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A STUDY OF READING AND ARITHMETIC SCORE CHANGES
AMONG TRAINEES COMPLETING THE DULUTH
ADULT BASIC EDUCATION PROGRAM

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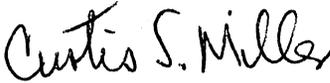

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CHAPTER I

THE PROBLEM AND ITS LIMITATIONS

After years of earlier effort to transform immigrants into employable citizens, the United States recently realized that public education had failed to meet the same need among a substantial number of the native-born in later generations. Responding to a Congressional inquiry, the Department of Health, Education, and Welfare admitted that "there is too much embarrassing evidence around us to say that our educational system is meeting its responsibilities" (Mangum, 1965, p. 349). Therefore, Congress was asked to act against adult functional illiteracy and occupational ignorance but, despite criticism from adult educators (Crabtree, 1962), confined its initial action to an attack upon occupational ignorance.

The Manpower Development and Training Act (MDTA) of 1962 sought a solution to the economic paradox of a skilled worker shortage amid a surplus of workers without salable skills. Section 202(a) of the Act's Title II authorized the "testing, counseling, and selecting for occupational training those unemployed or underemployed persons who cannot reasonably be expected to secure appropriate fulltime employment without training." Within a year, this selection program had proved that critics like Crabtree had been correct about the scope of functional illiteracy among adults; sixty per cent of the unemployed who were screened for occupational training projects "could not qualify because

of inadequate basic education attainment" (Wirtz, 1964, p. 70). A 1963 amendment to Title II of the Manpower Development and Training Act added Section 202(i), directing the Secretary of Labor to "refer to the attainment of basic education skills those eligible persons who indicate their intention to, and will thereby be able to, pursue courses of occupational training" Eligibility standards used by the Minnesota Department of Employment Security in making Section 202(i) referrals are set forth in the September 22, 1967, revision of the Local Office Procedures Manual for Manpower Development and Training as follows:

1. Primary consideration for unemployed individuals, under-employed individuals (including any farm family with a net income below \$1,200 a year), youth between 16 and 21 years of age with special attention to unemployed dropouts.
2. Disadvantaged persons determined to fall within one of the following categories: the educationally deficient who could hold jobs with proper training; the physically, mentally, or emotionally handicapped; inmates of correctional institutions; members of racial, religious, or ethnic minority groups; older workers (45 or older); the poverty-stricken with annual net incomes ranging from \$1,090 to \$5,000 depending upon family size and farm or non-farm residence; women heads of households; welfare recipients; workers in isolated geographical areas; migrant farm workers; releasees from prison; out-of-school and out-of-work youth between 16 and 21 years of age; and military service rejectees.
3. Probable ability of applicants to benefit from training and to have a reasonable expectation of employment.
4. All selection and referral to be done without discrimination.

With selection and referral of basic education trainees assigned to the state employment services under the Secretary of Labor's direction, it became the responsibility of the Secretary of Health, Education, and Welfare to establish special institutions where

basic education could be provided. The Duluth Board of Education, through its Vocational and Adult Education Department, prepared a proposal for an adult basic education center which was accepted by the appropriate federal and state agencies on September 14, 1965. This proposal created the Duluth Comprehensive Facility in a former supermarket; on November 15, 1965, the Facility began enrolling its first trainees. The Duluth Comprehensive Facility was authorized to provide basic education services to forty trainees at a time upon their proper referral from the various local offices of the Minnesota State Employment Service. A partial text of the official proposal laid down these guidelines for the Facility's operation:

A Facility of this type will conduct a program to bring up the adult to a level of achievement whereby he or she will qualify for a vocational class, another retraining program, or a job. Methods at the Facility will be of the non-traditional type. Achievement at one's own speed will be possible with a large amount of individual assistance.

The availability of this Facility is needed to conduct activity whereby a person referred can see the reason for being adequately trained to meet the needs of one's self and society. All who need the services of this Facility will be served. (Duluth Board of Education, 1965, unnumbered page)

The services focussed upon the improvement of reading, writing, arithmetic, and social skills of trainees referred to the Comprehensive Facility. In the initial two-year period ending November 15, 1967, the Comprehensive Facility has served a total of 155 trainees, not including those who remained enrolled beyond that date. The total does include, however, a few cases of trainees who dropped out within a few days after enrollment and trainees who had to leave for some personal reason but re-enrolled later.

The Problem

Statement of the problem. It was the purpose of this study to (1) determine from standardized test scores what changes, if any, occurred in the reading vocabulary, reading comprehension, and arithmetic skills of the trainees during enrollment; (2) determine whether differences in the amount of time spent in training appreciably affected test scores; and (3) estimate, at least partially, the grade gap between trainee skill level at the time of enrollment and the last grade of formal schooling.

Importance of the problem. Measurement of whatever changes that occur in a trainee's basic education skills during enrollment is important for two reasons: first, to help decide whether he can be referred to specific vocational training or to a specific job, and, second, to determine how well the program is fulfilling the objectives stated in its guidelines. This study is an initial attempt to use accepted statistical procedures in analyzing basic skill changes among a large group of trainees who have completed their period of enrollment at the Duluth Comprehensive Facility. Basic education programs under the 1963 amendment to Title II of the Manpower Development and Training Act are still so new that few statistical studies of their results are available.

Limitations upon the Study

Although aptitude and intelligence tests also are administered to trainees by both the Duluth Comprehensive Facility and local offices

of the Minnesota State Employment Service, analysis of their results lies beyond the scope of this study.

