two fifth-grade groups. The writer served as instructor for all four groups. Classes were held daily five days per week and were one hour in length. The first two days of class time were spent on a testing program. The last two days were spent in follow-up testing. Thus the actual instruction covered one full month or four weeks, which represented twenty hours of actual class time.

The children were given the Peabody Picture Vocabulary Test to determine their mental ages and IQ's. The whole battery of the California Achievement Test was also administered. The Iowa Basic Skills, Form I, A-1 and A-2, was used as the pre-test tool for this study to determine levels of ability in those areas that A-1 and A-2 measure; namely, arithmetic concepts and arithmetic problem solving ability. Dutton-Adams Attitude Scale was administered to determine the individual attitudes toward numbers. A card file was kept to permit compilation of pertinent data such as--least liked subjects, number of siblings, status of the home (such as broken), etc.

On the third day of the camp experience actual instruction began. The children made their own textbooks as the class progressed and instruction followed the "concept" method insofar as possible. As each concept was presented a follow-up activity was planned to reinforce that concept. Extensive use was made of models and aids as well as of the total camp environment in the arithmetic program.

In the final two days, devoted to follow-up testing, the Iowa Basic Skills, Form III, A-1 and A-2 was given to the total group. The same Dutton-Adams Attitude Scale was administered to measure any changes in attitude.

In March of 1966, after the children had been in their regular classrooms for six months, a random sample of 30 children was drawn from a random table and these pupils were again tested. Form I of the Iowa was repeated and also the attitude scale. The random population represented thirty-seven per cent of the total group as the actual number in the experiment was eighty-two. The remaining fifteen had to be rejected because of severe retardation, sickness, early departure from camp, and other reasons less pertinent to this study.

Of the total group in this study thirty-seven were Negroes, thirty-two were Caucasians, and thirteen were of Mexican-Spanish descent. Forty-two were below the twenty-

percentile rank in arithmetic; sixty-three were below grade level; and IQ's ranged from 68 to 145.

Findings

The specific findings of this study--those related to the specific objectives--were interpreted in terms of the following hypotheses:

H_1 Disadvantaged and underachieving children will respond in a positive manner to the "concept" method of instruction in mathematics as evidenced by gains on an achievement test.

H_2 Disadvantaged and underachieving children will tend to show a positive change in attitude as a result of the influence of careful attention to method (concept) and materials as evidenced by a positive change on an attitude scale.

H_3 Disadvantaged and underachieving children will tend to show a positive relationship between attitude toward mathematics and achievement in mathematics.

Other findings in this study were simply conclusions reached after careful examination of the data. These data related to the writer's desire to learn more about the disadvantaged child and may be classified as general information.

The first hypothesis proved true for the fifth grade both in immediate gains and long term gains. The concept method did not appear to be effective for the fourth graders in short term goals; however, the data suggest a possible benefit after several months.

The second hypothesis, dealing with attitudes, proved valid with both fourth- and fifth-graders. After having returned to their regular classrooms for six months, 44% of the fourth graders ranked themselves higher than they had previously on the attitude scale; 12% held their scores to the last testing level; and 44% rated themselves at a lower level, indicating a less positive feeling or liking for arithmetic. Of the fifth graders, 57% continued to improve in attitude after being in regular classrooms; 14% held at the last testing level or end of camp experience; and 29% regressed to a lower level of rating attitude.

The third and last hypothesis, dealing with the relationship between attitudes and achievement, did not appear valid. The fifth graders showed a substantial correlation from the pre-test to the post-test; however, this did not prove true for the other testing situations. The fourth graders showed a moderately low correlation between attitudes and achievement from the pre-test to the post-test; but again, this did not hold true for the other testing situations.

It would appear from these data that the concept method is more effective with the older children, in this case fifth graders as opposed to fourth graders, in terms of immediate gains. It was further demonstrated that attitudes can be significantly changed regarding liking

arithmetic when careful attention is given to methods and materials. And finally, there appeared to be little correlation between attitudes and achievement among disadvantaged and underachieving children at the fourth and fifth grade level.

The fact that this particular camp group was composed of multi-problem children definitely appeared to affect scores and attitudes adversely. The evidence seemed to indicate that more discriminating instruments are needed to evaluate economically deprived and disadvantaged children.

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A THESIS

Submitted to
Michigan State University
in partial fulfillment of the requirements
for the degree of

DOCTOR OF EDUCATION

School of Education

1966

ACKNOWLEDGMENTS

The writer is indebted to a number of persons without whose help this study could not have been executed or brought to fruition. The writer wishes to express her appreciation to Dr. Calhoun C. Collier, chairman of her Guidance Committee, for his help and encouragement throughout the years as well as his help and interest in the planning of this study. Special gratitude is also due to the other members of her guidance committee: Dr. W. Vernon Hicks, Dr. William J. Walsh, and Dr. Jay W. Artis, who were most generous with their time and advice.

She also expresses thanks to Mr. Paul Oberle, Director of the Summer Camp, who asked the writer to join the staff and permitted her the latitude and freedom necessary for this project. Mr. Robert Bowers and Mrs. Agnes Beer, guidance counselors at camp, supervised the testing programs, and rendered a valuable service.

The writer wishes to acknowledge appreciation to Dr. Helen Tewes, Director of Elementary Education for the Saginaw Schools, and to the principals and teachers of Saginaw for permitting her access to the pupils for testing and interviewing. Their cooperation and friendliness were most appreciated.

Grateful acknowledgment is accorded Dr. Jean LePere who made helpful recommendations regarding treatment of the data.

Special recognition is acknowledged to all children who served as subjects for this study. They were the real teachers and from them the writer learned much.

The writer is indeed grateful to The Iowa Testing Service and to Dr. Hieronymus, a member of its staff. The Testing Service furnished all testing booklets for the program. Dr. Hieronymus reviewed the data and made many helpful suggestions.

The acknowledgments would not be complete without expressing a debt of gratitude to the writer's parents. They are responsible in large measure for the values and attitudes the writer holds. These same attitudes and values (so prized in our middle-class society) made it possible and acceptable to her to work with less fortunate people--the children involved in this study.

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CHAPTER I

INTRODUCTION

This study was prompted by recent trends in our society such as: increased concern with the problem of school dropouts; more emphasis on new mathematics; governmental war on poverty; and the recognition that a large proportion of the nation's children were neglected. At the time these topics were very much in the news the writer was invited to work directly with a group of neglected or disadvantaged children. The challenge was accepted, and work began on the study in the summer of 1965.

Purpose or need for the study. In the book Excellence, John Gardner wrote:

> For every talent that poverty has stimulated it has blighted a hundred.[1]

The relevancy of this statement becomes more clear when one considers the magnitude of the problem.

> In the families of the poor there are 12,000,000 children. These are the hostages to poverty.[2]

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[1]John W. Gardner, Excellence Can We Be Equal and Excellent Too! (New York: Harper and Row, Publishers, 1961), p. 99.

[2]Ben H. Bagdikian, In the Midst of Plenty (New York: American Library, Signet Book, 1964), p. 140.

In discussing the effects of poverty on children Bagdikian cautions:

> This is one characteristic of the poor that the United States ignores at its peril.[3]

The investigator found various estimates in sheer numbers of those in our society who were directly effected by poverty. However, there was rather general agreement in at least two facets to the problem of poverty. These were: children suffer its ravages most and education holds the most promise.

In the past decade many programs have been instituted to alleviate problems associated with the deprived child. These bear various labels indicating objectives such as: "remedial," "preventative," "enriching," and "compensatory." The Higher Horizons and The Great Cities Projects are probably the better known. In the majority of these existing programs reading and the language arts have received greatest emphasis. On the other hand, arithmetic has received scant attention. The bulletin entitled, "Programs for the Educationally Disadvantaged," summarizing state and city projects, supports this.[4] Passow, in writing on "Education in Depressed Areas," states:

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[3] Ibid.

[4] U. S. Department of Health, Education and Welfare, Programs for the Educationally Disadvantaged, A Report of a Conference on Teaching Children and Youth who are Educationally Disadvantaged, Bulletin No. 17 (Washington: Government Printing Office, 1963).

> Because success in reading and other language arts constitutes the key to academic progress, most programs stress method, materials, special personnel, and other audio-visual and guidance services to improve as the verbal and other basic skills.[5]

From the same source the author says:

> Efforts to improve school programs in depressed areas vary considerably in scope and comprehensiveness. Almost all focus in some way on the improvement of reading and language skills, for academic success depends largely on ability to read.[6]

Two recent conferences were held which stress the need for more emphasis and research in the area of mathematics for the low achiever and for the disadvantaged child. One was held in 1965 and was a joint effort by the U. S. Office of Education and the National Council of Teachers of Mathematics. The other was sponsored by the School Mathematics Study Group in 1964. The following excerpts were taken from the reports of these two conferences:

> From the very beginning SMSG recognizes perfectly well that we were doing something for only part of the school population. We have made a remarkable amount of progress, but we are far enough along to realize that the rest of the school population, the students who are not doing well in mathematics, must be given attention.[7]

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[5]A. Harry Passow (ed.) Education in Depressed Areas (New York: Teachers College Press, 1963), p. 335.

[6]Ibid., p. 280.

[7]School Mathematics Study Group, Conference on Mathematics Education for Below Average Achievers (California: Leland Stanford Junior University, 1964), p. 1.

> At all levels, however, the emphasis and attention have been directed toward the above-average mathematics achiever.[8]

Not only is it evident that a large segment of the nation's children has been by-passed by curriculum changes in mathematics but it is now realized that our modern technological society demands that ways and means be explored to reach these children.

> Like it or not, we have suddenly awakened in a world which revolves around science, and it in turn rests on mathematics.[9]

> We believe it is now time to show some consideration for the low achievers.[10]

From the above sources, as well as others listed in the bibliography, it appeared to the investigator that a real need existed in the area of arithmetic for the deprived child. Hence the purpose of this study was to explore ways and means which might prove successful for the underachieving and disadvantaged child in the area of arithmetic. Success was to be equated with better achievement and understanding in mathematics as evidenced by scores on standardized tests. Moreover, it was the intent of the writer to make

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[8]U. S. Department of Health, Education and Welfare, The Low Achiever in Mathematics, Report of a conference by the U. S. Office of Education and the National Council of Teachers of Mathematics, Bulletin No. 31 (Washington: Government Printing Office, 1965), p. 2.

[9]Ibid., p. 1.

[10]Ibid., p. 2.

every effort to influence attitudes toward arithmetic by either reversing negative attitudes or encouraging more positive attitudes toward arithmetic.

Statement of the problem. The purpose of this study was to try out innovations in mathematical materials and methods for a summer program for fourth and fifth graders that would: (1) provide disadvantaged and underachieving children with motivation; (2) combine concrete and conceptual experiences; (3) yield positive changes in attitudes toward arithmetic and achievement in arithmetic; (4) be compensatory for those pupils who lacked basic understanding of simple mathematical concepts; (5) provide opportunities for success for all students; (6) utilize the camp environment rather than just the classroom for instruction; (7) be feasible in five weeks with one hour daily instruction sessions.

It was hypothesized that: (1) attitudes toward arithmetic would be changed in a positive manner; (2) achievement in arithmetic would be enhanced; (3) there would be a positive correlation between attitudes and achievement. Furthermore, it was felt that useful information regarding disadvantaged children could be gained by opportunities, unique in a camp setting, for establishing rapport. The inherent informality within daily living milieu, together with classroom teacher-learning environment, should yield pertinent perceptions.

The problem simply stated is: in terms of goals and limiting factors will the major hypotheses (regarding achievement and attitudes) prove valid? Also the question is raised, can such a program yield serendipitous information that can contribute to greater understanding of the problem of disadvantagement?

Limitations to the study. The study makes no attempt to evaluate the following: (1) the effect of a camp environment on learning; (2) the superiority of any standardized test over another; (3) the effectiveness of concrete experiences isolated from conceptual experiences; (4) the advisability of smaller or larger groups; (5) the effect upon learning of having junior counselors with the pupils during much of the class time.

Definition of terms. Terms used in this thesis are those that are generally in common usage today. A few of the definitions are discussed in some detail further on in the paper. For the sake of clarity however, key terms, those providing appropriate orientation, are defined here. These terms are: disadvantaged, underachieving, concept, concept method, arithmetic, junior counselor, and compensatory.

Disadvantaged, as used in this study, referred primarily to a condition of economic poverty. The children involved in this study were chosen from homes in which the family income was less than three thousand dollars. Poverty has attending ills that cause embarrassment and deprivat

therefore, when the term disadvantaged was used it was with the wish to convey that for the most part these children lacked much in a material sense that the typical child in our affluent society enjoys. Also, the term was meant to convey a broader meaning involving deprivation of experiences and opportunities. Deprived was used interchangeably with disadvantaged.

Concept has been used profusely in recent literature, particularly in mathematical literature, but the investigator did not find the term defined. Webster's New Collegiate Dictionary defines concept as "a mental image of a thing formed by generalization, from particulars"; also, "an idea of what a thing in general should be." As the term concept was introduced to the children in the study, the words idea or understanding were substituted. Conceptual learning is directed to categories and generalizations concerning these categories. This interpretation permits not only identification and classification of mathematical symbols, processes, etc., but also provides for drawing appropriate conclusions that are related to these categories. Hence both the category idea and the generalization notion are essential to the definition of the term concept.

Concept method was considered an approach to teaching which stressed the ideas and basic understandings which underlie our number system. Teaching direction was away from computation and drill and toward seeking relationships, patterns, and structure. For example: addition is bringing together two or more groups of objects forming one larger group; subtraction is the undoing of addition or forming smaller groups or sets from one larger group. If a child has formed such concepts then equations like $7 - \square = 3$, $7 - \triangle = 4$, $4 + \triangle = 7$, $3 + \square = 7$, and $\square + \triangle = 7$ would have real meaning for the child as in each case he would be applying a learned concept. Thus the concept method was an approach to teaching arithmetic which would enhance understanding and give meaning to the child's world of numbers. In practice the method was accompanied by many activities and a lavish utilization of tangible aids and/or models that were intended to promote learning and make the experience an enjoyable one. Concept method was chosen as the term to describe where the major emphasis was placed (i.e. greater understanding rather than on computation and memorization) and should not be interpreted to mean that concrete experiences were neglected.

Arithmetic and mathematics were used interchangeably in this paper to mean a skill or tool subject consisting of symbols and numbers which aid man in describing and keepin

account of his physical world. It answers such questions as: how many? how big? how much? and other quantitative concerns of man. In all instances it has applied only to elementary school arithmetic.

Junior counselors were high school seniors or college students who planned to become future teachers. Each junior counselor was assigned to a group of camp children usually on a ratio of one to five or six. They lived in the cabins with the children and often followed them to classes to aid the instructor with group activities.

Compensatory is frequently used in current literature dealing with disadvantaged children and describes a type of education. Bloom, Davis and Hess refer to it as "system of compensatory education which can prevent or overcome earlier deficiencies."[11] As used in this paper compensatory teaching was designed to supplement instruction or to fill an individual need. Most ideas presented to pupils were those to which they had already been exposed in previous school experiences. However, in many cases the understanding was weak, faulty, or non-existent. Thus much of the teaching would fall into the category of compensation for

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[11]Benjamin S. Bloom, Allison Davis, and Robert Hess, Compensatory Education for Cultural Deprivation (New York: Holt, Rinehart and Winston, Inc., 1965), p. 6.

a lack of knowledge and understanding or supplementation to existing understanding. The program took place during summer and outside of the child's regular school and so in this sense too the summer camp experience may be thought of as compensatory or supplemental.

CHAPTER II

REVIEW OF THE LITERATURE--PART I

The survey of the literature was divided into two general topics. These were: (1) Poverty; and (2) Research in Mathematics. Each of these will be treated in separate chapters. Chapter II is a review of the literature pertaining to poverty, disadvantaged children, and appropriate subtopics of disadvantagement. Chapter III contains a review of the research in mathematics pertaining to disadvantaged children, underachievement, modern mathematics, and conceptual learning. The writer considered these areas would provide a background and understanding of the problems of the disadvantaged child as well as an overview of mathematical research relevant to the present study.

In the main, readings were confined to those written in the past two decades. Before this time the problems of the disadvantaged child did not appear clearly identified or defined. Even at present the terms "disadvantaged" or "deprived" do not appear in the Michigan State University library card files. Throughout our history sporadic concern for the problems of poverty has been limited to a depression period or some minority group. It would seem that this myopia has prompted several writers to speak of the "invisibility" of the poor.

It follows that little could be done in way of research in mathematics with disadvantaged children until the need for such was realized.

Review of the literature pertaining to poverty. "Deprived" or "disadvantaged" have already been defined in terms of an economic condition called poverty. Poverty is probably as old as recorded history. Both the Old and New Biblical Testaments contain numerous references to the poor. Luke even included the poor in a Beatitude. However, in terms of today's life it is difficult to see his rationale; for the poor seem anything but "blessed." In Matthew's version it is the poor in spirit that are blessed. At the risk of sounding iconoclastic it would seem that the poor economically are also the poor in spirit.

Galbraith in The Affluent Society presented poverty as something less than a major problem in America. Poverty in modern times has been reduced to a "case poverty" and an "insular poverty," according to Galbraith, and it is only because our roots extend back to a time when poverty was prevalent that we still think in terms of poverty being part of America.

> Poverty was the all-pervasive fact of that world. Obviously it is not ours.[1]

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[1]John Kenneth Galbraith, The Affluent Society (Boston: Houghton Mifflin Company, 1958), p. 2.

> As a general affliction, it was ended by increased output which however imperfectly it may have been distributed, nevertheless accrued in substantial amount to those who worked for a living. The result was to reduce poverty from the problem of the majority to that of a minority. It ceased to be a general case and became a special case.[2]

Harrington's approach was that poverty, while a massive and serious fact, was invisible.

> That the poor are invisible is one of the most important things about them. They are not simply neglected and forgotten as in the old rhetoric of reform; what is much worse, they are not seen.[3]

According to Harrington poverty moreover forms a culture in America.

The literature presented a spectrum to the approach of poverty. Usually these fell into three major categories: (1) an economic or coldly statistical approach that provided numbers and income figures, (2) a cultural approach, dealing with cultural deprivation relative to middle-class values; and (3) a social angle often a concern of social class. Bagdikian,[4] in his book In the Midst of Plenty, used the case-history approach. In all there was agreement upon who constituted the poor. Generally they were presented as clusters of people throughout the United States presenting

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[2]Ibid., p. 323.

[3]Michael Harrington, The Other America (New York: Penguin Books Inc., 1963), p. 14.

[4]Ben H. Bagdikian, In the Midst of Plenty (New York: The New American Library, 1964).

pockets of poverty and including the following groups: minority people defining racial and ethnic groups, the aged, the migrants, the slum dwellers, certain rural groups such as are found on run-down farms and in Appalachia. The Negro is often considered separately because his color compounds his poverty problems.

Bagdikian gives a rather definitive description of the poor.

> There are about 8,000,000 in rural areas, but some of these are also among the 8,000,000 aged poor. About 7,000,000 are "unskilled" workers. About half are in households where a man is out of work. Many others are dependent on wages that can't raise the family out of poverty. . . . There are special groups--the 500,000 American Indians and the few hundred thousand derelicts of Skid Row. . . . Most notable today is the Negro, once concentrated in the rural South but now two-thirds in the cities, North and South. . . . But poverty is not limited to Negroes. One calculation shows Negroes to constitute 22 per cent of the poor.[5]

Slums or depressed city areas have received considerable attention by many writers. Harrington presents them as follows:

> And there is a new poverty that is becoming more and more important, a consequence of the revolution taking place in American agriculture. In Detroit, Cincinnati, St. Louis, Oakland and other cities of the United States, one finds the rural poor in the urban slums, the hill folks, the Oakies who failed, the war workers from the forties who never went back home.[6]

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[5] Ibid., p. 139.