The study further recognized that reading and arithmetic skill changes, while important, did represent a limited portion of the total behavior change probably occurring in each trainee. Setting some personal goals in place of failure feelings, improved emotional stability, gains in social skills--altogether a better self-concept--also could have occurred as a result of or in addition to progress in basic education skills. However, changes in trainee behavior other than basic skill changes were not analyzed in the study; only those changes for which comparative data were available were measured.

Another limitation upon the study was the possibility that standardized achievement tests, including those actually in use at the Duluth Comprehensive Facility, may not have been the best method of measuring skill changes in adult basic education trainees. The tests used, for example, are based upon childhood norms and are designed for school-age children instead of late adolescents and adults whose life concerns are considerably different. Nevertheless, the study had no alternative but to rely upon the data available for ex post facto analysis.

Finally, the test data did contain a few discrepancies which lacked reasonable explanation. It was known, of course, that many of the trainees had one or more serious personal problems which could have affected a test score on any given day. The study therefore assumed that, while score discrepancies from these causes or from

faulty test administration did represent a limitation, they probably would have been offset or cancelled out in so large a group of scores.

Summary

This chapter has described briefly the recent development of a federal effort to overcome remaining functional illiteracy among American adults and the Duluth Board of Education's participation in that effort. The problem of measuring learning outcomes in such an effort also has been discussed. Although analysis of past testing results precludes experimental control, enough control was present in the Duluth Comprehensive Facility testing program to justify this limited but hopefully meaningful study.

CHAPTER II

REVIEW OF THE LITERATURE

Recent years have produced much literature, most of it government-sponsored, on the broad problem of adult unemployment due to deficient basic education. Little literature has been published through 1967, however, on the MDTA basic education programs for adults and late adolescents. And even less literature contains specific data, conclusions, and recommendations about the measurement of learning outcomes in such programs. This chapter therefore will be but a brief summary of only that literature related to the specific problem under study rather than to the much wider question of the challenge posed to all of adult education by the quickening technological advance. The two statements below may be said to constitute the current view of American education on adult unemployment due to deficient basic education:

The margin for educational error or failure has disappeared. Every person must learn to read, write, and compute. This concept is not new but it is obvious that any person who cannot read, write, or compute cannot function effectively in a technological age. (Vern, 1965, p. 365)

The facts of life in modern society are that the intellectual skills, which involve reading, writing, calculation, analysis of information, are becoming basic requirements for independence, for productive work, for political participation, for wise consumption. Such intellectual skills were far less important in the simpler rural society from which ours has grown, and, as in all rural societies, the schooling to develop these skills was less important there. (Coleman, 1966, p. 218)

Literature about the Level of Skills Needed

Since the Duluth Comprehensive Facility does strive for

functional literacy among all completing trainees, what is meant by this term should be clearly understood. Gorman defines functional literacy as "the ability to engage in those reading activities essential to the welfare of all citizens in a culture"; he estimates sixth grade ability to be the present functional literacy level in the state of Illinois (1967, p. 204). Karlsen and Burrill (1967) classify as functional illiterates some 12,000,000 adult Americans over eighteen years of age who do not have the equivalent of a normal sixth grade education. In a study of Nevada MDTA basic education trainees, Whittemore, Echeverria, and Griffin point out that "many existing employment opportunities require as a minimum a reading level, a general numerical ability level, and an overall performance level approximating that reached by sixth grade students" (1966, p. 19). However, a 1965 survey for the U. S. Office of Education by the Information and Training Division of McGraw-Hill, Inc., made a major recommendation that MDTA training should "integrate both basic literacy skills and job skills in comprehensive programs that progressively lead the trainee from zero literacy and job skill to at least eighth grade literacy achievement and semi-skilled job competence" (1965, p. 34). Finally, the Office of Education itself, in a Region VI* report issued in November, 1967, declared that "the ultimate goal of the Adult Basic Education Program is to provide an opportunity for adults to move from total illiteracy to a position which is comparable to that of an eighth grade graduate" (Office of Education, 1967, p.8).

*Region VI includes the states of Minnesota, North Dakota, South Dakota, Iowa, Nebraska, Kansas, and Missouri.

Literature about the Achievement Gap

Manpower statistics compiled by the Department of Labor regularly refer to employment in terms of educational attainment or years of schooling completed (Wirtz, 1966). This practice seems open to serious question, at least insofar as it applies to the under-educated segment of the labor force. The Information and Training Division survey (1965) concluded that educational attainment may be considerably lower than reported educational level; "some disparity exists between completed schooling and at least reading level" (p. 9). William F. Brazziel of the Norfolk, Va., MDTA Adult Basic Education Program told the survey that it is not uncommon to find large numbers of persons performing at levels of achievement two and sometimes three grade levels below the last grade completed in school. The survey cited one case where an MDTA Adult Basic Education Program, the Washington, D. C., Armstrong Adult Education Center, attempted to measure this achievement gap; the tested reading grade level of fifty-four trainees turned out to be 1.4 compared to a last grade completed level of 4.6. The excellent Pallone report on a South Bend, Ind., pilot project rehabilitating the hard-core unemployed (1965) found the typical trainee's "educational age equivalent to be that of a child who has completed 3.6 years of formal schooling although he has completed, on the average, 7.9 years in his own educational history" (p. 13). It was because of findings like these that this study sought comparable mean measurements of the trainees enrolled at the Duluth Comprehensive Facility. The implications of such an achievement gap can be seen in the President's Man-

power Report to Congress, which is based upon statistics supplied by the Department of Labor. The report declared in part:

As of April, 1963, 28 per cent of the labor force had no more than an eighth grade education (16,900,000) and four-fifths of these had no formal job training, either Expected gains in education indicate that, in the adult civilian labor force, the number of workers with less than five years of formal schooling probably will be reduced from 3.1 million now to less than 2 million by 1975. Adults with at least a high school diploma may rise from just over 50 per cent of the labor force to about 60 per cent in 1975 (about 43 million). A further drop in the proportion of workers without a high school education is indicated by the projections but they also make it clear that, unless vigorous action is taken to prevent it, millions of workers will still have an education inadequate by present-day standards and likely to be still more inadequate by 1975. (1964, pp. 66, 74-75)

Literature about Results of Tests in Adult Basic Education

Cooper observed in a report on his MDTA Adult Basic Education Program that "post-training changes in test scores should be indices of achievement attributable to the general education courses" (1964, p. 7). In the Pallone report, initial scores on the Stanford Achievement Test Battery were said to measure "worker characteristics while subsequent scores measured learning outcomes" (1965, p. 6). The Nevada study by Whittemore and his associates found .05 or better significance in post-test Differential Aptitude Test score changes from pre-test scores, indicating that "certain significant changes did take place as a result of the learning experience offered the trainees in basic education" (1966, p. 27). The Armstrong Adult Education Center project cited earlier showed a reading grade level gain of 1.3 in nine months to a post-test average of 2.7, according to the McGraw-Hill survey (1965).

Extensive tables of pre-test and post-test scores in the Pallone report list a mean gain range of from .2 to 3.9 grade levels by white male trainees on paragraph comprehension, vocabulary, spelling, language usage, arithmetic reasoning, and arithmetic computation; most of the mean gains appear to be about one grade level whether the post-test came after 20 or 36 weeks of training (pp. 35-45). However, the size of samples used was quite small, in no case more than twelve, and no levels of significance were established for the mean gains reported. The U. S. Office of Education Region VI Report referred to previously quoted various states in the region as indicating that the "average time needed to raise an adult student from one grade level to another varies from 40 class hours of instruction to 150 hours according to individual differences and needs" (p. 8). Although it was not clear whether this statement referred to a single subject or to all subjects at a given grade level, the quoted range of from 40 to 150 class hours does seem to be somewhat less than the rate of trainee progress in Nevada, South Bend, Washington, D. C., or, as will be evident later, in Duluth, Minnesota.

Literature about Types of Tests in Adult Basic Education

Considerable concern is expressed in the literature about the lack of suitable standardized instruments for testing the progress of functionally illiterate adults. The best-known test, the General Aptitude Test Battery (GATB) used by state employment services, does not suffice, says the Information and Training Division survey, because it

". . . depends upon sixth grade achievement in language skills to obtain accurate results. It is therefore hardly suitable for evaluating potential trainees who have severely limited reading ability" (1965, p. 17). Pallone described "the G score of the GATB as inadequate to measure accurately the learning ability of workers characterized as hard-core unemployed" and cautioned against using it "as a limiting factor in occupational planning and vocational training of the hard-core unemployed" (1965, p. 14). Yet Whittemore's Nevada study concluded that the GATB "G" score can be an effective initial placement device and even the verbal and numerical sub-tests of the Differential Aptitude Test can produce significant results with MDTA trainees (1966, pp. 27-28). Karl- sen, Madden, and Gardner (1967) warn, however, that "low-achieving adults do not have the motivation necessary to take a lengthy test bat- tery" (p. 29). Burrill has joined with Karl- sen in declaring that "new tests must be devised to evaluate progress in adult basic education. For some time it has been clear to educators working in adult programs that tests currently used with children are inappropriate in many ways for adults" (1967, p. 2). Mangano (1967) also is quite emphatic about relating test content "to the vocabulary and experiential background of adult basic education students"; he believes that adult-oriented tests must replace the elementary school instruments now generally used to measure learning by functionally illiterate adults (p. 4). Aker (1967) has called upon test publishers to recognize their primary responsibil- ity of insuring that such tests are reliable and valid for adult basic education students. These views seem to be shared by Bayley (1963) in

her more general criticism of psychological research for focussing too much upon the most observable periods of the lifespan, childhood and old age; in her opinion, insufficient attention has been paid to the relatively stable adult years and age-specific norms for this period of life are needed.

There appears to be agreement among most of the authors just cited that adult basic education tests of the paper-and-pencil type should be very legible but not childish, should use a familiar format like a magazine, should contain short and simple directions, should avoid the possible confusion of separate answer sheets, should provide alternate forms of equivalent difficulty, and should permit easy scoring. In its manual forms, the Gates Reading Survey does meet these criteria although it is a test for children; it has been used by not only the Duluth Comprehensive Facility but by other MDTA adult basic education centers as well. In fact, the Whittemore (1966) study describes the Gates as "quite useful" (p. 28). The Woody-McCall Mixed Fundamentals of Arithmetic test used by the Duluth Comprehensive Facility also is a child's test but otherwise meets the criteria above.

On the broader question of test reliability and validity raised by Aker, the Gates Manual makes the following comment about temporal stability which perhaps applies equally to children and adults:

Variation from the student's typical performance is the great source of unreliability in the test score. His score may be affected more or less by his physical condition, whether he is tired, sleepy, indisposed, or feeling fine. It will depend upon whether he does his best work from start to finish of the test or eases up, lets his attention wander, or is distracted by

breaking his pencil, or by getting unduly frightened or angry as a result of a bad start, and so on (1958, p. 9).