[6] Harrington, op. cit., p. 83.

Passow on the same theme states:

> Typically, the depressed area population tends to be a stratified group of predominantly unskilled or semi-skilled workers, largely in-migrant, who have moved to the city from a rural region. The ethnic and racial composition tends to be primarily from the so-called minority groups--southern Negro, Puerto Rican, Appalachian white, American Indian, Mexican, and most recently, Cuban.[7]

Poverty has many facets and many definitions. Some of these follow:

> Poverty should be defined in terms of those who are denied the minimal levels of health, housing, food, and education that our present stage of scientific knowledge specifies as necessary for life as it is now lived in the United States.[8]

> Poverty should be defined psychologically in terms of those whose place in the society is such that they are interned exiles who, almost inevitably, develop attitudes of defeat and pessimism and who are therefore excluded from taking advantage of new opportunities.[9]

> Poverty is a persistent gap between "what is" and "what ought to be" as viewed subjectively by the individual himself, objectively by science, or according to the standards of society.[10]

In the final analysis most writers conclude that a definitive and realistic guide to poverty is a financial one. There

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[7] A. Harry Passow (ed.), Education in Depressed Areas (New York: Teachers College Press, 1963), p. 1.

[8] Harrington, op. cit., p. 175.

[9] Ibid.

[10] Margaret I. Liston, "Profiles of Poverty," AAUW Journal, LVIII (October, 1964), p. 14.

are various income guidelines by which poverty is measured. These change with the economy and are based on price indices and estimated cost of living. The most common figures currently are $1,000 for an individual and $3,000 for a family. It is this figure that the government presently uses as a guideline on the "War on Poverty." It was this figure which was used as the cut-off point for the children chosen for the summer camp experience who thus became the subjects for this project.

Caudill listed four causes for present-day American poverty. They were:

> . . . the frontier, the waste entailed in settlement, slavery, and the great waves of immigration.[11]

In following his development of these factors one can form a more knowledgeable view of the poor. The poor are often thought of as a shiftless group who lack the initiative to better their own lots. Rodman[12] speaks of this prejudice against the lower classes (which comprise the poor) and uses such terms as: "dirty," "lazy," "irresponsible," etc. to demonstrate the feelings often reflected by upper and middle-class persons toward the poor. However, Caudill's

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[11]Harry Caudill, "Reflections on Poverty," in New Perspectives on Poverty, eds. Arthur Shostak and William Gomberg (New Jersey: Prentice-Hall, Inc., 1965), pp. 3-9.

[12]Hyman Rodman, "The Lower Class and the Negroes; Implications for Intellectuals," eds. Arthur Shostak and William Gomberg (New Jersey: Prentice-Hall, Inc., 1965), p. 168.

historical treatment shows the antecedent conditions that have caused poverty and thus serves to prompt a more charitable consideration.

In terms of scope, in 1937 according to Roosevelt the poor comprised one-third of the nation.[13] More recently Kennedy in a letter to Johnson stated that one-sixth of the people lived--"below minimal levels of health, housing, food and education."[14] Harrington placed the figure "somewhere between 20 and 25 per cent."[15] President Johnson currently designates it as one-fifth of the nation.[16] Whatever figure is used to delineate the poor most accurately must be a moot question. The important facts are that poverty is a mass phenomenon; it tends to perpetuate itself; and its presence should weigh heavily on the American conscience.

> Whether there are 20,000,000 poor or 54,000,000 (taken from various income tables), either represent more degradation, suffering, and social blight than the American ethic can tolerate.[17]

Against this backdrop of poverty the disadvantaged child emerged. In our race with the Russians, our desire

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[13]Robert E. Will and Harold G. Vatter (eds.), Poverty in Affluence (New York: Harcourt, Brace & World, 1965), p. 14 (Second Inaugural Address).

[14]Bagdikian, op. cit., preface.

[15]Harrington, op. cit., p. 178.

[16]Will and Vatter, op. cit., p. 16.

[17]Bagdikian, op. cit., pp. 138, 139.

for excellence, and increased concern over the high rate of school dropouts, delinquency and juvenile crime, some significant facts have been observed. A relationship between income and education has been well documented by Sexton.[18] Dropouts and delinquents were proportionately higher among low income groups. Also, a large percentage of our youth was denied equality of opportunity which brought untold wasted potential that was sorely needed to keep America strong. It was these concerns that caused President Johnson to declare war on poverty. It was these concerns that caused Congress to pass the Economic Opportunity Act of 1964.

> Because it is right, because it is wise, and because, for the first time in our history, it is possible to conquer poverty, I submit, for the consideration of the Congress and the country, the Economic Opportunity Act of 1964.[19]

> Our fight against poverty will be an investment in the most valuable of our resources--the skills, and strength of our people.[20]

Review of the literature pertaining to disadvantaged children. Of the many labels given to the disadvantaged child most terms applied either oversimplify the problem or emphasize the negative aspects.

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[18]Patrica C. Sexton, Education and Income (New York: The Viking Press, 1964), pp. 15, 16, 132.

[19]Will and Vatter, op. cit., p. 17.

[20]Ibid., p. 16.

> The terms "deprived," "handicapped," "underprivileged," and "disadvantaged," unfortunately emphasize environmental limitations and ignore the positive efforts of low-income individuals to cope with their environment.[21]

Riessman used the above terms interchangeably and states, "any term connotes inadequacy."[22]

Terms such as "culturally different" or "less-privileged" offer no improvement in being definitive or fair. Thus the writer chose to use either disadvantaged or deprived and hoped to convey both the economic plight and other poverty-related deprivations which cause these children to fall short of their potential. Kaplan summarizes this idea in the following:

> Whether we choose to call these pupils disadvantaged, culturally deprived, or economically impoverished, they usually exhibit two characteristics; they are from the lower socio-economic groups in the community and they are notably deficient in cultural and academic strengths.[23]

Two excerpts from Poverty in Affluence give a more comprehensive picture of the difficulties these children face.

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[21]Frank Riessman, "The Culturally Deprived Child: A New View," Programs for the Educationally Disadvantaged, Washington: Government Printing Office, 1963), p. 3.

[22]Frank Riessman, The Culturally Deprived Child (New York: Harper and Brothers Publishers, 1962), p. 112.

[23]Bernard A. Kaplan, "Issues in Educating the Culturally Disadvantaged," Vital Issues in American Education, eds. Alice and Lester Crow (New York: Bantam Books, 1964), p. 98.

> Hence, being born into the educationally deprived home and community, be it city slum, marginal farm, or deserted Appalachian mining town, entails a firm inheritance that even a Horatio Alger hero could not overcome.[24]

> Poor parents cannot give their children the opportunities for better health and education needed to improve their lot. Lack of motivation, hope, and incentive is a more subtle but no less powerful barrier than lack of financial means. Thus the cruel legacy of poverty is passed from parents to children.[25]

It has already been determined: (1) disadvantaged children are products of poverty--the children of the poor; (2) various terms are used to refer to deprived children; (3) any term or label used to refer to these children fails to convey a precise meaning that is fair to the child; and (4) disadvantagement is a massive problem--there are approximately 12,000,000 children who belong to this group.

For a more complete understanding of the disadvantaged child at least three aspects should be given minimal consideration. These are: (1) home environment, (2) learning, both barriers to and capacity for, and (3) attitudes toward self, school, and others. In reality these are interrelated and present an almost circular kind of interaction.

Environment. Much has been written in recent years regarding the effects of environment on learning. The

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[24]Robert Will and Harold Vatter (eds.), Poverty in Affluence (New York: Harcourt, Brace & World, Inc., 1965), pp. 191,192.

[25]Ibid., p. 193.

length of this paper does not permit a detailed account of the old debate of nature vs. nurture. McCandless wrote:

> This controversy has for the most part been reduced to its common-sense merits.[26]

Kelley maintains that for over thirty years we have known the effects of environment on intelligence:

> Dullness is therefore more an achievement than a gift.[27]

A look at what the environment provides or fails to provide in the impoverished home gives some insight into the problems of the disadvantaged.

> These living conditions are characterized by great overcrowding in substandard housing, often lacking adequate sanitary and other facilities. . . . In addition, there are likely to be large numbers of siblings and half-siblings, again with their being little opportunity for individuation.[28]

> In the child's home there is a scarcity of objects of of all types, but especially of books, toys, puzzles, pencils, and scribbling paper.[29]

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[26]Boyd R. McCandless, Children and Adolescent Behavior and Development (New York: Holt, Rinehart and Winston, Inc., 1961), p. 239.

[27]Earl Kelley, In Defense of Youth (New Jersey: Prentice-Hall Inc., 1962), p. 129.

[28]Martin Deutsch, "The Disadvantaged Child and the Learning Process," Education in Depressed Areas, ed. A. Harry Passow (New York: Teachers College Press, 1963), p. 167.

[29]Ibid.

Undeniably a deprived child has many stimuli in his home environment; however, it is regarding the type and variety that most writers are concerned.

> A child from any circumstance who has been deprived of a substantial portion of the variety of stimuli which he is maturationally capable of responding to is likely to be deficient in the equipment required for learning.30

Those in our society who feel that poverty makes the man, or that it is the result of shiftlessness, have overlooked or failed to appreciate fully the role environment plays and the helplessness of the child to overcome its effect.

> Culturally deprived children can do little to alleviate the devastating effect their physical surroundings have on them.31

Macroscopic environmental factors that one can see or smell, or those that are conspicuous because of their absence, constitute only one phase to the problem of disadvantagement. Sociological and psychological ramifications are just as real as the physical manifestations mentioned above. Taken altogether the home and community milieu can not be overemphasized in a study of the disadvantaged. Nor can their effects be overstated when considering the limiting

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[30] Ibid., p. 166.

[31] August Kerber and Wilfred Smith (eds.), Educational Issues in a Changing Society (Michigan: Wayne State University Press, 1962), p. 157.

factors to learning and the formation of attitudes.

Achievement and learning pose real problems for the teacher and comprised one of two major concerns for the present study. A wealth of literature exists and a multitude of studies and/or programs are currently under way which should yield interesting findings. Evaluation, however, appears to be one of the weaknesses of most programs. There are at least three reasons for this. A number of the existing programs are still in their infancy and their sponsors are hesitant to divulge this type of information until findings are complete. The Higher Horizons Program exemplifies this inasmuch as its evaluator, the Bureau of Educational Research, is waiting until the findings are complete before publicizing the full report. Another reason appears to be that often well-meaning groups have attempted to do too much at one time without carefully isolating factors that could be measured or evaluated.

> But as they are generally organized, there is no way of discovering which of the modifications and what combination are most effective. It is possible that one or two new approaches do as much as a whole host of changes. But how is one to know, except by testimonial--which is at best a questionable technique--which procedure really effected a change in the pupils.[32]

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[32]Mirian Goldberg, "Factors Affecting Educational Attainment in Depressed Urban Areas," Education in Depressed Areas, ed. A. Harry Passow (New York: Teachers College Press, 1963), p. 97.

A third reason for weaknesses in evaluation lies in the fact that there has been a scarcity of research on deprived children. Both Goldberg[33] and Landers[34] confirm this.

Initially most programs for the disadvantaged followed the same route that was used with middle-class children. This more-of-the-same idea was partially due to a lack of know-how and partially due to the idea that what worked well with one group should work well with another. Goldberg states it thusly:

> The various efforts now under way . . . have operated generally on the theory that what the present situation calls for is an expansion of services which had proved effective in past generations or with middle-class children who had learning difficulties. Characteristics of these programs are increases in such services as guidance, remedial instruction, individual psychological testing, and counseling."[35]

One reason for the difficulty the deprived child has in school and that effects his achievement appears to be directly related to his home environment.

> Undesirable conditions at home can cripple a child's ability to learn; a child who is deprived, whether of physical necessities or of sympathetic understanding or of both, cannot function at top capacity.[36]

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[33] Ibid., pp. 89, 90.

[34] Jacob Landers, "The Higher Horizons Program in New York City," Programs for the Educationally Disadvantaged (Washington: Government Printing Office, 1963), p. 56.

[35] Goldberg, op. cit., p. 69.

[36] Henen R. Nieber, "From Rich Homes or Poor," NEA Journal, LIV (October, 1965), p. 45.

> The culturally deprived youngster's early experience may put him at both a cognitive and emotional disadvantage in "achieving" in the school's terms.[37]

Operation Headstart, with its desire to get children young so that some of the effects of impoverishments can be prevented and/or overcome, is the best testimony to the effect of environment on learning.

> Few people believed that a six to eight week experience in a Headstart Child Development Center would (or could) counter all the forces impinging upon the economically disadvantaged child, but educators agreed that the programs would be a favorable beginning.[38]

Of the twelve stated goals for Headstart, which included the whole child, three relate directly to learning. One of these follows:

> To improve and expand the child's mental processes, aiming at expanding ability to think, reason, and speak clearly.[39]

Much has been written about the hidden IQ of deprived children, Riessman devotes a whole chapter to it in his book, Culturally Disadvantaged Child. Clark, Goldberg, and Deutsch, in Education in Depressed Areas, express the notion that the deprived child has hidden potential for learning that does not show up on standardized IQ tests. If their

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[37]Passow, op. cit., p. 286.

[38]Milly Cowles, "One Front in the War on Poverty," AAUW Journal, LIX (October, 1965), p. 14.

[39]Ibid., p. 15.

contentions are true (and there is much evidence to support them) then despite the fact that a deprived child is a slow learner, it's a false premise that he is not capable of achieving.

> Most disadvantaged children are relatively slow in performing intellectual tasks. This slowness is an important feature of their mental style, and it needs to be carefully evaluated.[40]

> The assumption that the slow pupil is not bright functions, I think, as a self-fulfilling prophecy.[41]

New optimism is currently being exhibited both as to the reversibility of the environmental handicap and as to the potential for the deprived to achieve. In speaking of the Higher Horizons Program, Riessman draws this conclusion:

> It [the Higher Horizons Project] demonstrated convincingly that supposedly uneducable children from lower socio-economic backgrounds can successfully learn and progress in a reorganized school environment.[42]

From a report on the Detroit Great Cities Project, Marburger[43] also affirms the ability of deprived children to perform

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[40]Frank Riessman, "The Culturally Deprived Child: A New View," Programs for the Educationally Disadvantaged, HEW (Washington: Government Printing Office, 1963), p. 4.

[41]Ibid., p. 5.

[42]Frank Riessman, The Culturally Deprived Child (New York: Harper and Brothers Publishers, 1962), p. 98.

[43]Carl Marburger, "Working Toward More Effective Education," Programs for the Educationally Disadvantaged, HEW (Washington: Government Printing Office, 1963), p. 71.

providing the school can make work interesting. Clark also makes the point that deprived children have greater potential for learning than has been formerly thought:

> The evidence is now overwhelming that high intellecual potential exists in a larger percentage of individuals from lower status groups than was previously discovered, stimulated and trained for socially beneficial purposes.[44]

According to Sexton if deprived children were given the same opportunities that middle and upper-class children enjoy, they too could excel.

> If lower-income groups were afforded the same educational advantages as upper-income groups would their children be just as "gifted"? They might be, and there is evidence that they would be.[45]

The concluding remarks of the conference for disadvantaged children as reported by Cummings include the following:

> The most important discovery about the pupil from a disadvantaged home is that he has a capacity for learning, even as other pupils do.[46]

The failure to recognize the potential of the deprived child has been costly on two levels.

> The actual costs to the government are immersed in the expenditures for criminality, delinquency, unemployment, ill health, mental illness, and social

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[44]Kenneth B. Clark, "Educational Stimulation of Racially Disadvantaged Children," Education in Depressed Areas, ed. A. Harry Passow (New York: Teachers College Press, 1963), p. 161.

[45]Sexton, op. cit., p. 61.

[46]Howard H. Cummings, "Conclusion," Programs for the Educationally Disadvantaged, HEW (Washington: Government Printing Office, 1963), p. 101.

> disorganization. The cost of undiscovered, unused, and abused human beings who could have done so much for society can only be guessed, but the evidence of the unused potential is painfully obvious and enormous.[47]

From the literature it seems evident that though there are limiting factors that adversely effect learning for the disadvantaged child he has the capacity to learn and is capable of doing so when conditions are favorable.

Attitudes toward self, others, and school. McCandless defines self-concept as "a set of expectancies, plus evaluations of the areas or behaviors with reference to which these expectancies are held." He elaborates by:

> Our illustration also suggests that the self-concept holds properties in common with drive in that one selects some developmental, recreational, and avocational areas as a function of certain characteristics of the self-concept, and rejects other.[48]

In discussing the self-concept and school achievement the same author makes this statement.

> It might be predicted that poor self-concepts, implying, as they so often do, a lack of confidence in facing and mastering the environment, might accompany deficiency in one of the most vital of the child's areas of accomplishment--his performance in school.[49]

McCandless cites studies in support of his position regarding the self-concept:

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[47] Kerber and Smith, op. cit., p. 156.

[48] McCandless, op. cit., p. 176.

[49] Ibid., pp. 185, 186.

> Change in self-concept is, of course, required by the process of maturing and is central to such activities as counseling, psychotherapy, and remedial teaching.[50]

> All of the present discussion of the self concept has been based on the assumption that it is learned. It seems logical to think that the self-concept, based as it is on attitudes and values held about the self, has much in common with general social attitudes and personal beliefs and values. Any theory or research, then, that relates to changing attitudes should have relevance for changes in the self-concept.[51]

McCandless further contends that there is a relationship between self-acceptance and how the child accepts others; and that parents play a vital role insomuch as their attitudes strongly shape the child's self-concept. The ideas of the above author that were relevant to this study are listed below:

self-concepts are learned
self-concepts can be modified
parents influence self-concepts
self-concepts are based on attitudes
achievement is effected by self-concepts
self-concepts are central to remedial teaching
drives and self-concepts are related

Recent research by Brookover, LaFere, et al., at Michigan State University, supports some of the above ideas and expands on them:

> The basic postulate is that academic behavior or school learning is limited by the student's self-concept of his ability in these areas. We further

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[50] Ibid., p. 198.

[51] Ibid.

> postulate that self-concept results from the expectations and evaluation held by significant others as perceived by the student.[52]

Of nine statements that were accepted, as a result of this study one was of particular relevance.

> Parents are perceived by more than 90% of the students as academic significant others in all grades. (Junior High)[53]

Apropos to the disadvantaged child, as well as the societal need to develop all talent to its maximum, the following statements by this research team are germane:

> There is, moreover, sufficient evidence to warrant the position that enhancement of self-concept of academic ability should be a crucial concern to educators striving to assist students to achieve at the highest level of achievement possible.[54]

> Perhaps the most important implication of this investigation concerns a theme in educational literature that only a limited number of students are able to learn mathematics, languages, science, and other school subjects to the extent required by our advance technological society.[55] (emphasis mine)

Most literature on the disadvantaged at some point refers to the negative self-concept, warped self-image, aggressive behavior, alienation, et cetera. Classroom problems resulting in part from such characteristics are of

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[52] W. B. Brookover, J. LePere, D. Hamachek, S. Thomas, E. Erickson, Self-Concept of Ability and School Achievement, II (Michigan: Michigan State University, 1965), pp. iii, iv.

[53] Ibid., p. 208.

[54] Ibid., pp. 208,209.

[55] Ibid., p. 210.

vital concern to educators and other personnel working with deprived children.

> So often, administrators and teachers say, they are children who are "curious," "cute," "affectionate," "warm," and independent in the kindergarten and first grade, but who so often become "alienated," "withdrawn," "angry," "passive," "apathetic," or just "trouble-makers" by the fifth and sixth grades.[56]

The negative feelings of these children are stressed by Shostak:

> Deprived youngsters by the millions are presently failing in school and dropping out. They do not learn to read properly; they fall farther and farther behind; some begin to hate themselves and the system that makes failure public; many withdraw from competition, and the gap between the slum and the suburb widens.[57]

The attitudinal problems are further brought out by Kornberg:

> But in our schools we have seen that the "very difficult children" are almost a norm among the culturally disadvantaged youngsters, and those who are given the special help often return to the classroom as difficult as ever. There is no overnight cure for the attitudes, fears, defenses, deficiencies in children that grew so early, over so many years.[58]

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[56]Martin Deutsch, "The Disadvantaged Child and the Learning Process," Education in Depressed Areas, ed. A. Harry Passow (New York: Teachers College Press, 1963), p. 165.

[57]Arthur B. Shostak, "Educational Reforms and Poverty," New Perspectives on Poverty, eds. Shostak and Gomberg (New Jersey: Prentice-Hall, Inc., 1965), p. 64.

[58]Leonard Kornberg, "Meaningful Teachers for Alienated Children," Education in Depressed Areas, ed. A. Harry Passow (New York: Teachers College Press, 1963), p. 263.

> To me the salient characteristic about these children in a classroom is their alienation. To use their jargon, they are not "with it."[59]

Riessman[60] and Marburger[61] both have written of the alienation, indifference, and poor attitudes of the deprived children. Kaplan,[62] in discussing programs for the disadvantaged, emphasizes the important role that attitudes and motivation play. This is further supported by Clark:

> It is clear that a fundamental task of the school in stimulating academic achievement in disadvantaged children is to provide the conditions necessary for building in them positive images of themselves--building in these children a positive self-esteem to supplant the feelings of inferiority and sense of hopelessness which are supported by an all-too-pervasive pattern of social realities.[63]

It is noteworthy that of the twelve goals of the Headstart Program referred to earlier at least five were in some way related to self-concept and attitudes.

Writings abound with information regarding indifference and/or hostility dominant among disadvantaged children.

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[59] Ibid., p. 274.

[60] Frank Riessman, "The Culturally Deprived Child: A New View," Programs for the Educationally Disadvantaged, HEW (Washington: Government Printing Office, 1963), p. 7.

[61] Carl Marburger, "Working Toward More Effective Education," Programs for the Educationally Disadvantaged, HEW (Washington: Government Printing Office, 1963), p. 71.

[62] Kaplan, op. cit., p. 107.

[63] Clark, op. cit., p. 157.

In respect to how these attitudes toward self, others and school effect achievement much is theorized but concrete evidence is not abundant. In any case a healthy concern is now evident.

In summary, as a compilation derived from the literature cited and from other readings in the bibliography, a list of traits or characteristics of disadvantaged children are presented. It should be clear that when one considers a particular child any specific trait in the list may or may not apply to this child, and if so it may be to any degree.

product of a broken home
member of a large family
anti-intellectual
has poor attitudes
is a physical learner
has short-term goals
has short attention span
poor reader
lacks time consciousness
has poor auditory habits
has verbal inadequacies
craves respect not love from school
needs structure
likes action
is a slow task performer in academic matters
has high mobility history
evidences low self-esteem
low achiever academically
possesses weak motivation

Despite the fact that only the more negative traits have been considered here, the writer is aware that disadvantaged children also have many positive attributes. Riessman, in the Culturally Deprived Child, and in a chapter

in New Perspectives on Poverty stressed these. A partial list of these positive traits taken from Riessman and others is presented:

has well developed informal verbal skills
respects physical strength
is creative and improvisational
has strong peer ties
has strong sibling ties
has a well developed sense of humor
enjoys music, games, sports
has preserved his ethnic traditions
values education
is free from self-blame and parental overprotection

Recommendations. Recommendations for working with deprived children usually stress capitalizing on the positive strengths or attributes already cited. Other recommendations include providing opportunities for success, promoting a better self-image, utilizing more physical activities such as role playing and games, building on the child's interests, adjusting instruction to life-oriented, here-and-now kind of experience, and encouraging closer ties with home and community. Wilkowski[64] refers to respect for children, patience, ability to accept children for what they are, more concrete materials or aids, changing pace more frequently, and use of praise.

Many recommendations fall outside the scope of this paper and would include such concerns as more state and

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[64]Genevieve Wilkowski, "Teachers of Culturally Disadvantaged Children," Michigan Education Journal, XLII (May, 1965), pp. 14-17.

federal support, more community involvement, more counselors and specialists working directly with the disadvantaged child, better facilities and a host of reforms that are beyond specific recommendations that could help the teacher in the day-to-day classroom situation.

Sexton[65] lists 37 suggestions that are related to the problems of lower-income children and their education. A sample of these is presented:

use of IQ test should be stopped
there should be warm encouragement of parents for greater school involvement
reduction of class size
extra help, rather than failing marks
more field trips
more males in the classrooms
more research dealing with lower-income groups

Overview

After the Russians proved that man was no longer earth-bound a wave of criticism was launched at the American public schools. Claims were made that the United States needed more mathematicians and scientists and that these could be recruited only among the gifted. Thus in the late fifties and early sixties the gifted child received more attention in our schools. More recently there has been an increasing realization that the future of America will depend upon present development of human resources not only

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[65] Sexton, op. cit., pp. 267-276.

among the academically elite few but also among the less talented many.

The advent of automation brought a new set of problems that had to be faced by the American people and the schools. The questions of how to absorb the unskilled workers--those displaced by the machine, and how to prevent unemployment had to be answered. These concerns plus others such as the dropout problem, juvenile crime, and delinquency brought educators and politicians into a concerted effort to fight against poverty and allied problems. Consequently today we are in the midst of an era of genuine and massive concern for those in our society who have until recently been shamefully neglected.

One cannot point to any single event or publication as having had the greatest impact upon or having been most significant in bringing about this realization. There were a number of influential landmarks. Patricia Sexton's book, Education and Income, was noteworthy in this respect. Conant's work, Slum and Suburbs, Riessman's, Culturally Deprived Child, and Harrington's The Other America--all served to arouse public interest. The Anti-segregation Law of 1954 and the Opportunity Act of 1964 were important events in connection with the new awareness and they portend to accomplish much in way of alleviating inequalities and preventing wasted human assets.

The investigator found two contemporary writers who were particularly cognizant of the educational problems related to socio-economic status at a much earlier date than most. Frank Riessman in his introductory remarks in a 1962 conference report stated:

> I have been interested in the problems of lower socio-economic groups for about 15 years, during most of which time there has been a lack of concern for the educational problems of children from lower-income families.[66]

Allison Davis, writing in Contemporary American Education, expressed a similar concern:

> Nearly 15 years ago, in an address to the general session of the American Association of School Administrators, I pointed out that our efficiency as a Nation and the preservation of our position vis-a-vis the communist powers depended largely upon learning how to motivate and teach the socio-economic groups in our schools.[67]

There have always been a few concerned individuals who spoke out in defense of poverty's victims. Jane Addams, of Chicago's famed Hull House, was one of those actively concerned. In the late nineties, speaking at a National Educational Association convention, Miss Addams portrayed the plight of the immigrant child in large cities and schools. She noted these children lacked interest, were alienated, and frequently dropped out of school. She pointed up how

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[66]Riessman, op. cit., p. 3.

[67]Allison Davis, Contemporary American Education, eds. Droplin, Full and Schwarcz (New York: The Macmillan Company, 1965), p. 543.

the schools had failed:

> Has anything been done up to this time, has even a beginning been made, to give him a consciousness of his social value?[68]

In the introduction to this article (the reproduction of Miss Addams' speech) the editor made the following comment:

> The depth of understanding that pervades her testimony has marked relevance to the current struggle in schools with culturally disadvantaged students.[69]

Further evidence that the problems of disadvantaged children are not new is the book, The Education of the Ne'er-do-Well, published in 1916. Therein Mr. Dooley was concerned with the rise of the factory system, the demise of the apprenticeship, and the concomitant effects upon many children. If one would substitute "automation" for "factory system" and "disadvantaged" for the "ne'er-do-well," the ideas presented would sound quite contemporary. There are many interesting parallels in this book that demonstrate rather well the appalling lag in both sociological and educational reforms. The current Great Cities Projects had their counterpart in Minneapolis, Chicago, and New York during the early part of the century. Mr. Dooley's pleas for adult education, and vocational education is echoed in

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[68] Jane Addams, Contemporary American Education, eds. Droplin, Full and Schwarcz (New York: The Macmillan Company, 1965), p. 173.

[69] Ibid., p. 82.

Conant's Slums and Suburbs. Among other recommendations in the Ne'er-Do-Well were:

> greater cooperation between schools and industry
> trade union involvement
> holding power for dropouts
> new school design including showers, gardens, roof playgrounds
> inductive approach to teaching
> increasing the school day and year

Mr. Dooley's greatest concern was for the unskilled, unemployed, and unmotivated youth--the ne'er-do-well of his day.

> Waste is repugnant to us today, yet we have failed to provide for the great majority of the boys and girls.[70]

The literature shows that neither poverty nor its children is a new phenomenon in the United States. History is replete with token innovations to help the deprived child. Included among these were compulsory education laws, child labor laws, hot lunch programs, etc. Today we are witnessing innovations at local, state, and national levels to overcome problems that have been building up for years. Perhaps it can soon be said, Blessed are the poor--for they shall be helped.

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[70] William H. Dooley, The Education of the Ne'er-Do-Well (Boston: Houghton Mifflin Company, 1916), p. 19.

CHAPTER III

REVIEW OF THE LITERATURE--PART II

According to Goodlad, the current curriculum reform dates back to the years following World War II; however, he states it is usually linked more recently with the Russian satellite of 1957.

> This spectacular event set off blasts of charges and counter-charges regarding the effectiveness of our schools and stimulated curriculum revision, notably in mathematics and the physical sciences.[1]

The above author continues by analyzing the strengths and weaknesses of the mathematics programs that were part of the revised curricula. Some of these criticisms are relevant to the present study.

> Tens of thousands of schools have been scarcely touched, or touched not at all, especially in areas of very sparse or very dense populations. Tens of thousands of teachers have had little opportunity to come to grips with what advances in knowledge and change in subject fields means for them. . . . The gap between the haves and have-nots persists and, in some ways, is accentuated.[2]

Goodlad contended that, although there was great uniformity among the various projects and/or programs, objectives were

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[1]John Goodlad, "Changing Curriculum of America's Schools," Saturday Review, XLVI (November 16, 1963), p. 65.

[2]Ibid., p. 66.

"vague," "not stated," or had a "mystical quality." He felt this was particularly true regarding structure and concept-attainment.

No end would be served to describe each of the major math programs that came into existence as a result of curriculum reform. These are well known and each group has published a wealth of materials. It might be fruitful though to examine certain aspects. In 1963 the National Council of Teachers of Mathematics published a bulletin, An Analysis of New Mathematics Programs, in which an overall analysis was made of eight of the better known programs. The following criteria were used in the evaluation:

Social Applications
Placement
Structure
Vocabulary
Methods
Concepts vs. Skills
Proof
Evaluation

A resume followed each of these topics--usually in the form of questions. None of these were defined. The members of the committee noted that mathematics is in a state of flux and they leave it to the reader to decide his own position on each of the above topics. One example should demonstrate this lack of a stance by the committee.

> Concepts vs. Skills
> What relationship should exist in the mathematics programs between the function of developing concepts and that of developing skill in the manipulation of

> symbols? Some persons feel that a student can gain the full meaning of a concept only when he approaches the level of automatic response in his use of the concept. There is also the question: What level of skill is optimum for our present society as opposed to the changing concepts resulting from changing cultures?[3]

Even though the committee did not take a more definitive position they did consider each of the above topics crucial to a mathematics program.

The investigator made a comparative study of the eight programs included in the bulletin and recognized that whereas each program was unique nevertheless commonalities were evident. Among the latter that appeared most frequently were: concept oriented; stress upon understanding, thinking, and reasoning; search for patterns, ideas and principles. The language of mathematics was considered important and thus a precise vocabulary essential. In some programs new content was introduced; others introduced topics earlier grade-wise than is dictated by tradition. A few stressed the discovery method, in-service training for teachers, development of aids, films and materials, etc. This is by no means a thorough presentation of what may be considered a "new mathematics" program; however, it would serve as a guide as to what is deemed important by those

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[3]National Council of Teachers of Mathematics, An Analysis of New Mathematics Programs (Washington: 1963), p. 3.

who have developed such programs. It should be noted that all eight programs were designed for the typical child or the more able learner. The School Mathematics Study Group recognized this and have more recently made an effort to include the deprived and underachievers.

> It should be noted that much of the success of the so-called new mathematics has been demonstrated with middle-class children.[4]

Conference members from the joint meeting of the U. S. Office of Education and the National Council of Teachers of Mathematics recognized this neglect too:

> Our intent here is to consider the mathematical need and proper instruction in mathematics for that category of youth referred to by Dr. Conant as "social dynamite"--those who possess no skill, who are unemployable and unschooled. . . . Our range of interest will include mathematics for those students who are potential dropouts, as well as for those who remain in school, but who, for one reason or another, exhibit a pattern of low achievement in mathematics.[5]

Reasons for updating the math curriculum appear in much of the literature and include the following taken from Frontiers in Mathematics Education, published by the Michigan Department of Public Instruction in 1961. These appear in summary form:

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[4]School Mathematics Study Group, Conference on Mathematics Education for Below Average Achievers (California: Leland Stanford Junior University, 1964), p. 15.

[5]U. S. Department of Health, Education and Welfare, The Low Achiever in Mathematics (Washington: Government Printing Office, 1965), p. 1.

1. Mathematics must grow and change to meet the demands of a changing world.

2. More mathematicians are needed.

3. Other fields of knowledge are making increased use of mathematics.

4. Experiments indicate the value of earlier introduction of selected concepts and skills.

5. Inability to predict the skills needed in the future.

6. New development in child psychology and a greater understanding of the learning process require elimination of rote memorization and meaningless drill.

7. Large numbers of our population have been inadequately prepared in mathematics.

8. Greater realization that the development of persons proficient in mathematics begins in the elementary school.

9. Schools must produce more highly trained technical people and also informed and literate citizens in mathematics to enable them to understand their technological world.[6]

These same reasons could be advanced for up-dating the curriculum for the underachiever, the slow learner or the disadvantaged. In the book Compensatory Education for Cultural Deprivation, the authors review the social changes and forces that necessitate educational changes for the deprived.

> A central factor in the entire problem of education and cultural deprivation is the rapidly changing

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[6]The Department of Public Instruction, Frontiers in Mathematics Education (Michigan: MDEA-310, 1961), pp. 8, 9.

> economy and job-distribution system which requires more and better education for the entire population. It is this new set of requirements which force changes in education to meet the special problems of cultural deprivation in various groups of our society.[7]

Germane to the changing economy and job-distribution system, which are realities of modern life, are the remarks by an industrialist:

> Those of us in industrial mathematics see very clearly that the mathematical requirements are changing. One consequence, of course, is that many workers are being technologically replaced. Their jobs have changed, they must be retrained, and mathematics is often part of the retraining. . . . Problems of very substantial mathematical nature may come to be involved in jobs which were (and in many respects still are) of very routine nature.[8]

It is clear that these changes will effect the underprivileged groups.

> We will certainly continue to require more and better mathematical training in all facets of our activity. For us today, the point is that many of these activities will involve people from the groups we are talking about educating.[9]

In the "Gardner Report,"[10] setting forth national

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[7]Benjamin Bloom, Allison Davis, and Robert Hess, Compensatory Education for Cultural Deprivation (New York: Holt, Rinehart and Winston, Inc., 1965), p. 5.

[8]B. H. Colvin, Conference on Mathematics Education for Below Average Achievers, taken from Panel Discussion, SMSG Conference (California: 1964), p. 105.

[9]Ibid., p. 104.

[10]Paul Woodring, "National Goals in Education," a Commentary on the Gardner Report, Saturday Review, XLIII (December 17, 1960), p. 51.

goals for education, mathematics was listed as second only to reading as a priority subject in the elementary school. Paul Rosenbloom[11] equated the two (reading and mathematics) as "key subjects, for making low-ability children employable."

It is apparent from the literature that: (1) a knowledge of mathematics is urgently needed by all members of our society; (2) research and curricular innovation in mathematics for the low achiever and disadvantaged has been neglected, (3) a large percentage of the low achievers and slow learners belongs to the group labeled disadvantaged.

Underachievers and low achievers. Through the literature the writer found various terms applied to low-achieving children. Often they were referred to as slow learners, educationally handicapped or retarded. Despite some confusion of terms, when these were defined and used consistently they were based on either IQ tests or achievement tests or both. According to E. Paul Torrance[12] this traditional concept of underachieving is no longer valid. He quotes Getzels and Jackson in support of this:

> In determining overachievement and underachievement, educators usually fail to take into account the

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[11]Paul C. Rosenbloom, "Implications of Psychological Reseach," The Low Achiever in Mathematics, HEW (Washington: Government Printing Office, 1965), p. 25.

[12]E. Paul Torrance, "Who is the Underachiever?" NEA Journal, LI (November, 1962), p. 17.

> relationship between the capacities and needs of the individual and the ability of the environment to provide outlets for these capacities and needs.[13]

In poetic terms Torrance describes the underachiever:

> A scorned imagination, an unused memory, tabooed sensations, an interrupted thought, a rejected question, a forbidden day dream, an unexpressed idea, an unsought judgment, an unpainted picture, an unsung song, a safely hidden poem, unused talents. . . . These make an underachiever.[14]

Low achievers are defined in the SMSG conference bulletin as:

> 1. Those children who have intellectual deficiencies.
> 2. Those children who have cultural deficiencies.
> 3. Those children who have both intellectual and cultural deficiencies.
>
> Perhaps a qualitatively different group are the children who are neither culturally nor intellectually deficient but who are slower learning.[15]

From the Low Achiever in Mathematics the following description emerges:

> The low achievers can best be characterized as students having an intellectual potential at the low-average level, who are generally about one or more years below grade in arithmetic and one or more years retarded in reading.[16]

Disadvantaged children are often thought of as slow learners because they as a rule are physical learners. A distinction

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[13] Ibid., pp. 15, 16.

[14] Ibid., p. 15.

[15] SMSG, op. cit., p. 81.

[16] George B. Brain, "Responsibilities of School Administrators," The Low Achiever, HEW (Washington: Government Printing Office, 1965), pp. 35, 36.

should be made between the slow learner as a physical learner, and the slow learner as a less capable learner, albeit difficult in some cases.