While any of these factors could render a particular score completely unreliable, they do not fall into the same category as the more serious possibilities of test anxiety and emotional disturbance.

Anastasi (1961) has emphasized that some cases of reading retardation in children are symptoms of more basic personality maladjustment. She believes that even diagnostic test batteries do not suffice in cases of reading and arithmetic difficulties; diagnosis and treatment of such difficulties really require a trained specialist, in her opinion. She continues:

Severe reading disabilities require a thorough clinical case study, including supplementary information on sensory capacities and motor development, medical and health history, complete educational history, data on home and family background, and a thorough investigation of possible emotional difficulties. Although survey and group diagnostic tests may serve to identify individuals in need of further attention, the diagnosis and therapy of reading disabilities often represent a problem for the clinician. This also may be true in cases of severe arithmetic disabilities. (1961, p. 465)

Severe reading and arithmetic retardation appears frequently among trainees referred to the Duluth Comprehensive Facility. If Anastasi's warning has merit in the case of children, it may have even more merit in the case of educationally retarded adults whose reading and arithmetic deficiencies have been compounded by the passing years. Yet the literature on adult basic education programs provides no indication of any real effort to adopt the clinical approach urged by Anastasi; most programs seem limited to the use of achievement tests and even those appear to be mainly for class placement purposes.

However, some authorities concerned about obtaining valid, reliable measurements of reading and arithmetic retardation are considering abandonment of the traditional paper-and-pencil test. The Fifth Annual MDTA Report to Congress observed that paper-and-pencil tests "are not very valid for persons of little experience in using paper and pencil and may even be inhibiting" (1966, p. 56); Project Peace at Cleveland was cited for experiments with non-verbal measurement using a comprehensive system of audio-visual devices and mechanical responses.

Finally, the literature points out that, despite the compounded problems of the functionally illiterate adult, he does possess definite advantages over the functionally illiterate child. Karlsen, Madden, and Gardner insist that "functional literacy is within the reach of virtually all adults regardless of IQ" because even those who are illiterate have been exposed to "information, skills, and techniques far beyond those known to the elementary school child" (1967, p. 26). Pallone expresses similar optimism in his declaration that "an overwhelming majority of hard-core unemployed workers within the limits of this study have been found to be educationally rather than mentally retarded" (1965, p. 58). Even without the remedial help of clinical specialists, the progress made by adults in projects like his is seen by Pallone as more evidence of Martin Hamburger's theory of human behavior. That theory, Pallone reminds us, holds that, given "conducive circumstances, people will behave so as to maximize their internal strengths in harmony with society" (1965, p. 59). Surely those exponents of the self-actualizing personality, Carl Rogers and A. H. Maslow, would agree.

Pertinent Findings of "The Coleman Report"

The 1966 federal survey of inequalities in educational opportunity, known as "The Coleman Report," appears to possess particular pertinence for this study. Generally, it offers massive evidence that public education in the United States has not met the needs of minorities, including that minority of social class which contains so many trainees now in adult basic education. Some conclusions from "The Coleman Report" evidence point to possible reasons why the typical adult basic education trainee did not succeed as a child in the usual school setting; moreover, these same reasons may indicate why the typical trainee demonstrates better achievement now in an adult basic education program. For example, "The Coleman Report" charges:

Whatever may be the combination of non-school factors--poverty, community attitudes, low education level of parents--which put minority children at a disadvantage in the verbal and non-verbal skills when they enter the first grade, the fact is that the schools have not overcome it. (1966, p. 21)

Socioeconomic background, peer environment, and sense of control over one's own destiny were found by Coleman to correlate more highly with basic skill achievement than any input factors from the school. And he includes such well-known school input factors as adequacy of buildings, curriculum offerings, and instructional quality. Coleman concludes that, for members of minorities, the schools they attended as children were unable to overcome or even offset "their immediate social environment" (p. 325). Kent has declared that Coleman's findings amount to a historic shift of "the responsibility to create achievement" from the child to the educational institution (1968, p. 242).

Summary of Literature

The available literature in the field of adult basic education seems to establish that a minimum level of sixth grade ability in the basic skills, and preferably eighth grade level, is necessary to meet the challenge of today's world of work. The literature also indicates that the use of pre-tests and post-tests can measure progress toward this objective but that there is a serious question about which type of test can best measure such progress among functionally illiterate adults. It is evident from the literature that the achievement tests now in general use have found the basic skill ability level of trainees in adult basic education to be considerably below their last year of formal schooling; therefore, years of formal schooling probably is a poor criterion for predicting the occupational success of the typical unemployed adult. However, the studies published so far seem to show that this typical unemployed adult is the victim of educational rather than mental retardation and his deficiency probably can be overcome by specialized basic education.

CHAPTER III

THE METHOD OF THE STUDY

The sources of the data for this study, information about how the data were collected, a description of the study population, and the procedures used to analyze the study data will be presented in Chapter III.

The Study Design

The several variables involved in the study data have been divided into three sections to improve clarity.

The first section examined the pre-test and post-test raw scores in reading vocabulary, reading comprehension, and arithmetic for eighty-seven of the 146 adult basic education trainees who attended the Duluth Comprehensive Facility between November 15, 1965, and November 15, 1967. Raw scores were obtained from three sources: the Woody-McCall Mixed Fundamentals of Arithmetic Test; the Vocabulary sub-test of the Gates Reading Survey; and the Comprehension sub-test of the Gates Reading Survey.* The pre-test raw score was subtracted from the post-test raw score of each trainee in each of the three basic skills, vocabulary, comprehension, and arithmetic; each difference thus obtained was then analyzed by a procedure described later in this chapter.