> Although it is true that many disadvantaged children are slow learners this position tends to overlook some distinctions. One group of slow learners consists of those with limited genetic endowment, whom the best of instruction would profit in only limited ways. Disadvantaged children are not slow learners in the same sense.[17]

The functional slow learner, as opposed to the less capable learner, is a product of environmental factors that have failed to provide the child with the variety of experiences and stimuli necessary for full development and normal achievement. Leiderman's remarks substantiate this view:

> The major thesis of this paper, derived from developmental approaches, is that the slow-learning group consists of some children, perhaps a majority, who are retarded in their mental development because contact with their physical and social environment was deficient in their early years. This thesis makes research data on the culturally deprived groups relevant.[18]

There is a consensus among many that the number of children who as a result of a deprived background are doing poorly in school generally, and in mathematics in particular, is a sizeable group.

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[17]Harry Beilin and Lassar Gotkin, "Psychological Issues in the Development of Mathematics Curricula for Socially Disadvantaged Children," Conference on Mathematics Education for Below Average Achievers (California: SMSG, 1964), pp. 15, 16.

[18]Gloria F. Leiderman, "Mental Development and Learning of Mathematics in Slow-Learning Children," Conference on Mathematics Education for Below Average Achievers (California: SMSG, 1964), p. 47.

> It seems reasonably clear that early deprivation in the child's background will result in less ability to abstract; that his lessened verbal development is related to difficulty in learning mathematics; and that a larger proportion of children from disadvantaged groups in the population contribute to the slow-learning and low-achieving groups in our schools.[19]

Presently there seems to be little concern for categorizing those who are disadvantaged into neat groups of ability levels as has been done with other children. Probably this is because diagnostic instruments that would yield reliable results are lacking. Frequently one finds terms used interchangeably such as "underachiever" and "slow learner" that would have connoted more than a subtle difference in the past framework. Most disadvantaged groups contain a wide range of ability levels as well as a wide range of maturational and developmental levels. Yet they are lumped together in many programs. Or the low achievers or slow learners are grouped together which would undoubtedly include some disadvantaged children as well as those less capable genetically of achieving. It follows that this would depend to some degree upon the area being served; however, Havighurst[20] found as many as 80% of slow learners to be from low socio-economic backgrounds. The ability to

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[19] Ibid., p. 53.

[20] Lloyd M. Dunn, "The Slow Learner," NEA Journal, XLVIII (October, 1959), p. 21.

identify talent or lack of it among disadvantaged children presently can not be done with much predictability.

The developmental approach to teaching the disadvantaged child, regardless of what his potential might be, appears to offer promise.

> If we consider the slow-learning child as one with limited abilities and potential for learning, then our emphasis will be on creating learning experiences suitable for his circumscribed capacity. However, if our approach assumes that the child is a changing organism whose development is affected by both external and internal factors which may expedite or impede his development, our thinking and planning for his education will consider his motivation for learning as well as his cultural environment.[21]

This view is a charitable one and certainly for deprived children has many strong points. Until much more is known about the deprived learner it offers hope for the greatest number of children in all academic areas including arithmetic.

From cited definitions, given for underachieving, low-achieving, and slow-learning, it should be apparent that whatever term or criterion is used it fails to connote a precise, well understood framework when applied to disadvantaged children. Even so, the focal point of interest is a group of children who are called disadvantaged and, for reasons not fully understood, are not achieving in school to the degree that available evidence indicates they should. It

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[21]Leiderman, op. cit., p. 45.

is recognized, however, that many factors impinge upon the learning abilities of these children. Among the identifiable factors that adversely affect learning and/or achievement are:

limited background of experiences
limited background of objects, books, toys, etc.
lack of adult models to stimulate and facilitate early learning
poor attitudes and disinterest resulting from the child's perception of the real world and his opportunity to excel in it
history of repeated failures
poor self-image
object of discrimination
poorly developed verbal and auditory skills
unmet basic needs--nutrition, medical, security, love

As a result of poor physical environment combined with the adverse psychological, sociological and physiological influences the child is ill equipped as a learner. Thus Leiderman used the term "cumulative deficit" to denote the "increasing discrepancy between achievement and expected learning."[22] It is in this orientation that one can speak, with a more complete understanding, of what underachievement means in respect to deprived children.

A study by Ross[23] on underachievers in arithmetic, taking a case study approach, yielded important data relevant

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[22] Ibid., pp. 55, 56.

[23] Ramon Royal Ross, "A Case Study Description of Underachievers in Arithmetic" (unpublished Doctoral thesis, An Abstract, University of Oregon, 1962).

to this thesis. The pertinent generalizations taken from the abstract follow:

1. Arithmetic underachievement did not become apparent until the fourth grade.
2. Subjects tended to be from home environments which provided little intellectual stimulation.
3. Subjects characteristically were withdrawn and defeated in their attitude toward school.
4. Subjects were underachieving in school subjects other than arithmetic.
5. Parents tended to be from low socio-economic classes.

Concepts, conceptual development. The mathematical literature reflects profuse usage of the term concept; but it is assumed the meaning is understood for it is not defined. It was necessary to turn to psychology for enlightenment. Bruner, et al. present two views of concepts:

> There are those who urge that a concept, psychologically, is defined by the common elements shared by an array of objects and that arriving at a concept inductively is much like "arriving at" a composite photograph by superimposing instances on a common photographic plate until all that is idiosyncratic is washed out and all that is common emerges. A second school of thought holds that a concept is not the common elements in an array, but rather a relational thing, a relationship between constituent part processes.[24]

The same authors add that such a controversy is fruitless and present another definition:

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[24]Jerome Bruner, Jacqueline Goodnow and George Austin, A Study in Thinking (New York: John Wiley & Sons, Inc., 1956), p. 244.

> The workable definition of a concept is the network of inferences that are or may be set into play by an act of categorization.[25]

Concepts appear to be related to both a category and a thinking process:

> Concept attainment is, to be sure, an aspect of what is conventionally called thinking. . . . But we also have urged a broader view: that virtually all cognitive activity involves and is dependent on the process of categorizing.[26]

> The concept or category is, basically, this "rule of grouping" and it is such rules that one constructs in forming and attaining concepts.[27]

Hunt disagrees with these authors on some points. According to him:

> Arbitrary categorization is not concept learning, yet it sometimes appears in the psychological literature under this name. . . . Furthermore, the learner can use his classifying rule only for the stimuli he has previously experienced. This does not seem consistent with the dictionary definition of a concept; a concept should be generalizable beyond our immediate experience.[28]

Regarding simple categorization or classification, Hunt supports Church's conclusion:

> Church reasoned that a name has two properties, its meaning or concept and its denotation. The denotation

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[25] Ibid., p. 244.

[26] Ibid., p. 246.

[27] Ibid., p. 45.

[28] Earl B. Hunt, Concept Learning (New York: John Wiley and Sons, Inc., 1962), p. 4.

> is the set of objects to which the name can be applied. The concept is a statement of structure in the description of the objects to which the name applies.[29]

As an example of this Hunt uses dog as an object belonging to a set. Set is equivalent to denotation. The concept is the rule or statement of structure based on the descriptions of dog and determines whether or not this object should be relegated to the set called dog. In this way the name (or dog in this case) is both a category and an idea.

Hunt was aware of the ambiguities in the literature tangential to the use of the terms concepts and concept formation, as well as the failure on the part of many writers to define the term. Mathematical writers are no exception.

> Concepts are essentially definitions in symbolic logic. Therefore, their role in logic should be considered. In the psychological literature especially, very little attention has been given to a formal definition of concepts and concept learning. Several authors in mathematical logic, however, have considered the role of concepts and names at length. At a less abstract level, others have considered the problem of recovering the definition of a particular concept from examples of objects to which a name can be applied.[30]

For an understanding of inherent meaning in most of the mathematical writings that employ concept and concept learning and/or teaching as part of the terminology a synthesis of Hunt and Bruner could serve as a useful guide. Both authors

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[29] Ibid., p. 29.

[30] Ibid., p. 8.

appear to agree that a concept is of two orders. The first order according to Bruner is the simple category. Hunt refers to this type as a set or denotation. Examples of these are squares, circles, fourness, or any object or event that can be classified. The second order, and the more sophisticated one, involves meaning associated with the object. Bruner defines this idea of concept in terms of inferences that are set into play as part of the classifying act. Hunt stresses the meaning behind the object, not as it may appear to the learner but as it should be. Both authors would agree that concept formation involves a thinking process. Examples of the second order of concept would include generalizations such as those pertaining to the cardinal use of number, addition being the opposite process of subtraction, etc. It is in this second frame of reference that the term concept is most frequently used. Although there is a subtle difference between the constructs of these two authors, both add to a better insight. It appears in the mathematical literature that the term concept is used with the above connotations.

> The Greater Cleveland Mathematics Program is a concept-oriented modern mathematics program in which the primary emphasis has been placed upon thinking, reasoning, and understanding, rather than on purely mechanical responses to standard situations. The child is continuously encouraged to investigate how and why things happen in mathematics. He is led to make generalizations, to test these generalizations, and to find new applications for them.[31] [Italics mine]

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[31]National Council of Teachers of Mathematics, An Analysis of the New Mathematics Programs (Washington: 1963), p. 10.

The investigator is aware that the presentation on concepts is an oversimplification of a very complex topic. In moving from a purely psychological orientation to a mathematical one it was necessary to establish a framework that was tenable in the mathematical sphere.

A research bulletin published by the U. S. Department of Health, Education, and Welfare covering elementary mathematics raised the following question pertinent to the present topic:

> What extent can mathematics concepts be developed in the elementary grades?[32]

The authors concluded after reviewing recent studies "that children can learn considerably more mathematics than the present programs include." None of the studies cited in support of this conclusion yielded any information that added insight or support to the present study. Those reviewed involved primary children, talented children or use of SMSG materials.

One study was found that had marked relevance to the present topic. This was a doctoral dissertation on a comparison between a conceptual approach to teaching fifth and sixth grade arithmetic and a more traditional approach.

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[32]Kenneth Brown and Theodore Abell, Analysis of Research in the Teaching of Mathematics (Washington: U. S. Dept. of HEW, Government Printing Office, 1965), p. 2.

The author, Patricia Spross,[33] established that children evidenced essentially the same progress with the conceptual approach as with the traditional approach in the area of fundamentals as measured by the California Achievement Test Form BB. There was a significant difference in favor of the group taught by the conceptual approach in achievement as measured by other instruments. The author concluded:

> On the basis of these results, it may be assumed that it is possible to meet the arithmetic curriculum requirement in grades five and six by using a tangible and conceptualized presentation which explains arithmetic rather than by rote-teaching methods.[34]

No study was found that employed a conceptual approach to teaching disadvantaged children.

Attitudes and achievement in mathematics. In Chapter II attitudes were discussed at some length. Kaplan, McCandless, Clark and others place a concern for attitudes in a paramount position. Most current mathematical literature also reflects a similar concern. Numerous studies have been done to determine the relationship between achievement and attitudes. Most of these have yielded a positive correlation. However, the results differ considerably and the

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[33]Patricia McNitt Spross, "A Study of the Effect of a Tangible and Conceptualized Presentation of Arithmetic on Achievement in the Fifth and Sixth Grades" (unpublished Doctoral thesis, Michigan State University, E. Lansing, Michigan, 1962).

[34]Ibid., p. 67.

question is still an open one. The 1965 bulletin published by the Department of Health, Education and Welfare, dealing with recent research, contains the question: "Does pupil attitude affect achievement?"[35] In response to this question the authors cited a number of studies that added to the existing knowledge. Brief summaries of these, together with other studies the investigator found, follow.

Faust,[36] in a study examining the relationship between attitudes and achievement in selected school subjects, found a higher correlation in respect to attitudes and arithmetic achievement than for other school subjects. Two separate studies by Shapiro and Solomon, both of whom investigated the relationship between achievement and attitudes associated with intermediate grade school children, found a positive correlation.

> Mean scores between groups of sixth-grade children who liked arithmetic and groups who disliked it proved significant in all areas.37

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[35]Brown and Abell, op. cit., p. 3.

[36]Claire Edward Faust, "A Study of the Relationship Between Attitude and Achievement in Selected Elementary School Subjects" (an Abstract of an unpublished Doctoral thesis, State University of Iowa, 1962).

[37]Esther Winkler Shapiro, "Attitudes Toward Arithmetic Among Public School Children in the Intermediate Grades" (an Abstract of an unpublished Doctoral thesis, University of Denver, Colo., 1961).

> The general ability to learn was found to be associated with the children's liking for arithmetic.[38]

It was further learned from these investigations that fifth grade boys and girls were influenced more by peer attitudes than pupils at any other grade levels. Methods which failed to promote success in arithmetic caused children to dislike both the subject and the teacher. Parental attitudes related more closely to children's attitudes then they did to achievement.

Bassham, Murphy, and Murphy studied the relationship between achievement and attitudes in arithmetic when reading and mental ability were held constant.

> In the sample of 159 pupils (sixth graders) over four times as many pupils with a poor attitude toward arithmetic were classified as .65 below expected achievement as were classified as .65 above expected achievement. Almost three times as many high-attitude pupils over-achieved .65 grade as underachieved that amount.[39]

The authors caution against predicting achievement on the basis of attitudes since there appeared wide variation in achievement at both extremes of the distribution of attitudes. The complex nature of attitudes is recognized as well as the role of self-perception in changing attitudes.

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[38]Nellie Ollivene Solomon, "Factors Associated with Children's Attitudes Toward Arithmetic," Analysis of Research in the Teaching of Mathematics based on doctoral study (Washington: HEW, 1965), p. 86.

[39]Harrell Bassham, Michael Murphy, and Katherine Murphy, "Attitude and Achievement in Arithmetic," The Arithmetic Teacher, XI (February, 1964), pp. 66-73.

> Attempts to favorably influence attitudes toward mastery of materials require changing the pupil's perception of himself in relation to that material. He must see himself as being able to master the materials, as being able to use it after mastery, as succeeding not only in his own eyes, but in the eyes of others. Unlike interest, attitude does not respond so readily to mere verbal appeal; the predisposition to expect failure is often quite resistant to change.[40]

Lerch[41] noted changes in more than one-half of the attitudes in two groups of children. He felt the key lay in both the teacher's attitude and in his ability to adjust instruction to individual differences.

In The Arithmetic Teacher, March 1963, a study of particular interest and similar to this writer's study, finds the authors concerned with attitudes, achievement and methods. The study by Lyda and Morse[42] involved fourth grade pupils though the size of the group was not specified nor were they deprived children. The writers quoted Paul A. Witty and William Ragan to support the theory that attitudes are important in learning; they noted other sources to demonstrate the role of the teacher and methods used in order to build positive attitudes and make learning meaningful. The evaluating tools used in this study were similar to the one

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[40] Ibid., p. 71.

[41] Harold H. Lerch, "Arithmetic Instruction Changes Pupil's Attitudes," The Arithmetic Teacher, VIII (March, 1961), pp. 117-120.

[42] Wesley Lyda and Evelyn Morse, "Attitudes, Teaching Methods, and Arithmetic Achievement," The Arithmetic Teacher, X (March, 1963), pp. 136-139.

under investigation. The children had twenty-one instruction periods of forty minutes each. Concept of numbers, the understanding of the numeration system, and place value were stressed. The IQ mean of the group was 92; the range was 73-124. The conclusions follow:

1. When meaningful methods of teaching arithmetic are used, changes in attitude toward arithmetic take place. Negative attitudes become positive, and the intensity of positive attitudes becomes enhanced.
2. Associated with meaningful methods of teaching arithmetic and changes in attitude are significant gains in arithmetic achievement, that is, in arithmetical computation and reasoning.[43]

Abrego[44] did not find a relationship between attitudes and arithmetic achievement with either traditional or modern mathematics. Stevens[45] explored the relationship between the attitudes of high achievers and low achievers and found a significant difference only between the two top groups of achievers. Students had been grouped into ability levels of high, average and low or remedial. There was no significant difference found between the average and remedial and little difference between the high achievers and remedial groups in attitudes.

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[43] Ibid., p. 138.

[44] Mildred Brown Abrego, "Children's Attitudes Toward Arithmetic," The Arithmetic Teacher, XIII (March, 1966), pp. 206-209.

[45] Lois Stevens, "Comparison of Attitudes and Achievement Among Junior High School Mathematics Classes," The Arithmetic Teacher, VII (November, 1960), pp. 351-357.

One interesting finding by Stright[46] was that as children progressed upward through the grades positive attitudes toward arithmetic diminished. At the third grade level 63% of the children liked arithmetic, at fourth grade 59% expressed a liking for it and at the sixth grade level only 53% said they liked arithmetic. Sister Josephina[47] found arithmetic to be the least liked subject among elementary children.

In the majority of research findings there appeared a positive correlation between attitude and achievement in arithmetic. But research in this area is still in its infancy and results are not always clear-cut. Moreover, research has been confined overwhelmingly to the typical child. Late recognition of the deprived child has precluded substantial research in this area.

Finally, some important facts which have emerged from recent literature and are pertinent to this study are:

1. There is a relationship between socio-economic level and achievement in arithmetic.[48]

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[46]Virginia M. Stright, "A Study of Attitudes Toward Arithmetic of Students and Teachers in the Third, Fourth, and Sixth Grades," The Arithmetic Teacher, VII (October, 1960), pp. 280-287.

[47]Lyda and Morse, op. cit., p. 136.

[48]Alwin W. Rose and Helen C. Rose, "Intelligence, Sibling Position, and Sociocultural Background as Factors in Arithmetic Performance," The Arithmetic Teacher, VIII (February, 1961), pp. 50-57.

2. IQ scores are poor predictors of success with lower-socio-economic children in arithmetic.[49]

3. Number concepts are less developed among disadvantaged children.[50]

4. Attitudes toward arithmetic develop as early as third grade; Dutton maintains that grades four through eight are crucial years in this respect.[51]

5. Teaching techniques should vary in both degree and kind from methods employed with the typical learner.[52]

6. Disadvantaged children are handicapped in their ability to handle abstractions.[53]

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[49] Ibid.

[50] M. E. Dunkley, "Some Number Concepts of Disadvantaged Children," The Arithmetic Teacher, XII (May, 1962), pp. 359-362.

[51] Abrego, op. cit., p. 206.

[52] Billy J. Paschal, "Teaching the Culturally Disadvantaged Child," The Arithmetic Teacher, XIII (May, 1966), pp. 369-374.

[53] Harry Beilin and Lassar Gotkin, op. cit., pp. 12-14.

CHAPTER IV

THE METHOD OF THE INVESTIGATION

The general design of this chapter will include: (1) a description of the students in the study; (2) description of the camp environment relating to teaching facilities; (3) method of instruction; (4) materials and activities used in instruction; (5) instruments used in the study; and (6) testing sequence.

A description of the students in the study. Students ranged in ages from eight through twelve and were composed of fourth and fifth graders. Thirty-seven were Negroes, 32 were white and 13 were of Mexican-Spanish descent. There were 44 fourth graders and 38 fifth graders. Forty-two had come from broken homes and averaged six siblings. IQ's ranged from 68 to 145 with a mean of 96. Fifteen had repeated one or more grades and 25 rated arithmetic as the least liked subject. Sixty-one were below grade level in reading and 63 were below in arithmetic. All came from the greater Saginaw area and from a low-socio-economic background. Each subject had been identified as an underachiever and as disadvantaged by his regular classroom teacher. The Appendix contains a more complete listing of characteristics and a scattergram depicting the dispersion of these traits.

A description of the camp facilities. The children involved in this study were attending a summer camp at St. Mary's Lake. Each child had been assigned to a cabin and a junior counselor for the five weeks duration of camp experience. The classroom assigned to the writer for arithmetic was not ideal for such an experience. It was small, contained no shelves and only one very small and battle-scarred chalk board. The room was on the water front which posed a real problem as there were children swimming and indulging in water sports throughout the days. Visual as well as auditory distractions were a constant source of competing stimuli.

Camp facilities included several acres of woodland, a small lake, a modest main lodge, six dormitory-like cabins, and a picnic area. These facilities became part of the extended classroom for instructional purposes.

Method of instruction. As stated earlier each class period was one hour daily. The concept approach to teaching, as already discussed, utilized a methodology which stressed main ideas, generalizations, structure, understanding, and relationships in a mathematical setting. The children were guided to an understanding of meaningful mathematical concepts or ideas.

Objectives were: first, to reverse negative attitudes and encourage more positive feelings toward mathematics; and

secondly, to help the children develop a better understanding of mathematics. To accomplish these goals a procedure was instituted that permitted flexibility, large and small group activities, utilization of camp environment, frequent changes in pace, numerous concrete aids and models, and involvement of junior counselors.

A routine was established to give the pupils an established framework within which they could operate and yet enjoy a degree of freedom. Class always began on time and started out in the regular classroom.

No commercial textbook was used in this experiment. Each day one general topic was introduced and explored in search for meaningful concepts (samples of these appear in the Appendix). After these had been developed in the classroom by using aids, demonstrations, and discussion, the group (20 to 26 pupils) would move out of the classroom to engage in an activity pre-planned to reinforce these concepts. At the end of each period the class members would help the instructor summarize what they had learned. The writer each evening typed these statements up on a manuscript typewriter, cut a stencil, mimeographed enough copies for each child, cut the copies to book-size and further prepared them for assembly into the child's personal arithmetic book. Each day these were passed out and served as a review. Once a week the children placed these pages into their books. In

cooperation with the arts and crafts director the book covers were designed and constructed by the pupils.

The classroom became a veritable laboratory in which the children could construct, manipulate, measure, and explore mathematical ideas and participate in demonstrations. A minimal amount of time was devoted to paper and pencil work. There was no stress on drill, computation, or memory work. Every effort was made to make the class enjoyable for the children and to give them experiences in success. Praise was used frequently whenever a child made some gain. There were no homework assignments except when a child volunteered to attack a problem presented in class as a challenge and which always related to some aspect of camp living.

In an attempt to make arithmetic relevant and desirable to the pupils, considerable time was spent on finding out from each child what he thought he would like to be when he grew up. Then in group discussion the children were guided into the realization that, whatever choice they made, they would need to know a great deal about numbers or arithmetic. Time also was spent on the notion that mathematics is not truly difficult; that anyone can master it--it really only invclves four simple operations and there is more than one way to solve a problem. The majority of these children had experienced so many failures that both of these time consuming activities appeared justified

to the investigator to serve as motivation and to help the child gain confidence.

A lesson plan follows in this thesis which is considered a typical class session. No two days were exactly alike but the same general format was adhered to. A summary sheet portraying uniqueness of the program in terms of techniques and emphases, and contrasted with a more traditional approach, appears following the lesson plan in this chapter. Examples of extended classroom activities appear in the Appendix.

TYPICAL LESSON PLAN

Beginning of the hour:

1. Pass out new book page and review previous day's work.

2. Introduce new topic--Zero

   Demonstrate with egg carton and ping-pong balls, abacus, chalk-board, and place value charts.

   Guide pupils to understand the importance of zero in our number system; uses of zero; what happens to a number when we add or subtract zero objects. List concepts of zero such as:

   a. zero is an important part of our number system
   b. zero tells us how many just as the other numerals do
   c. the empty place on the place value chart or abacus represents zero number
   d. when zero is added to a number the sum is that number
   e. when zero is subtracted from a number the remainder is that number
   f. there are many places we use zero, such as on thermometers, scales, telephone dials, etc.

20 to 30 minutes past the hour:

Assign 4 or 5 students to a junior counselor and provide pass-out sheets and pencils for outside activity. This activity involves finding all the places where zero is used at camp--the telephone, clock, license plates, thermometer, etc.

10 or 15 minutes before the end of the hour:

Reassemble the class and learn from them how many instances of zero they found, the function zero served in each case, etc.

Clear up any questions or misunderstanding, have children give information regarding zero they want printed for a book page.

List on chalk-board concepts and other pertinent information from children's prompting.

Tell children they will be dismissed as soon as they whisper the password to teacher or junior counselor. This must be something regarding zero. Example: I caught zero fish--meaning I caught no fish, 204 means there are no tens, etc.

Prepare for next group.

Summary of Teaching Techniques Used in Summer Program for Disadvantaged Children Contrasted with Regular Classes

Experimental	Regular
Considerable time spent on motivation	Minimal if any time spent on motivation
Children made own textbooks	Commercial texts used
Frequent use of games and role playing	Limited use of games and role playing
Minimal amount of paper and pencil work	Paper work stressed
Multiple arithmetic aids used	Limited use of aids
Classroom approximated laboratory for construction and exploration	Little or no provision for construction and exploration
Classroom extended to entire camp grounds	Teaching confined to classroom
Frequent small group activities utilizing jr. counselors	Aides rarely available
Mathematics related to daily living and realities of life	Textbook followed
Departmentalized, no grouping	Self-contained, often ability grouping used
Many opportunities for success	Success often limited to few
No homework or grades	Homework commonplace, grades given
Daily review	Infrequent reviews
Frequent change of pace and activities	Limited activities
Considerable class discussion and participation	Limited discussion and participation
Emphasis on mathematical concepts	Emphasis on drill, problem solving

Experimental	Regular
Sessions one hour daily	Sessions vary from 20 minutes to 30 or 40 minutes
Concerned with attitudes	Little or no concern for attitudes

One experience that extended over several days and appeared to be very successful in terms of student interest may add further insight to techniques and procedures used in the program. Each child was given a foot-length of wood molding. When measurement was introduced each child made his own ruler, calibrating it from a commercial ruler and dividing it into quarter, half, and full inches. After the rulers were checked for accuracy each child marked the calibrations with a fine felt pen. The finished products were repeatedly used throughout the remaining classes in direct measurement, as number lines and for work with fractions.

Materials and activities. Some of the materials have already been mentioned and a complete list appears in the Appendix. Despite the limiting physical facilities of the classroom, every possible effort was made to approximate a mathematical laboratory. An adequate portable chalkboard was obtained; walls were covered with charts; racks constructed of pegboard served to hold a variety of manipulative aids; number lines, abaci, counting frames, etc. A draw-strin-

bag with counting sticks and discs was provided for each child. The total camp ground was utilized for observations, collections, and for problem solving. Treasure hunts were designed for both reinforcing ideas and for evaluating purposes. Role playing was introduced and games frequently used--domino-bingo, ten pins with oatmeal boxes and a soft ball, and numerous other games. Children kept scores, solved problems and generally used numbers in countless ways as part of the total experience. Every effort was made to have available representative models or aids to represent the real world of numbers. In this respect the teaching-learning situation evolved into very tangible experiences, with emphasis always upon understanding underlying concepts. Hence both materials and activities were used in the process as vehicles for developing the more abstract or conceptual ends stated as objectives, i.e. greater understanding of and more positive attitudes toward arithmetic.

Instruments used in the study. The Peabody Picture Test was used to determine mental maturity and IQ. The arithmetic portion of the Iowa Test of Basic Skills, Form I was administered to assess achievement level prior to the camp experience and Form III was used for evaluating progress. The California Arithmetic Achievement Test was used for comparative purposes in arithmetic and to determine reading level. The Dutton-Adams Attitude Scale was used to ascertain how the

child viewed arithmetic and to measure any changes in his feelings toward arithmetic.

No attempt will be made to justify any of these instruments. For the most part the guidance counselors made the choice as to what test instrument would be used. Actually so little is known about evaluating disadvantaged children, and so little research has been done to develop instruments designed specifically for the disadvantaged, that any instrument used would leave something to be desired. The writer confesses that availability was the main criterion in some instances.

Testing sequence. The first two days of class time were devoted to pre-testing. At this time the Iowa Basic Skills Form I achievement tests were given; also, the Dutton-Adams Attitude Scale. Within the first week, but not during arithmetic class periods, the Peabody Picture Test and the California Achievement test were administered. The last two days of camp were used for follow-up testing designated the post-test. During this time the Iowa Basic Skills Test Form III for arithmetic and the Dutton-Adams Attitude Scale were given.

After the children had been back in their regular classrooms (in Saginaw) for six months, approximately seven months after the camp experience, a random group of 30 was interviewed and tested. This testing situation has been

designated as the post-post-test. At this time (the last week in February and the first week in March) the Dutton-Adams Attitude Scale was given for the third time and the Iowa Arithmetic Achievement Test Form I was given for the second time. Personal interviews were also conducted during this interval.

Testing, with the exception of the Peabody Picture Test and the random testing, was done on a group basis. For the random or post-post-test the situation demanded testing be done on an individual basis. This was necessary as the children represented many schools throughout the Saginaw area and rarely were two children to be found in any one school.

Individual files were kept on each child and pertinent information was accumulated throughout the five weeks. These contained data regarding number of siblings, status of the home, least-liked subject, etc.

CHAPTER V

DATA AND RESULTS

Achievement was evaluated by the results of the standardized tests noted in Chapter IV. Raw scores from the arithmetic portion of the Iowa Basic Skills Test were converted to grade scores using the manual that accompanied the test booklets. Percentile ranks were determined by using the "Beginning of the Year" percentile norms for the pre- and post-tests and the "End of the Year" percentile norms for post-post-tests. Mean gains were determined for the fourth and fifth grades in (1) concepts, (2) problem solving, and (3) total test scores. The same information was computed for the random groups. The sign test was applied to determine significant gains and to reveal which sub-groups responded best to the concept method. According to Siegel[1] the sign test is useful when small samples are involved and the population is heterogeneous in respect to IQ, sex, etc. To establish that two pairs are significantly different, in this case the achievers and non-achievers, the sign test is applicable.

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[1]Sidney Siegel, Nonparametric Statistics for the Behavioral Sciences (New York: McGraw-Hill Book Company, Inc., 1956), pp. 68, 69.

Actual numbers of students who made gains were computed. Percentages of pupils who achieved were determined.

The data and analyses supplied by the Iowa Testing Service, which were based on estimated grade equivalent scores for the state of Iowa, were utilized to determine achievement gains and losses and served as verification of the investigator's data.

The Spearman Rank Difference formula was used to determine the relationship between reading and arithmetic and to correlate the Iowa and California arithmetic tests. The Spearman Rank Difference Method according to Noll[2] is an appropriate technique when small groups are involved and a comparison is to be made between two sets of scores such as arithmetic and reading.

By the above procedures the first hypothesis was tested:

> H_1 Disadvantaged and underachieving children will respond in a positive manner to the concept method of instruction in mathematics as evidenced by gains on an achievement test.

Table I shows achievement in mean grades for the total groups of fourth and fifth graders from Test A (pre-test) to Test B (post-test). Table II shows mean percentile rank gains for the same groups and same tests. Table III shows the mean grade gains for the random groups in all three tests--A, B, and C (pre, post, and post-post).

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[2]Victor H. Noll, Introduction to Educational Measurements: Houghton Mifflin Company, 1957), pp. 408, 4[illegible].

Table I.--Achievement in mean grades--total group*

Test	A-1	A-2	A-T
Fourth Grade			
Pre-test, Iowa Form I	3.41	3.74	3.58
Post-test, Form III	3.48	3.28	3.38
Gains from A to B	.07	-.46	-.20
Fifth Grade			
Pre-test, Iowa Form I	4.19	3.82	4.01
Post-test, Form III	4.23	4.22	4.22
Gains from A to B	.04	.40	.21

Table II.--Mean achievement in percentile ranks

Test	Rank	Gain
Fourth Grade		
Pre-test, Iowa Form I	33.2	
Post-test, Form III	27.7	-5.5
Fifth Grade		
Pre-test, Iowa Form I	22.6	
Post-test, Form III	27.8	5.2

A-1 = Arithmetic concepts
A-2 = Problem solving
A-T = Total tests

*N= 82 (44 fourth graders) and (38 fifth graders)

Table III.--Achievement in mean grades for random group*

Test	A-1	A-2	A-T
Fourth Grade			
Pre-test, Iowa Form I	3.55	3.65	3.60
Post-test, Form III	3.32	3.32	3.32
Gains from A to B	-.23	-.33	-.28
Post-post-test, Form I	4.17	4.08	4.12
Gains B to C	.85	.76	.80
Gains A to C	.62	.43	.52
Fifth Grade			
Pre-test, Iowa Form I	4.29	3.92	4.11
Post-test, Form III	4.42	4.15	4.27
Gains A to B	.13	.23	.16
Post-post-test, Form I	4.79	4.59	4.69
Gains B to C	.37	.44	.42
Gains A to C	.50	.67	.58

A-1 = Arithmetic concepts
A-2 = Problem solving
A-T = Total tests
*N = 30 (16 fourth graders) and (14 fifth graders)

According to the data supplied by A. N. Hieronymus,[3] representing the Iowa Testing Service, the mean gains were as follows: fourth graders achieved a .68 gain in concepts and a -.84 in total score. Fifth graders achieved a .47 gain in concepts and a +2.16 in total score. Although these results differ markedly from those of the investigator a similar pattern emerges. Meanwhile it must be remembered that these results were based on estimated grade equivalents for the state of Iowa.

The information below presents actual numbers and percentages of pupils who made gains in achievement.

Fourth grade--11 out of 44 students, or 25%, gained from the pre-test to the post-test; 14 out of 16, or 88%, gained from the post-test to the post-post-test (given to the random sample), and 11 out of 16, or 69%, gained from the pre-test to the post-post-test.

Fifth grade--23 out of 38, or 61%, made gains from the pre-test to the post-test; 8 out of 14, or 57%, gained from the post-test to the post-post-test (given to the random sample); 11 out of 14, or 79%, gained in achievement from the pre-test to the post-post-test.

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[3]A. N. Hieronymus, in a letter to the investigator found in the Appendix.

From the results of the Sign Test, fourth graders achieved significantly (at a .05 significant level) from test B to C and from A to C. Fifth graders achieved significantly from A to C. There was a marked difference between the sexes in achievement among the fourth graders, the boys showing a higher incidence of regression. When IQ's were considered the low-medium group and the high group achieved with greater frequency. The complete information on the Sign Test appears in the Appendix.

As the total results approximate an occurrence of chance in many respects a correlation was computed between the Iowa and California arithmetic tests to determine how reliable the test results on the main evaluating tool were. The Spearman Rank Correlation method was used for this purpose. There was a correlation of .58 between the two tests for fifth graders and a correlation of .71 for fourth graders. These results would signify that the pupils were not guessing and that the data were reasonably realiable.

It was mentioned earlier that there were almost as many underachievers in reading as there were in arithmetic. Therefore, the Spearman Rank Correlation method was applied between the reading scores and the Iowa arithmetic scores in order to determine the relationship between these two variables. Fifth graders evidenced a correlation of .49 and fourth graders showed a correlation of .55 between reading and arithmetic.

From the data it appears that in terms of immediate goals the hypothesis for achievement did not prove valid for fourth graders. However, in long term goals the concept method may have had a marked positive effect. The hypothesis proved valid for the fifth graders as evidenced by gains in mean grades and percentile ranks. This proved true for both immediate and long term results.

Evaluations regarding attitudes toward arithmetic were made by comparisons between scores on the Dutton-Adams Attitude Scale, considering both the self-rating results and the actual score results. These findings were submitted to the Sign Test to determine what could be considered significant changes by eliminating chance occurrence.

The hypothesis dealing with attitudes states:

H_2 Disadvantaged and underachieving children will tend to show a positive change in attitude as a result of the influence of careful attention to method and materials as evidenced by a positive change on an attitude scale.

It was found that the subjects in the experiment tended to mark the extremes on the attitude scale. It was therefore decided that the actual score would be more meaningful in interpreting how the child felt toward arithmetic. There was a mean difference of 2.7 between the actual scores and the self-rating scores which is considerable on an eleven point scale. Using the actual scores (averages of marked items) results obtained are reflected in Table IV.

Table IV.--Attitudinal changes

Test	Improvement	Regression	No Change	% Improvement
Fourth Grade				
A to B, Total	25	15	4	57
B to C, Random	7	7	2	45
A to C, Random	13	2	1	81
Fifth Grade				
A to B, Total	26	10	2	69
B to C, Random	8	4	2	57
A to C, Random	12	1	1	86
Fourth and Fifth Grades				
A to B	51	25	6	62

The Appendix contains scattergrams for both fourth and fifth grades depicting dispersions of the attitude changes. The Sign Test dealing with attitudes may be found there also. A summary of the findings follows.

The Sign Test reflected a significant number of changes in attitudes toward arithmetic within both fourth and fifth grades to warrant the conclusion that the hypothesis was true. In considering the sexes separately it was learned that fifth grade girls responded better. In considering IQ's the high-mediums (109-118) evidenced the greatest changes.

The low-mediums (89-98) were second in significance. It was also observed that, after having returned to the regular classrooms for six months, one-half of those who changed in attitude among the fourth grade random group regressed to a less positive feeling toward arithmetic. One-third of the changers among the fifth grade random group also regressed. However, a substantial number within both grade levels continued to improve or held constant.

In summary, it appeared that attitudes of disadvantaged and underachieving children can be changed in a positive manner at the fourth and fifth grade levels. This would seem clear on the basis of: (1) actual numbers--51 out of 82 showed improvement on the Dutton-Adams Attitude Scale, (2) percentage--62% made positive changes, and (3) the results of the Sign Test.

To determine the relationship between attitude and achievement in arithmetic the Phi Correlation technique utilizing a four-fold table was used. According to Garrett,[4] when statistical data fall into dichotomies such as true or false or in this case a postive or a negative relation ship the phi correlation is an appropriate measure of

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[4]Henry E. Garrett (New York: David McKay Company, Inc., 1964), pp. 388-389.

correlation. The Pearson Product-Moment Correlation method was applied to the random groups using the formula by Noll.[5] This method reveals the extent of relationship between two variables by determining the deviation from the mean of each individual in respect to both variables. The third and last hypothesis was tested by these procedures.

> H_3 Disadvantaged and underachieving children will tend to show a positive relationship between attitude toward mathematics and achievement in mathematics.

It was not possible to arrive at a definitive conclusion regarding the relationship between attitude and achievement on the basis of these data. Using the results of the Pearson Product Moment method for the fourth graders it appeared that there was no correlation between these two variables. However, the Phi correlation results would indicate a moderately low relationship. The fifth grade results on both procedures would indicate no correlation except for Test B with the random group which showed a substantial correlation between attitude and achievement. The results are summarized on the following page.

Some of the discrepancy is accounted for by the fact that use of the phi correlation gives no consideration to those individuals who make no change on either one or the other of the two variables. Eighteen showed a positive relationship, 15 showed a negative relationship, and 11

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[5]Noll, op. cit., p. 410.

Table V.--Relationship between attitude and achievement

P. P. Moment* Correlation	Test A	Test B	Test C
Random Groups			
Fourth Grade	.05	-.03	-.02
Fifth Grade	-.20	.43	.07
Phi Correlation	from Test A to Test B		
Total Groups			
Fourth Grade		.22	
Fifth Grade		.08	

*Pearson Product-Moment Method

failed to change from Test A to B in one of the two areas at fourth grade level. At the fifth grade level there were 19 reflecting positive relationship, 13 negatives and 6 no changes.