* Scores on the Speed sub-test of the Gates Reading Survey had to be excluded from the study because, in many cases, it was not clear whether the trainees had taken this sub-test under the 4-minute or the 6-minute time limit. Therefore, these scores were meaningless and would have contaminated the study.

Both the Gates Reading Survey and the Woody-McCall Mixed Fundamentals of Arithmetic Test are standardized instruments which proceed from less difficult to more difficult items in measuring skills; equivalent forms are provided for pre-test and post-test purposes. The 1960 revision of the 1958 Gates Reading Survey was used during the two-year period covered by this study. Its reliability coefficients for each of the sub-tests are in the .80's, "certainly adequate for most testing purposes," according to Buros (1965, p. 1066). As noted in Chapter II, however, Gates considers the lack of temporal stability to be the great source of unreliability in a testing situation. Gates is quoted in Buros as claiming that his survey's validity has been established by so many studies since 1928, the date of the earlier but similar survey, that "listing them all would be prohibitive" (1965, p. 1068). The review in Buros declares that the material in the survey has face validity. The 1936 revision of the Mixed Fundamentals of Arithmetic Test used during the two-year period covered by the study is criticized by Buros as an outmoded test with limitations "that must have reduced its validity even in the days of its greatest popularity. . . . At best, the scores can be justifiably employed only for the crudest kinds of comparisons" (Buros, 1953, p. 422). The test authors themselves presented no data on reliability or validity and the test is now out of print. However, the major limitations cited, lack of written problems and little of the arithmetic taught in the higher grades, may have been assets in the case of an educationally retarded study population. . So may have been the test's shortness and simplicity compared to others.

The second section of the data compared the pre-test and post-test raw scores according to differences in training time. The trainees were divided into two groups: (1) those trainees who had been in actual attendance for less than 600 hours, and (2) those trainees who had been in actual attendance for more than 600 hours. Their mean scores in each skill were then analyzed by groups to determine the effect, if any, of differences in training time.*

The third section of the data involved the conversion of mean raw scores obtained by all eighty-seven trainees on the pre-test for each skill into the grade equivalents established for those mean raw scores by the test authors. Such grade equivalents, when matched with the mean last year of formal schooling for all trainees, were assumed to measure, at least partially, the achievement gap of the trainees in a manner comparable to the achievement gap measurements reported in Chapter II.

The Data Collection

All data on the study population were obtained from the cumulative records located in the main office of the Duluth Comprehensive Facility. Most of the pre-tests and post-tests used in the study were administered by this investigator during the eleven months preceding November 15, 1967. The individual counseling record card of each train-

*Six hundred hours of training time seemed to be the logical division point for group comparisons because the usual initial enrollment period was 20 weeks of five six-hour days per week or 600 hours. Attendance beyond that initial enrollment period required a review of progress to date and a recommendation by the staff that an extension of training time was warranted.

ee provided the desired demographic data--age, sex, last year of formal schooling, rural or urban school background, size of family of origin, whether the family of origin had been broken by death or divorce, and marital status of trainee at the time of enrollment. The termination report required for each trainee was checked to obtain the total time in actual attendance at the Duluth Comprehensive Facility.

Selection of the eighty-seven trainees comprising the study population was based upon the availability of the desired data. The cumulative records disclosed that 155 trainees had completed a period of enrollment between November 15, 1965, and November 15, 1967, but fifty-three of these had to be excluded from the study because of records too incomplete for analysis. Another fifteen trainees were found to possess pre-test and post-test scores for the Vocabulary and Comprehension sub-tests but to lack either a pre-test or a post-test score for the Arithmetic test.* Still another three trainees were found to possess all necessary scores but to lack one or more minor items of demographic data. Therefore, the number of trainees for whom all desired data were available came to eighty-four, and, adding the three for whom only minor demographic data were lacking, established a study population of eighty-seven out of a possible 155, that is, 56 per cent of the total population. This percentage increased to 60 per cent by making nine logical exclusions from the total population---

*A population adding these fifteen to the study population was analyzed for changes in reading scores only. The purpose was to ascertain whether the mean raw scores for the 102 trainees were appreciably different from the mean raw scores of the eighty-seven trainees.

five trainees who were dropped or left voluntarily within their first two weeks of enrollment and four trainees who had been counted twice due to drop-out followed by later re-enrollment; subtraction of these nine reduced the total population from 155 to 146. At the time of the study cut-off date, November 15, 1967, thirty-six trainees in attendance lacked post-test scores because they had not yet reached termination; they were excluded from the study population for this reason.

A Description of the Study Population

The eighty-seven trainees whose raw scores were analyzed in the study were assumed to comprise a large enough population for a fairly normal distribution of scores within the ability limitations of such a population. Included among the eighty-seven were trainees meeting one or more of every eligibility criterion quoted in the Chapter I reference to the Minnesota State Employment Service Local Offices Procedure Manual. Thus, the eighty-seven trainees in the study population represented an often-forgotten minority in society, a minority which had either failed or been denied the opportunity to master certain crucial developmental tasks of life. Their enrollment at the Duluth Comprehensive Facility amounted to one more, perhaps a final, effort to rise above their past backgrounds of educational inequality. The following demographic data obtained from their counseling record cards describe, at least partially, the backgrounds of the study population:

1. AGE--The mean age was 26.9; the median age was 24.6. A frequency distribution placed the modal age at 22, with 25 of the 87

trainees falling within the 21-23 interval. Ages ranged from 17 to 53 years.