Out of 90 possible changes, combining both random groups on all three test situations, 40, or 45% showed a positive correlation. Thirty, 33%, showed a negative relationship and 20, or 22%, showed no change in one or the other factor.

From all the available information it appeared that a significant relationship between attitude toward arithmetic and achievement in arithmetic did not exist with fourth and fifth grade disadvantaged children.

The complete data dealing with attitudes and achievement appear within the following tables.

Table VI.--Relationship between attitude and achievement

Fourth grade random sample Test A

X Attitude	Y Achievement	x	y	x^2	y^2	xy
4.6	4.2	-1.6	.6	2.56	.36	-.96
7.4	2.8	1.2	-.8	1.44	.64	-.96
7.6	3.5	1.4	-.1	1.96	.01	-.14
4.2	3.6	-2.0	0	4.00	--	--
7.6	4.8	1.4	1.2	1.96	1.44	1.68
6.0	2.6	- .2	-1.0	.04	1.00	.20
7.6	3.8	1.4	.2	1.96	.04	.28
3.6	3.4	-2.6	-.2	6.76	.04	.52
8.0	4.7	1.8	1.1	3.24	1.21	1.98
7.7	2.8	1.5	-.8	2.25	.64	-1.20
7.6	4.2	1.4	.6	1.96	.36	.84
3.3	2.6	-2.9	-1.0	8.41	1.00	2.90
4.3	4.4	-1.9	.8	3.61	.64	-1.52
4.0	4.0	-2.2	.4	4.84	.16	- .88
7.6	3.4	1.4	-.2	1.96	.04	- .28
7.8	2.7	1.6	-.9	2.56	.81	-1.44
				49.51	8.39	1.02
Mean 6.2	3.6					

Pearson Product-Moment Correlation

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

$$r = \frac{1.02}{\sqrt{49.51 \times 8.39}}$$

$$= \frac{1.02}{\sqrt{415.3889}} = \frac{1.02}{20.38}$$

= .05

Table VII.--Relationship between attitude and achievement

Fourth grade random sample Test B

X Attitude	Y Achievement	x	y	x^2	y^2	xy
6.7	3.4	-.5	.1	.25	.01	-.05
8.0	2.4	.8	- .9	.64	.81	-.72
7.0	2.8	-.2	- .5	.04	.25	.10
3.6	2.8	-3.6	- .5	12.96	.25	1.80
7.6	4.0	.4	.7	16	.49	28
5.5	3.4	-1.7	.1	2.89	.01	-.17
7.3	3.8	.1	.5	.01	.25	.05
4.3	3.4	-2.9	.1	8.41	.01	-.29
8.0	3.4	.8	.1	.64	.01	.08
8.8	3.6	1.6	.3	2.56	.09	.48
8.8	4.2	1.6	.9	2.56	.81	1.44
8.6	2.3	1.4	-1.0	1.96	1.00	-1.40
6.4	4.6	- .8	1.3	.64	1.69	-1.04
8.8	2.9	1.6	- .4	2.56	.16	- .64
7.7	3.1	.5	- .2	.25	.04	- .10
8.2	3.0	1.0	- .3	1.00	.09	- .30
				37.53	5.97	- .48
Mean 7.2	3.3					

Pearson Product-Moment Correlation

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

$$r = \frac{-.48}{\sqrt{37.53 \times 5.97}}$$

$$r = \frac{-.48}{\sqrt{224.0541}} = \frac{-.48}{14.97}$$

$$r = -.03$$

Table VIII.--Relationship between attitude and achievement

Fourth grade random sample Test C

X Attitude	Y Achievement	x	y	x^2	y^2	xy
4.4	4.4	-3.0	.3	9.0	.09	-.90
5.6	4.5	-1.8	.4	3.24	.16	-.72
7.9	3.3	.5	-.8	.25	.64	-.40
8.0	3.0	.6	-1.1	.36	1.21	-.66
7.6	3.6	.2	-.5	.04	.25	-.10
8.0	3.4	.6	-.7	.36	.49	-.42
8.8	4.9	1.4	.8	1.96	.64	1.12
6.6	4.0	-.8	-.1	.64	.01	.08
8.2	4.7	.8	.6	.64	.36	.48
8.8	4.6	1.4	.5	1.96	.25	.70
8.0	4.8	.6	.7	.36	.49	.42
7.9	4.2	.5	.1	.25	.01	.05
6.9	4.7	- .5	.6	.25	.36	-.30
6.9	4.1	- .5	--	.25	--	--
7.2	3.2	- .2	-.9	.04	.81	.18
8.0	4.5	.6	.4	.36	.16	.24
				19.96	5.93	-.23
Mean						
7.4	4.1					

Pearson Product-Moment Correlation

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

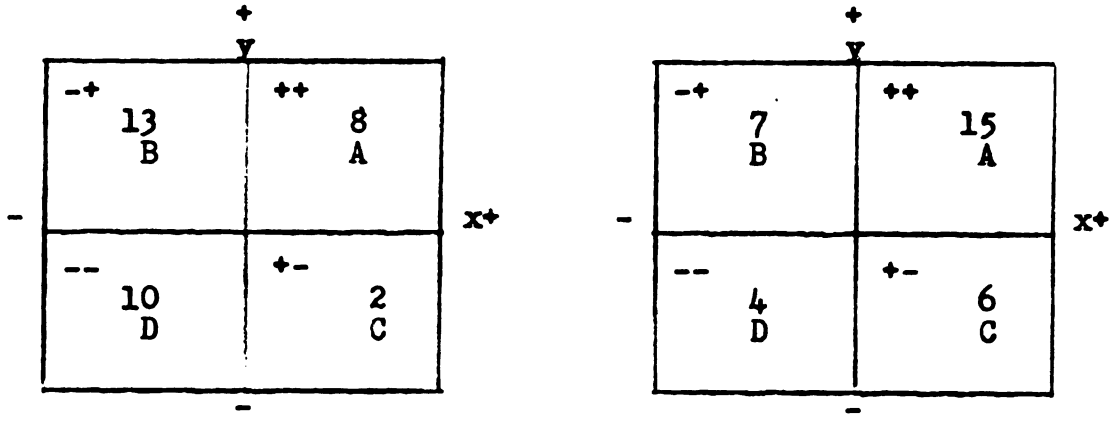
$$r = \frac{-.23}{\sqrt{19.96 \times 5.93}}$$

$$r = \frac{-.23}{\sqrt{118.3628}} = \frac{-.23}{10.88}$$

$$r = -.02$$

Table IX.--Relationship between attitude and achievement

Fourth and fifth grade total from Test A to B
Attitude and Achievement
Phi Correlation*



Fourth Grade

Fifth Grade

$$\phi = \frac{AD - BC}{\sqrt{(A + B)(C + D)(B + D)(A + C)}}$$

$$\phi = \frac{80-26 \text{ or } 54}{\sqrt{(21)(12)(23)(10)}} \quad \text{or } 57,960$$

$$\phi = \frac{60-42 \text{ or } 18}{\sqrt{(22)(10)(11)(21)}} \quad \text{or } 50,820$$

$$\frac{54}{240.75}$$

$$\frac{18}{225.43}$$

$$\phi = .22$$

$$\phi = .08$$

*Adapted from Garrett, p. 389.

Table X.--Relationship between attitude and achievement

Fifth grade random sample Test A

Attitude X	Achievement Y	x	y	x^2	y^2	xy
5.0	5.6	-1.6	1.5	2.56	2.25	-2.40
5.7	4.5	- .9	.4	.81	.16	- .36
5.2	4.4	-1.4	.3	1.96	.09	- .42
8.2	5.3	1.6	1.2	2.56	1.44	1.92
7.6	5.4	1.0	1.3	1.00	1.69	1.30
4.2	3.6	-2.4	- .5	5.76	.25	1.20
6.0	3.6	- .6	- .5	.36	.25	.30
7.7	3.4	1.1	- .7	1.21	.49	- .77
7.2	3.5	.6	- .6	.36	.36	- .36
8.0	2.2	1.4	-1.9	1.96	3.61	-2.66
5.3	3.8	-1.3	- .3	1.69	.09	.39
7.7	3.0	1.1	-1.1	1.21	1.21	-1.21
8.0	3.6	1.4	- .5	1.96	.25	- .70
6.6	5.8	--	1.7	--	2.89	--
				23.40	15.03	-3.77
Mean						
6.6	4.1					

Pearson Product-Moment Correlation

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

$$r = \frac{-3.77}{\sqrt{23.40 \times 15.03}}$$

$$r = \frac{-3.77}{\sqrt{351.7020}} = \frac{-3.77}{18.75}$$

$$r = -.20$$

Table XI.--Relationship between attitude and achievement

Fifth grade random sample Test B

Attitude X	Achievement Y	x	y	x^2	y^2	xy
7.7	5.2	.3	.9	.09	.81	.27
6.9	4.6	-.5	.3	.25	.09	-.15
7.7	5.2	.3	.9	.09	.81	.27
8.2	5.6	.8	1.3	.64	1.69	1.04
7.9	5.4	.5	1.1	.25	1.21	.55
4.5	3.6	-2.9	-.7	8.41	.49	2.03
7.2	3.0	- .2	-1.3	.04	1.69	.26
8.0	4.0	.6	- .3	.36	.09	-.18
6.9	3.0	- .5	-1.3	.25	1.69	.65
6.7	3.6	- .7	- .7	.49	.49	.49
5.5	3.2	-1.9	-1.1	3.61	1.21	2.09
8.8	2.8	1.4	-1.5	1.96	2.25	-2.10
8.8	4.8	1.4	.5	1.96	.25	.70
8.4	5.8	1.0	1.5	1.00	2.25	1.50
				19.40	15.02	7.42
Mean						
7.4	4.3					

Pearson Product-Moment Correlation

$$r = \frac{\sum xy}{\sqrt{\sum x^2 \times \sum y^2}}$$

$$r = \frac{7.42}{\sqrt{19.40 \times 15.02}}$$

$$r = \frac{7.42}{\sqrt{291.3880}} = \frac{7.42}{17.06}$$

$$r = .43$$

Table XII.--Relationship between attitude and achievement

Fifth grade random sample Test C

Attitude X	Achievement Y	x	y	x^2	y^2	xy
9.0	5.8	1.2	1.2	1.44	1.44	1.44
7.4	4.2	- .4	- .4	.16	.16	.16
5.8	4.6	-2.0	--	4.00	--	--
7.6	6.1	- .2	1.5	.04	2.25	- .30
7.9	5.8	.1	1.2	.01	1.44	.12
5.4	4.1	-2.4	- .5	5.76	.25	1.20
8.0	3.0	.2	-1.6	.04	2.56	- .32
9.0	4.0	1.2	- .6	1.44	.36	- .72
8.8	4.3	1.0	- .3	1.00	.09	- .30
8.0	3.6	.2	-1.0	.04	1.00	- .20
8.0	3.3	.2	-1.3	.04	1.69	- .26
8.0	4.6	.2	--	.04	--	--
8.8	3.9	1.0	- .7	1.00	.49	- .70
8.2	7.3	.4	2.7	.16	7.29	1.08
				15.17	19.02	1.20
Mean 7.8	4.6					

Pearson Product-Moment Correlation

$$r = \frac{\Sigma xy}{\sqrt{\Sigma x^2 \times \Sigma y^2}}$$

$$r = \frac{1.20}{\sqrt{15.17 \times 19.02}}$$

$$r = \frac{1.20}{\sqrt{288.5334}} = \frac{1.20}{16.98}$$

$$r = .07$$

Table XIII.--Individual Analysis of Relationship between achievement and attitude (Based on Random Sample)

Fourth Grade				Fifth Grade			
Iden. No.	A to B	B to C	A to C	Iden. No.	A to B	B to C	A to C
1	-	-	-	6	-	+	+
3	-	-	-	9	+	-	-
5	+	+	-	15	+	+	+
8	+	+	-	16	0	-	-
13	0	0	0	24	0	0	+
18	-	0	+	25	0	+	+
19	0	+	+	33	-	0	-
22	0	+	+	36	+	0	+
37	0	+	0	39	+	+	+
42	+	0	+	45	-	0	0
57	0	-	+	52	-	+	-
60	-	-	+	58	-	-	+
61	+	+	+	75	+	0	+
64	-	-	+	77	0	-	+
68	-	-	+				
69	+	-	+				
N 16				N 14			

90 Total possible changes

40 showed positive correlation — 45% (+) correlation
30 showed negative correlation — 33% (-) correlation
20 showed no change in one or the other factor — 22% (0) correlation

CHAPTER VI

SUMMARY, CONCLUSIONS AND IMPLICATIONS

Summary

The purposes of this dissertation were to explore the literature to learn what is known about the disadvantaged child; to survey what has been accomplished in the area of mathematics with deprived children; and to present a synthesis of these. A prime intention of the writer was to report the experiences and results of one program designed specifically to promote better attitudes and achievement in mathematics on the part of disadvantaged youth.

Conclusions

Analysis of the data indicated that modest gains in achievement were evidenced by the fifth graders by employing the concept method of instruction and other innovations in materials and activities. The results revealed both immediate and long term gains at the fifth grade level. Fourth graders appeared to benefit less from the camp experience in terms of achievement. However, considerable benefits may have accrued in better performance at a later date.

In terms of attitudinal changes the experiment appeared to be effective with both fourth and fifth graders. It was further learned that after an interval of seven months, which represented six months for the child to be in his regular classroom, fifty per cent continued to improve in attitude toward arithmetic. Thirty-seven per cent regressed and thirteen per cent held constant at the post-test level.

The relationship between attitude and achievement in arithmetic was not consistently significant. There was some evidence of a correlation but the over-all results proved erratic and did not lend genuine support to the hypothesis.

Implications

The instruments used for evaluative purposes in the experimental program left something to be desired. Even though the scale used to measure attitudes had been modified the children had difficulty interpreting it. Also, the apparent desire to please in many instances was evident by the child's marking the highest rating possible. His actual score computed by averaging separate items was at variance with his self-rating score. Even within the separate items there were many inconsistences. For example, many children marked item number 4 which states, "I have never liked arithmetic"; but also marked item number 13 which states, "I have

always liked arithmetic because it has presented me with a challenge." By careful examination of each individual score sheet it appeared this was not a tool that reflected reliable results.

Regarding the standardized tests measuring achievement it appeared that Form III was more difficult for this group than Form I. However, according to the Iowa Testing Service these are purported to be comparable forms. In searching for possible reasons why the results were so different in comparing fourth grade achievement with fifth grade achievement one explanation appeared to be in the area of reading. As was noted, there was a greater correlation between reading and arithmetic with the fourth grade group than with the fifth grade group. It was learned that of the 61 children who were below grade level in reading 36 of these were fourth graders. Of the 36, 25 were more than one-half year below grade level in reading. Thus it seemed apparent that reading played an important role in the cause of lower arithmetic achievement.

In searching for other possible clues the writer did considerable reading about Piaget's[1] experiments on concept formation and developmental stages related to attainment of

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[1]See the Arithmetic Teacher Journals, November, 1963, January and November, 1964, and May 1966; also the SMSG Conference Report.

certain concepts. Typical children, according to Piaget, cannot handle certain concepts of measurement and area, nor master ideas of invariance and conservation of number until the second and third stages of development. Deprived children often lag behind in learning certain concepts and generally have more difficulty dealing with abstractions. If substantial evidence reveals late arrival at certain developmental stages, then it's quite possible that the eight and nine year olds in this study were not ready for many of the experiences that were part of this arithmetic program. Implications are clear that both reading retardation and developmental lag deserve careful study in any arithmetic program for deprived children.

In a study by Jarvis[2] it was demonstrated that fourth, fifth, and sixth grade children who were given sixty minute periods of instruction in arithmetic excelled over those in the control group who had 35 to 45 minutes of daily instruction. Jarvis maintained that time allotments for arithmetic have received scant attention in the research. Thus what is considered an optimum amount of time for elementary arithmetic is a moot point. At the summer camp experience, the investigator chose the maximum

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[2]Oscar T. Jarvis, "Time Allotment Relationships to Pupil Achievement in Arithmetic," The Arithmetic Teacher, X (May, 1963), pp. 248-50.

available amount of time with the desire to help children as much as was possible within five weeks. A full hour daily would have been too long had not the sessions been planned to include a varied number of activities. The attention spans of these children were exceedingly short and a frequent change of pace was necessary to hold interest to any degree.

One most encouraging aspect of the total experiment proved to be the terminal interviews. The investigator posed four questions to the random group:

1. Are you doing as well in arithmetic this year as you did last?

2. Are you doing better this year than you did last?

3. Are you doing worse this year than last year?

4. How do you feel you are doing in arithmetic this year?

Of the 30 children 26 indicated that they were doing better this year--at least they thought they were. Only one child said he was doing worse than he did a year ago. Three professed they did not know how they were doing. It appeared from the follow-up testing and from the interviews a gratifying percentage of the children had either internalized or were in the process of internalizing a higher confidence level.

In the final analysis it appears that no one knows what is an acceptable standard relative to achievement with deprived children. In this study 34 benefited immediately. A larger proportion appeared to benefit over a period of time. Fifty-one improved in attitudes by the end of the camp experience. Inasmuch as the Sign Test is a rather conservative tool as it demands a large proportion of either positives or negatives before significant gains are reflected, some other technique of analyzing data might well reflect better results.

From both the objective and subjective evaluation it appeared to the investigator that a modest degree of success could be claimed. This premise can only be verified by additional research replicating this type of program. Additional research is also needed to ascertain if these results would be altered appreciably if the children were in their home setting rather than in a camp situation. The high incidence of regression in children's attitudes after they returned to regular classrooms raises questions regarding methodology and teacher influence. This should be an area of concern for all in the teaching profession.

In this type of program it is practically impossible to equate numbers with success. What eventually happens to these children in terms of academic accomplishments and of becoming responsible members of society will determine the real value of these efforts. Thus the final burden of proof rests with the children in this program.

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APPENDICES

APPENDIX A

Characteristics of Total Group
Proportion of Students Who Changed in Achievement
Proportion of Students Who Changed in Attitudes
Relationship between Achievement and Attitude
Fourth Grade Reading and Arithmetic Grade Scores and Class Ranks
Fifth Grade Reading and Arithmetic Grade Scores and Class Ranks

Characteristics of Total Group

(82 pupils)

I.Q. range	68 to 145
Mean I.Q.	96
Mean I.Q. of random sample (30 pupils)	99
Range of random sample	71 to 145
Age range	8 to 12
Number of Negroes in total group	37
Number of Spanish-Mexican in total group	13
Number of white in total group	32
Number of fourth graders	44
Number of fifth graders	38
Number of males	49
Number of females	33
Number falling below 25th percentile rank in arithmetic	42
Number below grade level in arithmetic achievement	65 -- 56
Number listing arithmetic as least liked subject	25
Number that are members of a broken home	42
Number that have repeated one or more grades	15
Average number of siblings	6
Range of number of children in family	1 to 14
Reading range, fourth grade	1.0 to 4.7

Mean reading level, fourth grade	3.4
Reading range, fifth grade	2.0 to 6.9
Mean reading level, fifth grade	4.7
Total number reading below grade level	61

Permitting 4 months as standard error.

Proportion of Students Who Changed in Achievement (Sign Test)*

Variables	Direction of Change +	0	-	No. of Changers	Sig. Level	Larger Propor.
Fourth Grade--Random						
A to B	4	3	9	13	.133	-
B to C	14	1	1	15	.001*	+
A to C	11	1	4	15	.059*	+
Fifth Grade--Random						
A to B	6	3	5	11	.500	+
B to C	8	3	3	11	.113	+
A to C	11	0	3	14	.029*	+
Fourth and Fifth						
A to B	10	6	14	24	.271	-
B to C	22	4	4	26	.001*	+
A to C	22	1	7	29	.001*	+
Boys--Total A to B						
Fourth Grade	6	6	17	23	.017	-
Fifth Grade	11	4	5	16	.105	+
Girls--Total A to B						
Fourth Grade	5	1	9	14	.212	-
Fifth Grade	12	0	6	18	.119	+
IQ's						
Very low (68-78)	3	0	4	7	.500	-
Low (79-88)	4	3	9	13	.133	-
Low-medium (89-98)	14	2	7	21	.095	+
High-medium (99-108)	11	3	7	18	.240	+
High (109-118)	1	1	8	9	.002	-
Very high (119-->)	1	2	2	3	—	-

*Significant at the .05 level

Figures taken from table by Siegle, p. 250.

Proportion of Students Who Changed in Attitudes (Sign Test)*

Variables	Direction of Change +	0	-	No. of Changers	Sig. Level	Larger Propor.
Fourth Grade--Random						
A to B	10	2	4	14	.090	+
B to C	7	2	7	14	.605	—
A to C	12	1	3	15	.018*	+
Fifth Grade--Random						
A to B	11	1	2	13	.011*	+
B to C	8	2	4	12	.194	+
A to C	12	1	1	13	.002*	+
Fourth and Fifth						
A to B	21	3	6	27	.001*	+
B to C	15	4	11	27	.300	+
A to C	24	2	4	28	.001*	+
Boys - A to B						
Fourth, Total	15	4	10	25	.212	+
Fifth, Total	12	1	7	19	.180	+
Girls - A to B						
Fourth, Total	10	0	5	15	.151	+
Fifth, Total	14	1	3	17	.006*	+
IQ's - Total						
Very low (68-78)	5	0	2	7	.227	+
Low (79-88)	8	0	8	16	.598	—
Low-medium (89-98)	15	1	7	22	.067	+
High-medium (99-108)	12	3	6	18	.119	+
High (109-118)	8	1	1	9	.020*	+
Very High (119--→)	3	1	1	4	—	+

*Significant at the .05 level

Figures from table by Siegle, p. 250.

Relationship between Achievement and Attitude
(Based on Random Sample)

Achievement		Attitude
	Change A to B	
Fourth Grade N = 16		
4 gained		10 gained
3 no change		2 no change
9 regressed		4 regressed
	Changed B to C	
14 gained		7 gained
1 no change		2 no change
1 regressed		7 regressed
	Change A to C	
11 gained		12 gained
1 no change		1 no change
4 regressed		3 regressed
Fifth Grade N = 14	Change A to B	
6 gained		11 gained
3 no change		1 no change
5 regressed		2 regressed
	Change B to C	
8 gained		8 gained
3 no change		2 no change
3 regressed		4 regressed
	Change A to C	
11 gained		12 gained
0 no change		1 no change
3 regressed		1 regressed
Total--Fourth and Fifth Grades N = 30		
	Change A to B	
10 gained		21 gained
6 no change		3 no change
14 regressed		6 regressed
	Change B to C	
22 gained		15 gained
4 no change		4 no change
14 regressed		11 regressed

Achievement	Attitude
Change A to C	
22 gained	24 gained
1 no change	2 no change
7 regressed	4 regressed

Fourth Grade Reading and Arithmetic

Grade Scores and Class Ranks

N = 43

No.	Arith. Calif.	Rank	Arith. Iowa	Rank	Calif. Reading	Rank
1	3.8	25	4.2	9.5	3.1	33
2	3.6	30	3.0	33	3.6	20
3	3.2	40	2.8	37	3.9	10
4	4.0	19.5	3.4	26	3.3	27
5	4.1	15	3.5	21.5	2.4	42
7	4.4	6	4.6	5.5	3.9	10
8	2.7	42	3.6	18	3.0	36.5
10	3.4	37.5	3.6	18	3.7	15
11	3.6	30	4.0	12	3.4	24
13	4.4	6	4.8	2.5	4.4	2
14	3.8	25	3.0	33	3.7	15
17	3.7	27.5	3.0	33	3.5	23
18	3.2	40	2.6	40.5	3.2	30.5
19	4.5	3.5	3.8	14.5	3.7	15
20	3.6	30	3.2	29	2.8	40.5
22	4.3	9	3.4	26	3.7	15
23	3.5	34	3.0	33	3.0	36.5
27	4.0	19.5	3.7	16	3.2	30.5
29	4.2	11.5	3.8	14.5	3.6	20
34	3.5	34	3.0	33	2.8	40.5
35	4.7	1.5	5.7	1	4.7	1
37	4.1	15	4.7	4	3.7	15
38	4.7	1.5	4.6	5.5	4.1	6
41	3.9	22.5	3.6	18	3.6	20
42	3.5	34	2.8	37	3.3	27
49	3.2	40	2.8	37	3.3	27
55	4.0	19.5	3.4	26	3.0	36.5
56	4.3	9	4.5	7	4.3	3
57	4.2	11.5	4.2	9.5	3.6	20
59	4.3	9	4.0	12	4.0	7.5
60	2.5	43	2.6	40.5	2.2	43
61	4.4	6	4.4	8	4.0	7.5
62	4.5	3.5	4.8	2.5	4.2	4.5
64	3.5	34	4.0	12	3.1	33
66	4.1	15	3.5	21.5	3.3	27
68	4.1	15	3.4	26	3.6	20
69	4.0	19.5	2.7	39	3.0	36.5
70	3.8	25	2.4	42.5	2.9	39
72	3.4	37.5	2.4	42.5	3.8	12
73	4.1	15	3.5	21.5	4.2	4.5
74	3.9	22.5	3.5	21.5	3.9	10
80	3.5	34	3.1	30	3.3	27
82	3.7	27.5	3.4	26	3.1	33

[illegible] w/Cal. r = .71 Iowa correlated w/read[illegible]

[illegible]ference Method rho = $1 - \frac{6 \sum D^2}{N(N^2 - 1)}$

Fifth Grade Reading and Arithmetic

Grade Scores and Class Ranks

No.	Arith. Calif.	Rank	Arith. Iowa	Rank	Calif. Reading	Rank
6	5.9	7	5.6	2	4.6	13.5
9	4.3	33	4.5	9.5	3.8	28.5
12	4.9	21.5	4.5	9.5	6.5	2.5
15	5.1	18.5	4.4	11	5.2	7
16	6.1	2.5	5.3	4	6.9	1
21	4.2	34	3.3	33	3.3	31
24	5.9	7	5.4	3	4.1	23
25	5.2	16	3.6	26	4.2	21.5
26	4.6	25	3.0	35.5	4.4	17
28	5.9	7	5.2	5.5	6.5	2.5
30	6.1	2.5	4.6	8	4.5	15
31	4.5	29.5	2.5	37	3.1	34
32	4.5	29.5	3.1	34	4.4	17
33	5.0	20	3.6	26	3.1	34
36	5.1	18.5	3.4	32	5.0	10
39	4.5	29.5	3.5	30	4.3	19.5
40	5.9	7	5.2	5.5	5.5	6
43	5.3	12.5	4.2	14	4.7	12
44	5.3	12.5	4.2	14	5.1	8
45	2.6	38	2.2	38	2.0	38
46	5.9	7	4.8	7	6.2	4
47	4.9	21.5	3.9	19.5	4.0	25
48	5.3	12.5	3.5	30	4.3	19.5
51	4.7	23	4.2	14	3.1	34
52	3.8	37	3.8	22	3.8	28.5
53	4.5	29.5	3.8	22	2.9	36
54	4.0	35.5	3.8	22	3.5	30
58	6.0	4	3.0	35.5	2.4	37
63	4.0	35.5	3.5	30	5.0	10
65	4.5	29.5	4.0	17.5	4.4	17
67	5.6	10	4.0	17.5	4.0	25
71	5.2	16	3.6	26	5.0	10
75	4.6	25	3.6	26	4.6	13.5
76	4.5	29.5	4.2	14	3.9	27
77	6.3	1	5.8	1	5.9	5
78	4.6	25	3.6	26	4.2	21.5
79	5.2	16	4.2	14	3.2	32
81	5.3	12.5	3.9	19.5	4.0	25

Iowa correlated with Calif. $r = .58$

Iowa correlated with Reading $r = .49$ $N = 38$

Spearman Rank Difference Method $\text{rho} = 1 - \frac{6 \Sigma D^2}{N(N^2 - 1)}$

APPENDIX B

Scattergram Showing Dispersion of Characteristics
Fourth Grade Achievement Scattergram
Fifth Grade Achievement Scattergram
Fourth Grade Scattergram, Total and Random Attitudes
Fifth Grade Scattergram, Total and Random Attitudes

Scattergram Showing Dispersion of Characteristics

	68-78 M	68-78 F	79-88 M	79-88 F	89-98 M	89-98 F	99-108 M	99-108 F	109-118 M	109-118 F	119- M	119- F	
Fourth Grade	1	1	6	6	6	4	9	1	5	2	3	--	44
Fifth Grade	2	3	2	2	6	7	5	6	2	1	2	--	38
8-9 Yr. olds	--	1	6	8	3	6	9	3	5	3	3	--	47
10-11 Yr. Olds	3	3	2	--	9	4	5	4	2	--	2	--	35
Below Gd. Level Arith.*	3	3	7	8	7	9	7	3	5	3	1	--	56
Below 25% ile Arith.	3	3	3	5	7	7	5	3	4	1	1	--	42
Below Gd. Level Reading	3	4	7	7	11	8	10	3	7	1	1	--	62

*Permitting 4 months as standard error.

Fourth Grade Achievement Scattergram
Total and Random
(by IQ and Sex)

Test	68-78 M	68-78 F	79-88 M	79-88 F	89-98 M	89-98 F	99-108 M	99-108 F	109-118 M	109-118 F	119--> M	119--> F	Total
A to B Improv.				///	///	//	///						11
A to B Regress.	/	/	////	///	//	//	////	/	////	//	//		26
A to B No change			/	/	/		//		/		/		7
B to C Improv.		/	//	/	//	/	//		///	/	/		14
B to C Regress.							/						1
B to C No change							/						1
A to C Improv.		/	/	/	/	/	///		//		/		11
A to C Regress.			/		/		/						3
A to C No change									/	/			2

= Pre-test, Iowa Form I B = Post-test, Iowa Form III C = Post-post test, Iowa Form I
Total N = 44 Random N = 16

Fifth Grade Achievement Scattergram
Total and Random
(by IQ and Sex)

Test	68-78 M	68-78 F	79-88 M	79-88 F	89-98 M	89-98 F	99-108 M	99-108 F	109-118 M	109-118 F	119--> M	119--> F	Total
A to B Improv.	/	//		/	////	///	///	////		/	/		23
A to B Regress.	/	/	/	/		///	/	/	//				11
A to B No change			/		/		/				/		4
B to C Improv.	/		/		/	//	/				//		8
B to C Regress.					/		/	/					3
B to C No change	/					/	/						3
A to C Improv.	//		/		/	/	///	/			//		11
A to C Regress.					/	//							3
A to C No change													0

= Pre-test, Iowa Form I B = Post-test, Iowa Form III C = Post-post test, Iowa Form I
Total N = 38 Random N = 14

Fourth Grade Scattergram
Total and Random Attitudes
(by IQ and Sex)

Test	68-78 M	68-78 F	79-88 M	79-88 F	89-98 M	89-98 F	99-108 M	99-108 F	109-118 M	109-118 F	119--> M	119--> F	Total	
A-B Improv.		/	/	////	////	///	////		////	//	//		25	
A-B Regres.	/		////	///	/	/	///	/			/		15	44
A-B No change					/		//		/				4	
B-C Improv.			/	/	//		//		/				7	
B-C Regress.		/	/				/		//	/	/		7	16
B-C No change						/	/						2	
A-C Improv.			//	/	//	/	///		///	/			13	
A-C Regress.		/									/		2	16
A-C No change							/						1	

A = Pre-test B = Post-test C= Post-post test Total N = 44 Random N = 16

Fifth Grade Scattergram
Total and Random Attitudes
(by IQ and Sex)

Test	68-78 M	68-78 F	79-88 M	79-88 F	89-98 M	89-98 F	99-108 M	99-108 F	109-118 M	109-118 F	119--> M	119--> F	Totals	
A-B Improv.	/	///	/	//	///	///	///	///	/	/	/		26	
A-B Regress.	/		/		////	/		//	/				10	38
A-B No Change								/			/		2	
B-C Improv.	/		/		/	///	//						8	
B-C Regress.	/						/				//		4	14
B-C No change					/			/					2	
A-C Improv.	/		/		//	///	///	/			/		12	
A-C Regress.											/		1	14
A-C No Change	/												1	

A = Pre-test B = Post-test C = Post-post test Total N = 38 Random N = 14

APPENDIX C

Letter, May 13, 1966, from A. N. Hieronymus, Professor Education and Psychology, University of Iowa, Iowa City, Iowa, stating his opinion and analysis of data.

Analysis forms, "Report of Grade-Equivalent Scores on the Iowa Test of Basic Skills," giving his statistical analysis of my data.

THE UNIVERSITY OF IOWA
IOWA CITY, IOWA 52240

College of Education

May 13, 1966

Miss E. Leona Hall
131 First Street
Breckenridge, Michigan 48615

Dear Miss Hall:

I again must apologize for my tardy reply. However, this time it was because I have worked almost continuously on your data when I could find time.

I am afraid I do not know much more than I did before, but possibly some of the additional analysis might be of help in one way or another.

I know it is not of much consolation to you but yours is not the only project of this kind which has yielded results which were difficult to interpret and understand. For example, in one extremely large-scale literacy project in which forms were counterbalanced to eliminate form effect as a possible influence, the "gains" over several months were negative. And these were projects of several different types in different states. The only conclusion that I could come to in consultation with those responsible for evaluating the project was that some people were helped a great deal by the training, but that many gained next to nothing, or "lost" because of lack of interest in the tests (the general attitude was that no matter how hard they tried they still would not exactly distinguish themselves!) In programs of this type it sometimes seems to be as much a matter of trying to determine how many can be helped at all, instead of determining average gain by averaging in the few who actually made substantial gains and were reliably measured with those whose scores were of questionnable validity.

In this project, the difficulty of the tests was by no means ideal for evaluating the project. I did not determine national percentile ranks but at one stage of analysis I did get Iowa PR's. The distributions of these for the post-tests in Grade 4, for example, were as follows:

	A - 1	A - 2
90-99		
80-89		
70-79	2	
60-69		
50-59		

40-49	1	1
30-39	2	
20-29	3	4
10-19	8	10
0- 9	28	29

raw score

On test A-1$_4$ (36 items) an expected "chance" score would be 9. 21 out of your 44 final test scores were at or below this score. This does not mean at all that these people "guessed." To the contrary, every child might have very carefully selected every item he marked. But the point is that either 1) many children did not take the tests seriously or 2) the tests were much too difficult. In this case I would expect both to be involved to some extent. And remember, 9 is the expected score. Half the children guessing should be expected to do better!

I suppose a case could be made for the proper use of tests at this difficulty to identify children with special problems but once they have been identified, an instrument should be employed which will measure and make fine discriminations within the group.

With respect to validity, from the description you sent of your program, I would expect some improvement on Test A-1 but not on Test A-2. All of the emphasis was on concepts measured in Test A-1. I would expect Test A-2 scores to be affected very little immediately. Of course, in the long run improved conceptual abilities should result in improved problem-solving ability.

I tried several ways of analyzing your data but am enclosing only the one I believe to be best suited to your purposes. The results still do not "look good" but I believe they are about as accurate as I can come up with. I have no reason to doubt the analysis you originally did. However, the Forms 1↔3 equating which lies behind the national norms is probably not perfectly accurate (it never is).

We have many Title I projects in Iowa which we are evaluating somewhat in reverse of your procedure (that is, Form 3 was administered first, Form 1 second). To help schools with their evaluations we are using what we believe to be comparable GE's for the two forms. However, these are Iowa GE's. Performance in Iowa (and Michigan.') is, of course, considerably higher than in the nation as a whole, so the GE's appear somewhat lower than your originals.

As you can see, the average gains or losses were as follows when computed by these methods.

Grade 4			Grade 5		
A - 1	A - 2	A - T	A - 1	A - 2	A - T
+.68	-2.36	-.84	+.47	+3.89	+2.16

I do not know how much change you expected to get. One way to compute this would be to figure that 25 hours might be approximately $\frac{25}{120}$ of a year's instruction time in arithmetic. This would be about 2 points on the GE scale if <u>average</u> learners were involved. But with "educationally disadvantaged" children who learn slowly, a reasonable <u>goal</u> might be something less. And it is probably not reasonable to expect everyone to achieve this goal.

It is here I bog down in trying to interpret results because I do not know the children or what happened during the course of the study.

In Grade 4, on Test A-1, the gains were distributed as follows:

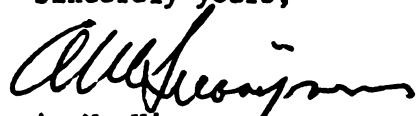
15	1	6	2	-3	2	-12		-21	
14		5	1	-4	4	-13		-22	1
13		4	4	-5	1	-14			
12		3	2	-6	1	-15			
11		2	3	-7		-16			
10		1	6	-8	2	-17			
9	3	0	4	-9		-18			
8		-1	4	-10		-19			
7	2	-2	1	-11		-20			

There are several "unreasonable" gains or losses which means probably that one or both scores were inaccurate. I would be as "suspicious" of the 15 and 9-point gains as of the 22-point loss. (Incidentally, if the child who lost 22 points had neither gained or lost, your average would have jumped from .68 to 1.2!)

This has been quite rambling, but I wanted to make as much of a case as I could for subjective considerations. If only 8 or 10 of the 24 gains listed above are genuine, I would think you could claim considerable success with your program. At least, judgments of this kind are necessary in research after all the evidence is in and the results tallied.

I believe the results as you initially analyzed them were essentially correct. These might be just a little more accurate. I know this is not what you had hoped for but I hope it will be of some help.

Sincerely yours,



A. N. Hieronymus
Professor, Education and Psychology

cc: Mr. John Sommer
Dr. Edward Drahozal

4th

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

Grade 4

Test A-1 — Form 1 — Form 3

Test A-2 — Form 1 — Form 3

Names of Pupils	Grade	Test V: Vocabulary V	Test R: Reading R	Test L: Language Skills — Spelling L-1	Capit'n L-2	Punct'n L-3	Usage L-4	Total L	Test W: Work-Study Skills — Maps W-1	Graphs W-2	Refs. W-3	Total W	Test A: Arithmetic Skills — Concepts A-1	Problems A-2	Total A	Comp. C
	14	31		9	26		-5		14	36		10	30		-6	
	9	26		6	23		-4		7	24		7	24		0	
	8	25		8	24		-1		6	22		3	18		-4	
	10	27		8	24		-3		9	27		10	30		+3	
	9	26		7	23		-3		10	29		7	24		-5	
	20	37		20	39		+2		15	38		11	32		-6	
	14	31		7	23		-8		8	26		7	24		-2	
	11	28		14	33		+5		10	29		9	28		-1	
	13	30		11	29		-1		11	31		11	32		+1	
	19	36		17	36		0		19	45		10	30		-15	
	8	25		8	24		-1		7	24		9	28		+4	
	11	28		8	24		-4		6	22		5	21		-1	
	7	25		9	26		+1		5	21		10	30		+9	

4th

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

Test A-1

Form 1 — RS | GE | PR

Form 3 — RS | GE | PR | GE D.F. | PR D.F.