2. SEX--The study population included 76 males and 11 females, ratio of almost seven to one.

3. LAST YEAR OF FORMAL SCHOOLING--The mean, median, and modal last year of formal schooling turned out to be identical, the eighth grade. A frequency distribution placed 22 of the 87 trainees at the modal year, 2 at no years of formal schooling, and 6 at twelve years of formal schooling.

4. CHILDHOOD BACKGROUND--Of the 87 trainees, 55 were raised in a rural environment and attended rural schools. The remaining 32 were raised in an urban environment and attended urban schools. This ratio of rural dominance among trainees referred to the Duluth Comprehensive Facility for adult basic education may be evidence supporting a "Coleman Report" conclusion that "large portions of our current problems in education of the disadvantaged stem from this rural background and from the sharp transition our society has undergone" (1966, p.218).

5. SIZE OF FAMILY OF ORIGIN--The mean number of children in the families of origin for 84 of the 87 trainees was 5.5; this information was lacking for 3 trainees. The median number of children was 5.2 and 15 of the trainees were found to be in the modal interval of five-child families. Families of origin ranged in size from one to 16 children, with 22 of the 87 trainees coming from families of 8 or more children.

6. MARITAL STATUS--The trainees were divided almost equally on the factor of marital status; 43 had remained single, 37 had married,

and 7 had married but were divorced at the time of enrollment. This record of only 7 out of 44 marriages broken by divorce or death differed considerably from the record of the 87 families of origin; 36 of those families had been broken by divorce or death before the trainees left home. Although no accurate data were available on how many of either the present or past families of the trainees were strained to the point of legal break-up, information on counseling record cards indicated that the number would be substantial.

7. FUNCTIONAL LITERACY--Assuming functional literacy to be at least the sixth grade level of basic skill ability referred to in Chapter II, the 87 trainees in the study population included 37 who had pre-test raw scores equivalent to sixth grade or above on the Vocabulary sub-test, 32 who had pre-test raw scores equivalent to sixth grade or above on the Comprehension sub-test, and 20 who had pre-test raw scores equivalent to sixth grade or above on the Mixed Fundamentals of Arithmetic test. In each skill, the remaining trainees pre-tested at less than the sixth grade functional literacy level. On the Vocabulary sub-test, 8 trainees indicated zero literacy by raw scores of zero although the test's grade conversion table places a score of zero at second grade level. On the Comprehension sub-test, 20 trainees indicated zero literacy by raw scores of zero although, again, the grade conversion table places a score of zero at second grade level. No trainee in the study population had an arithmetic pre-test raw score of zero; however, one trainee scored only 2 correct out of a possible 34, equivalent to second grade level on the test's conversion table.

Procedures Used for Data Analysis

In analyzing the data for the first two sections of the study design, directional hypotheses were used in all cases on the assumption that it was reasonable to expect a gain from pre-test to post-test; Ferguson has held that directional hypotheses "should be used more frequently" (1966, p. 167). All one-tailed tests of significance required by the use of directional hypotheses sought significance at or beyond the 1 per cent point of confidence, that is, at least 2.33 on the appropriate "t" table of significance values.

Since repeated measurements of the same subjects with the same scales constituted the study data, the difference method for correlated data was used in the first section of the analysis; Downie and Heath have pointed out that the condition of independent samples no longer exists in such data (1965). Raw score arithmetic means were computed in addition to computation of mean differences as a mathematical check to determine whether the differences between means equalled the mean differences. However, only the mean differences were used in testing the significance of score changes from pre-test to post-test.

Dividing the eighty-seven trainees into two groups based upon the variable of time in training to accomplish the second section of the data analysis involved three procedures--a chi square test of significance, a "t" test of significance, and computation of correlation coefficients which also were tested for significance. Use of six hundred hours of training time as the group division point resulted in two groups differing sharply in size as well as in mean hours of

training. For all eighty-seven trainees, the mean hours of training amounted to 782.4 or just over twenty-six weeks of thirty hours per week. Group I contained only twenty-six trainees whose mean hours of training came to 447.8 or not quite fifteen weeks. Group II, however, contained sixty-one trainees whose mean hours of training reached 925 or not quite thirty-one weeks. Furthermore, in attempting to compare two groups so different in size, the influence of unequal ends of the score distributions hindered the analysis as did the fact that the zero pre-test scores tended to fall into Group II. Another question was whether the two groups had become uncorrelated in the division process; they were made up of different individuals of definitely different training times despite the use of the same training materials and measurement methods for both groups. The second section of the analysis therefore sought significance of change in each group separately before seeking to determine whether one group had changed significantly more than the other group.

The third and final section of the data analysis involved only conversion of mean raw scores of all eighty-seven trainees on all three skills--vocabulary, comprehension, and arithmetic--into grade equivalents established by the test authors. It was assumed that these equivalents would represent a partial measurement of the study population's achievement gap between the mean last year of formal schooling and the mean level of the three basic skills. No attempt was made to test the significance of this achievement gap since such a test did not appear to be necessary.