Test A-2

Form 1 — RS | GE | PR

Form 3 — RS | GE | PR | GE D.F. | PR D.F.

Names of Pupils	Grade	Test V: Vocabulary V	Test R: Reading R	Test L: Language Skills — Spelling L-1	Capit'n L-2	Punct'n L-3	Usage L-4	Total L	Test W: Work-Study Skills — Maps W-1	Graphs W-2	Refs. W-3	Total W	Test A: Arithmetic Skills — Concepts A-1	Problems A-2	Total A	Comp. C
	13	30		11	29		-1		10	29		12	34		+5	
	11	28		12	30		+2		7	24		4	26		-4	
	11	28		11	29		+1		8	26		8	26		0	
	4	22		7	23		+1		9	27		9	28		+1	
	15	32		16	35		+3		8	26		9	28		+2	
	11	28		13	32		+4		11	31		7	24		-7	
	11	28		6	22		-6		6	22		5	21		-1	
	30	53		28	51		-2		21	49		14	37		-12	
	27	46		8	24		-22		11	31		10	30		-1	
	20	37		21	41		+4		15	38		11	32		-6	
	12	29		14	33		+4		9	27		8	26		-1	
	8	25		15	34		+9		6	22		8	26		+4	
	4	22		7	23		+1		8	26		5	21		-5	
	6	24		4	20		-4		12	33		4	20		-13	
	10	27		14	33		+6		9	27		6	22		-5	

4th

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

		TEST A-1								TEST A-2							
		Form 1			Form 3					Form 1				Form 3			
		RS	GE	PR	RS	GE	PR	GE	PR	RS	GE	PR	PS	GE	PR	GE	PR
Names of Pupils	Grade	Test V: Vocabulary V	Test R: Reading R	Test L: Language Skills: Spelling L-1	Capit'n L-2	Punct'n L-3	Usage L-4	Total L		Test W: Work-Study Skills: Maps W-1	Graphs W-2	Refs. W-3	Total W	Test A: Arithmetic Skills: Concepts A-1	Problems A-2	Total A	Comp. C
	19	36		19	38		+2			14	36		17	43		+7	
	17	34		15	34		0			12	33		14	37		+4	
	12	29		19	38		+9			13	34		14	37		+3	
	5	23		9	26		+3			6	22		1	16		-6	
	18	35		22	43		+7			15	38		12	34		-4	
	19	36		28	51		+15			18	44		11	32		-12	
	12	29		5	21		-8			12	33		9	28		-5	
	9	26		12	30		+4			10	29		7	24		-5	
	10	27		7	23		-4			9	27		9	28		+1	
	7	25		13	32		+7			6	22		4	20		-2	
	3	21		6	22		+1			7	24		3	18		-6	
	2	20		9	26		+6			7	24		4	20		-4	

4th

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

Names of Pupils	Grade	Test V: Vocabulary V	Test R: Reading R	Test L: Language Skills					Test W: Work-Study Skills				Test A: Arithmetic Skills			Comp. C
				Spelling L-1	Capit'n L-2	Punct'n L-3	Usage L-4	Total L	Maps W-1	Graphs W-2	Refs. W-3	Total W	Concepts A-1	Problems A-2	Total A	
	12	29		12	30		+1		8	26		8	26		0	
	9	26		9	26		0		10	29		9	28		-1	
	3	21		12	30		+9		12	33		8	26		-7	
	9	26		9	26		0		9	27		8	26		-1	
																131
		1277			1307					1293			1189			
			30				30				-104				-104	
					$\frac{30}{44} = .68$							$\frac{-104}{44} = -2.36$				

1
5TH

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

Grade 5

TEST A-1 — Form 1 / Form 3

TEST A-2 — Form 1 / Form 3

Names of Pupils	Grade	Test V: Vocab. V	Test R: Read. R	Test L: Language Skills — Spelling L-1	Capit'n L-2	Funct'n L-3	Usage L-4	Total L	Test W: Work-Study Skills — Maps W-1	Graphs W-2	Refs. W-3	Total W	Test A: Arithmetic Skills — Concepts A-1	Problems A-2	Total A	Comp. C
		RS	GE	RS	GE	PR	GE DIFF	PR DIFF	RS	GE	PR	RS	GE	PR	GE DIFF	PR DIFF
	26	51		21	45		-6		13	46		11	42	19	-4	
	17	39		12	33		-6		8	35		13	47	30	+12	
	17	39		23	48		+9		8	35		10	40	15	+5	
	16	38		21	45		+7		8	35		11	43	19	+7	
	24	47		27	55		+8		11	42		11	42	19	0	132
	12	33		13	35		+2		3	25		4	27	01	+2	
	25	49		24	50		+1		11	42		11	42	19	0	
	14	35		13	35		0		4	26		5	29	02	+3	
	10	31		6	27		-4		2	24		9	37	10	+13	
	24	47		13	35		-12		10	40		12	44	23	+4	
	18	46		19	42		+2		8	35		10	40	15	+5	
	6	27		9	30		+3		1	23		5	29	02	+6	
	9	30		8	29		-1		4	26		6	31	04	+5	

2
5th

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

TEST A-1 — FORM 1 — TEST A-2 — FORM 3

Names of Pupils	Grade	Test V: Vocabulary V	Test R: Reading R	Test L: Language Skills — Spelling L-1	Capit'n L-2	Punct'n L-3	Usage L-4	Total L	Test W: Work-Study Skills — Maps W-1	Graphs W-2	Refs. W-3	Total W	Test A: Arithmetic Skills — Concepts A-1	Problems A-2	Total A	Comp. C
	14	35		13	35		0		2	24		7	33	C6	+9	
	9	30		9	30		0		6	30		3	26	01	-4	
	23	46		21	45		-1		11	42		14	49	35	+7	
	13	34		15	37		+3		8	35		10	46	15	+5	
	13	34		10	31		-3		8	35		11	42	19	+7	
	2	23		7	28		+5		1	23		8	35	08	+12	
	15	37		13	35		-2		12	44		16	53	46	+9	
	10	31		17	39		+8		8	35		12	44	23	+9	
	13	34		10	31		-3		4	26		6	31	04	+5	
	15	37		5	26		-11		7	32		10	40	15	+8	
	9	30		8	29		-1		8	35		5	29	02	-6	
	8	29		11	32		+3		9	37		4	27	01	-10	
	14	35		8	29		-6		5	28		4	27	01	-1	
	5	26		5	26		0		5	28		4	27	01	-1	

5th

REPORT OF GRADE-EQUIVALENT SCORES ON THE IOWA TESTS OF BASIC SKILLS

Test A-1

Form 1: RS | GE | PR

Form 3: RS | GE | PR | GE D.F. | PR D.F.

Test A-2

Form 1: RS | GE | PR

Form 3: RS | GE | PR | GE D.F. | PR D.F.

Names of Pupils	Grade	Test V: Vocabulary V	Test R: Reading R	Test L: Language Skills — Spelling L-1	Capit'n L-2	Punct'n L-3	Usage L-4	Total L	Test W: Work-Study Skills — Maps W-1	Graphs W-2	Refs. W-3	Total W	Test A: Arithmetic Skills — Concepts A-1	Problems A-2	Total A	Comp. C
	13	34		13	35		+1		4	26		8	35	08	+9	
	14	35		13	35		0		6	30		7	33	06	+3	
	13	34		18	41		+7		7	32		13	47	30	+15	
	9	30		11	32		+2		7	32		7	33	06	+1	134
	10	31		18	41		+10		6	30		10	40	15	+10	
	10	31		12	33		+2		10	40		2	24	01	-16	
	30	59		26	53		-6		12	44		13	47	30	+3	
	12	33		11	32		-1		5	28		8	35	08	+7	
	14	35		17	39		+4		8	35		16	53	46	+18	
	13	34		15	37		+3		6	30		5	29	02	-1	
							18/38 = .47								144/37 = 3.9	
		1351			1369					1350			1398			
			18			18					148				148	

APPENDIX D

A Study of Attitude Toward Arithmetic (Dutton-Adams Scale)
A Study of Attitude Toward Arithmetic (Modified version)
Arithmetic Treasure Hunt (Addition and Subtraction)
Arithmetic Treasure Hunt (Multiplication and Division)
Arithmetic Treasure Hunt (Measurement)
Sample Games
Topics Covered in Summer Camp Arithmetic Program for Fourth and Fifth Graders
Aids and Materials Used in the Summer Camp Arithmetic Program
Sample pages from workbook

A STUDY OF ATTITUDE TOWARD ARITHMETIC

Check (X) only the statements which express your feeling toward arithmetic

___ 1. I feel arithmetic is an important part of the school curriculum.

___ 2. Arithmetic is something you have to do even though it is not enjoyable.

___ 3. Working with numbers is fun.

___ 4. I have never liked arithmetic.

___ 5. Arithmetic thrills me and I like it better than any other subject.

___ 6. I get no satisfaction from studying arithmetic.

___ 7. I like arithmetic because the procedures are logical.

___ 8. I am afraid of doing word problems.

___ 9. I like working all types of arithmetic problems.

___10. I detest arithmetic and avoid using it at all times.

___11. I have a growing appreciation of arithmetic through understanding its values, applications and process.

___12. I am completely indifferent to arithmetic.

___13. I have always liked arithmetic because it has presented me with a challenge.

___14. I like arithmetic but I like other subjects just as well.

___15. The completion and proof of accuracy in arithmetic gave me satisfaction and feelings of accomplishment.

Before scoring your attitude scale place an (X) on the line below to indicate where you think your general feeling toward arithmetic might be.

11	10	9	8	7	6	5	4	3	2	1
Strongly favor				Neutral				Strongly against		

Taken from Arithmetic for Teachers by Dutton and Adams. All underlined words were changed to prevent vocabulary difficulties, pp. 360, 361.

Modified Version Dutton-Adams Attitude Scale

A STUDY OF ATTITUDE TOWARD ARITHMETIC

Check (X) only the statements which express your feelings toward arithmetic.

③

7.2 __X__ 1. I feel arithmetic is an important part of the school.

3.3 __X__ 2. Arithmetic is something you have to do even though it is not enjoyable.

8.7 __X__ 3. Working with numbers is fun.

_____ 4. I have never liked arithmetic.

10.5 __X__ 5. Arithmetic thrills me and I like it better than any other subject.

_____ 6. I get no satisfaction from studying arithmetic.

7.9 __X__ 7. I like arithmetic because it is logical.

_____ 8. I am afraid of doing word problems.

9.6 __X__ 9. I like working all types of arithmetic problems.

_____ 10. I hate arithmetic and avoid using it at all times.

8.2 __X__ 11. I like arithmetic better through understanding its values, and knowing how and where to use it.

_____ 12. I am completely indifferent to arithmetic.

9.5 __X__ 13. I have always liked arithmetic because it has presented me with a challenge.

_____ 14. I like arithmetic but I like other subjects just as well.

9.0 __X__ 15. The completion and proof of accuracy in arithmetic gave me a good feeling.

73.9

Before scoring your attitude scale, place an (X) on the line below to indicate where you think your general feeling toward arithmetic might be:

73.9 / 9 = 8.2

1 2 3 4 5 6 7 (8) 9 10 (11)

Strongly against Neutral Strongly favor

9.2

ARITHMETIC TREASURE HUNT*
(Addition and Subtraction)

1. Number of steps leading to water front. _____
2. Number of individual buildings on camp ground. _____
3. Number of window panes in classroom. _____
4. Something in main lodge room that shows the problem 36 plus 52 equals 88. _____**
5. How many numerals on the clock plus the letters? _____
6. Bring me a leaf with five fingers.
7. Bring me ____ stones plus _____ sticks to equal 13.
8. Bring me one-half dozen acorns.
9. Number of steps leading to basement minus your age. _____
10. If you ate three hotdogs last night and had to pay 15 cents for each, how much would it have cost? _____
11. Mr. Bower's license number is 4296, Miss Moleski's is 5721. How much is the sum of these two? _____
12. Mr. Squirrel stored 32 acorns for winter. Mr. Bluejay took all but 11. How many did he take? _____
13. Number of picnic benches minus number of picnic tables. _____
14. Bring me 17 acorns minus 15 plus 2. _____
15. Number of numerals on clock minus number of numerals on phone dial. _____

*sample of reinforcing activities produced in manuscript.

**Piano keyboard.

ARITHMETIC TREASURE HUNT*
(Multiplication and Division)

1. How many people would be at the picnic tables if each table had six people for a cook-out? _____
2. Number of steps leading to basement multiplied by number of pianos at camp. _____
3. There were 95 children at dinner last night and they ate 279 hot-dogs. How many is this for each child?

   _____
4. Number of pages in phone book divided by three. _____
5. The temperature last week for each day was 82°, 64°, 75°, 83°, and 85°. What was the average temperature?

   _____
6. If each child in group 4 (24) caught an average of three fish each. How many fish would that be in all? _____
7. If each child in camp drinks nine pints of milk a day how many pints will each child drink in a week? _____
8. If you paid five cents a pint how much would it cost for one week? _____
9. There are five sleeping cabins. If each cabin held the same number of campers, how many would there be in each cabin? (There are 93 campers now.) _____

*Sample of reinforcing activities produced in manuscript.

10. You go down and up the basement steps for each meal. How many steps would this be for one day? _____

11. Bring me enough pine cones to show the problem, 21 divided by 7. _____

12. If the campers drink 64 quarts of milk each day, how many gallons is this? _____

ARITHMETIC TREASURE HUNT*
(Measurement)

1. What time is it by the clock in the lodge? _____
2. Temperature from the thermometer on porch. _____
3. Temperature from the thermometer on west window. _____
4. How large are the tile squares in the floor of lodge? _____
5. How long is the piano keyboard? _____
6. Size of one section of the south gate (feet and inches)? _____
7. Number of quarter inches on your ruler. _____
8. Size of storage doors on the outside grill (L and W). _____
9. Size of bench by horseshoe game (L and W). _____
10. Size of window panes in your classroom. _____
11. Size of the tables in the classroom(L and W). _____
12. How many half inches on your ruler? _____
13. How many degrees warmer does the window thermometer show than the porch thermometer? _____
14. How many gallons does the fire extinguisher hold? _____ (the one by the phone booth)
15. How many minutes have passed since you started this treasure hunt? _____

*Sample of reinforcing activities. These were produced on manuscript typewriter.

Sample Games

Domino Bingo (Used for both addition and multiplication.)
Cards contain domino shapes and include numerals. A child may cover the proper rectangle when he has added or multiplied the two sets of dots on his dominoes correctly. Otherwise played as regular bingo.

Ten Pins
Played as regular bowling game by rolling soft-ball into oatmeal boxes. Child must keep running scores using the values of the boxes knocked over. The values are changed frequently. Variations to this include putting problems on boxes.

I Went Shopping
Played in rotation, each child naming an item and price. The next child must include all items named before him and add another and total the prices. When the addition breaks down, game starts over. Example: I went shopping and I bought an ice cream cone, it cost five cents. The next child would repeat the first child and add another item and price, it cost 8 cents, altogether they cost 13 cents, etc.

Miniature Golf
Using open milk cartons lying flat on floor, hit baseball into a carton, trying to choose the one labeled with the largest distance numeral. Score is kept of yardage by adding together the values indicated on boxes.

I'm Thinking of a Number
Similar to "I Spy." If ten were added to my number the answer would be 15, what is my number? The child can use any method to identify his number. Example: My number can be divided into 40 an equal number of times but it is not ten. What is it? It may be 8, 5, 2, etc.

Find The Problem
An object is pre-chosen from a specified area which represents a problem. T he problem can be any of the four arithmetical operations. The child searches until he has found it but doesn't tell the others. Example: There is an addition problem in the recreation room which represents 6 plus 8 equals 14. Answer: 6 ping-pong mallets and 8 pool sticks. Or find 18 triangles in the main lodge. Answer: the roof rafters form 18 triangles.

Topics Covered in Summer Camp Arithmetic Program for Fourth and Fifth Graders

Numeral and number
  cardinal use
  ordinal use
Our number system
Place value
Zero
Addition
Subtraction
Multiplication
Division
Story problems
Measurement
Fractions
Simple geometric shapes

Samples of Major Concepts Explored

Addition:
  it is a way of grouping
  it is bringing together two or more groups forming one larger group
  it is the opposite of subtraction
  it is related to multiplication
  zero is the identity number for addition
  3 + 4 is the same as 4 + 3, the order does not change the answer
  (5 + 4) + 6 is the same as 5 + (4 + 6), we can associate different numbers

Subtraction:
  it is the opposite of addition
  it is regrouping a larger group into smaller groups
  it is related to division
  zero is the identity number
  we can show proof by adding our answer to the number we took away

Fractions:
  a fraction is part of a whole
  a fraction can be expressed in different ways
  the numeral over the line tells us how many parts we are talking about
  the numeral below the line tells us the size of the parts
  the larger the bottom numeral is--the smaller the parts
  the larger the top numeral is--the more parts we have
  therefore 1/10 is less than 1/5 of the same object and 2/10 is more than 1/10
  a fraction can also express part of a group as 1/2 do[illegible]

Aids and Materials Used in the Summer Camp Arithmetic Program

Number line
Wall charts
  fraction
  place value
  matrices
Flannel board
  flannel symbols
  animal cut-outs
  fractional parts
  geometric shapes
Magnetic board
  peg board, rubber bands, and golf tees
Abaci
Number frames
Draw-string bags
  counting discs
  craft sticks
Dominoes
  modified bingo cards, to accommodate dominoes
Place value canisters
Egg cartons
  ping-pong balls
Milk cartons and other containers
Wood molding
  for rulers
Tape measures
  10'
  50'
Rulers and yard sticks
Oatmeal boxes and soft ball, for ten pins
Models
  showing relationship between square and circle
  modification of cuisenaire rods
  thermometers
Graph paper
Tile squares

1.

In arithmetic we do four operations. They are:

1. addition
2. multiplication
3. subtraction
4. division

Arithmetic answers such questions as these:

How many? How big? How far? How much?

We need these answers every-day. We believe in five (5) weeks we can learn much about numbers.

2.

Today we learned a new word, the word is concept. It means an idea or understanding. Each day we will explore a new concept. In this way we will have a better understanding of numbers. Also we learned the difference between number and numeral.

Numeral means a sign, symbol or name.
Examples: 5,V,3, etc., we use the numerals 0,1,2,3,4, 5,6,7,8,9, to express ideas.

Number means an idea or concept. It is something we think.
Examples: five (5) cows, three (3) apples, etc.

5.

Zero

We spent a lot of time working with zero today. We used an egg carton with ping-pong balls and removed some balls. In this way we have a better understanding of zero. We also learned the following about zero.

1. It is a numeral
2. It has value, that is, we need it to tell us information.
3. It holds a place. Example: 702 tells us there are no tens.
4. Also we need it for thermometers and other instruments.
5. On a place value chart or abacus the empty space represents the zero.