Summary of Methods Used in Study

This chapter has described the type of data collected for evidence of basic skill changes among trainees attending the Duluth Comprehensive Facility, has reported how the data were collected and checked for accuracy, has explained the selection of the study population, has reviewed major factors in the population's backgrounds, and has examined the various procedures necessary to analyze the data in order that the three main purposes of the study might be accomplished. The method of dividing the analytical procedures into three sections for clarity's sake also has been discussed.

CHAPTER IV

FINDINGS OF THE STUDY

Chapter IV will include statements of the various hypotheses implicit in the study, set forth the data germane to each hypothesis, discuss the analysis of the pertinent data, and report whether each hypothesis must be accepted or rejected. It should be noted again that each hypothesis will be of the directional type requiring a one-tailed test of significance. No significance test will be computed, however, for the final hypothesis about the basic skill achievement gap in the study population.

Hypothesis One

The first hypothesis held that there would be a significant gain from the pre-test mean raw score to the post-test mean raw score on the standardized vocabulary, comprehension, and arithmetic tests taken by the study population.

Vocabulary. The direct difference "t" test for matched pairs was the method used to analyze the vocabulary data. Table I reports the analysis results on Page 29. The mean raw score for all eighty-seven trainees was 24.43 on the pre-test and rose to 29.01 on the post-test, a difference between means of 4.5.* The mean difference of the eighty-seven individual differences also was 4.5, as was the "t" value

*Adding in the raw scores of fifteen trainees not in the study population due to the lack of arithmetic raw scores changed the vocabulary pre-test mean to 25.3 and the vocabulary post-test mean to 29.3 for a difference between means of 4.0. These data were not tested for significance, however.

at these degrees of freedom. Table I below indicates that the vocabulary portion of the first hypothesis must stand; the gain from the pre-test mean score to the post-test mean score was significant beyond the 1 per cent point.

TABLE I
VOCABULARY ANALYSIS
N=87

Pre-Test Mean	Post-Test Mean	Mean Difference	"t" Value	Point of Significance
24.43	29.01	4.5	4.5	1%

NOTE: The standard error of the mean difference was 1.0.

Comprehension. The direct difference test also was used to analyze the data on reading comprehension. The mean raw score was 17.94 on the pre-test and rose to 23.28 on the post-test, a difference between means of 5.3;* the mean of the eighty-seven individual differences also was 5.3, resulting in a "t" value of 5.9 at these degrees of freedom. Table II below contains the results of this data analysis.

TABLE II
COMPREHENSION ANALYSIS
N=87

Pre-Test Mean	Post-Test Mean	Mean Difference	"t" Value	Point of Significance
17.94	23.28	5.3	5.9	1%

NOTE: The standard error of the mean difference was .9.

*Adding the raw scores of the fifteen trainees not in the study population changed the pre-test mean to 19.0 and the post-test mean to 23.2, a difference of 4.2. No test of significance was made.

From Table II it can be seen that the comprehension portion of the first hypothesis also must stand; the gain from the pre-test mean score to the post-test mean score was significant beyond the 1 per cent point.

Arithmetic. The difference test also was used to analyze the arithmetic data for the study population. The pre-test mean raw score was 15.95; the post-test mean raw score was 21.69. A difference between means of 5.7 was matched by a 5.7 mean difference for the eighty-seven individual differences, resulting in a "t" value of 13.0 at these degrees of freedom. Table III below presents the arithmetic data.

TABLE III
ARITHMETIC ANALYSIS
N=87

Pre-Test Mean	Post-Test Mean	Mean Difference	"t" Value	Point of Significance
15.95	21.69	5.7	13.0	1%

NOTE: The standard error of the mean difference was .4.

The arithmetic portion of the first hypothesis must be accepted; the gain from the pre-test mean score to the post-test mean score was significant far beyond the 1 per cent point.

Hypothesis Two

The second hypothesis held that the study population, if grouped according to the variable of training time, would make significant pre-test to post-test gains, and, further, that the group with the longer training time would make a significantly greater gain.

Table IV on Page 31 reports the analysis of the data by groups.

TABLE IV

DATA ANALYSIS BY GROUPS

GROUP I (Under 600 Hours)
N = 26

Test	Pre-Test Mean	Post-Test Mean	Mean Difference	"t" Value	Point of Significance
Vocabulary Sub-test	25.96	29.86	3.8	2.9	1%
Comprehension Sub-test	21.07	23.77	2.7	2.3	1%
Arithmetic Test	17.65	21.77	4.1	5.4	1%

NOTE: The standard errors of the mean difference were 1.3, 1.2, and .8, respectively.

GROUP II (Over 600 Hours)
N = 61

Test	Pre-Test Mean	Post-Test Mean	Mean Difference	"t" Value	Point of Significance
Vocabulary Sub-test	23.77	28.67	4.9	3.3	1%
Comprehension Sub-test	16.61	23.06	6.4	5.5	1%
Arithmetic Test	15.23	21.66	6.4	12.3	1%

NOTE: The standard errors of the mean difference were 1.5, 1.2, and .5, respectively.

It is evident from the data in Table IV that the first portion of the second hypothesis must stand for both Group I and Group II. On each of the three tests in each group, six in all, the gain from pre-test mean score to post-test mean score was significant at or beyond the 1 per cent point.

Between-groups analysis. All of the previous analyses have made use of the difference method for correlated data; the pre-test and post-test scores represented the same individuals. However, the difference method could not be used for an analysis between Groups I and II because each group's mean scores did not represent the same individuals; the between-groups data therefore became uncorrelated. To accept or reject the second portion of the second hypothesis, that Group II would show a significantly greater gain due to its much longer mean training time, required other statistical procedures.

Table IV provided an indication that the second portion of the second hypothesis might be true. The three "t" values for Group II were clearly larger than the three "t" values for Group I, evidence that the Group II mean score gains were the more significant. But it was possible that Group II's more significant gains might have been caused solely by Group II's much larger N rather than the longer training time stated in the hypothesis. Table IV also showed that, while the post-test mean scores of both groups were at about the same level as might be expected of trainees completing the same program, there was a noticeable numerical score spread between the group pre-tests. The lower pre-test mean scores could be said to indicate that Group II

began its training at a lower achievement level in all three skills, which also might explain why Group II required a longer time to reach a post-test level comparable with Group I. On the other hand, the lower pre-test mean scores for Group II could have been caused by the unequal ends of the two distributions, that is, the presence of more zero pre-test scores in Group II than in Group I. Scattergrams appearing in the Appendix indicate that this was the case.

A "t" test sought to determine whether the pre-test mean scores of the two groups were, in fact, significantly different; the same test also was applied to the post-test mean scores of both groups. The results are shown below in Table V. Table V establishes statistically

TABLE V

VALUES OF "t" FOR DIFFERENCES BETWEEN MEANS OF GROUPS I AND II

df = 85	Vocabulary	Comprehension	Arithmetic
Difference between pre-test means	.56	1.4	1.7**
Difference between post-test means	.34	.27	.07

** Significant at the 5 per cent point of confidence.

what was apparent in Table IV, namely, that there was no significant difference between the post-test mean scores of the two groups, indicating that both had reached about the same mean plateau near the functional literacy level by the completion of their training time. However, Table V also fails to show any significant difference at the

1 per cent point or better between the pre-test mean scores of the two groups. The "t" values do indicate a slight trend, namely, that the pre-test mean scores were more different than the post-test mean scores; the difference was even significant at the 5 per cent point in the case of arithmetic. However, none of the "t" values reached the 1 per cent point of confidence established for this study.

The limitations of the group size differential and unequal-end distributions prompted the use of chi square, a distribution-free statistical procedure, to seek evidence of significant difference between Groups I and II.* A chi square test for each skill was based upon observed and expected frequencies above and below the study population's pre-test mean scores. Results obtained from separate contingency tables for vocabulary, comprehension, and arithmetic are set forth below in Table VI. It seems apparent from Table VI that in

TABLE VI
CHI SQUARE VALUES BY SKILLS

Test	Chi Square Value	Degrees of Freedom	Point of Significance
Vocabulary Sub-test	.17	1	N.S.
Comprehension Sub-test	2.86	1	5%
Arithmetic Test	1.52	1	N.S.

*Using the Fisher's Z transformation procedure to seek evidence of significant difference in correlation coefficients was attempted but abandoned. Ferguson has noted that, in this procedure, the "interpretation of what the difference in correlation means may be difficult" (1966, p. 188).

no case was the chi square value significant at this study's 1 per cent point of confidence; however, the value for the comprehension sub-test did exceed the 5 per cent point of significance, 2.706, for a one-tailed chi square test. It was assumed that chi square tests of the three post-test mean scores also would have found no significant difference. Use of chi square, then, seemed to establish that Group II did not contain a significantly larger number of pre-test raw scores below the population mean, a finding similar to that of the "t" cited previously.

The second section of the second hypothesis therefore could not not be accepted or rejected without reservation. Some of the statistical evidence pointed to a greater achievement gain by Group II because of its longer time in training but limitations upon that evidence raise a question about its significance. More control over the data is needed.

Hypothesis Three

The third hypothesis held that an achievement gap between the mean last year of formal schooling and pre-test mean scores in the three basic skills would be found in the study population.

Earlier in this chapter the description of the study population reported that its mean last year of formal schooling was the eighth grade; the specific statistic obtained from a frequency distribution was 8.1. Mean pre-test scores for the three skills of vocabulary, comprehension, and arithmetic were converted into grade equivalents, using the conversion scales published by the test authors. It was assumed

that the equivalents would represent a partial but important measurement of the population's achievement gap between years of schooling and learning outcomes. The pre-test mean score for vocabulary had a grade equivalent of 5.1, exactly three grade levels below the mean last year of formal schooling. The pre-test mean score for comprehension had a grade equivalent of 4.8, slightly more than three grade levels below the mean last year of formal schooling. The pre-test mean score for arithmetic had a grade equivalent of 5.2, almost three grade levels below the mean last year of formal schooling. These data also are presented in Figure 1 on Page 38.

Post-test mean scores, also converted into grade equivalents, indicated a partial closing of this achievement gap by more than half a grade level in vocabulary, more than half a grade level in comprehension, and more than a whole grade level in arithmetic. The post-test grade equivalents were 5.8, 5.7, and 6.3, respectively. Only in arithmetic, therefore, did the mean score grade equivalent move upward past the functional literacy level from pre-test to post-test; for vocabulary and comprehension, the mean score grade equivalents did move upward but still remained slightly below the functional literacy level of sixth grade. By using grade equivalents from median scores of frequency distributions, however, the study population moved upward past the functional literacy level on comprehension as well as arithmetic. Examination of the data disclosed that, of the eighty-seven trainees in the study population, nine moved from below functional literacy to above it on their vocabulary raw scores, seventeen did the same on their comprehension raw

N 87

Last year of formal schooling ———

Vocabulary grade equivalent +++++

Comprehension grade equivalent ———

Arithmetic grade equivalent - - - - -

(NOTE: Equivalent scores are pre-test only)

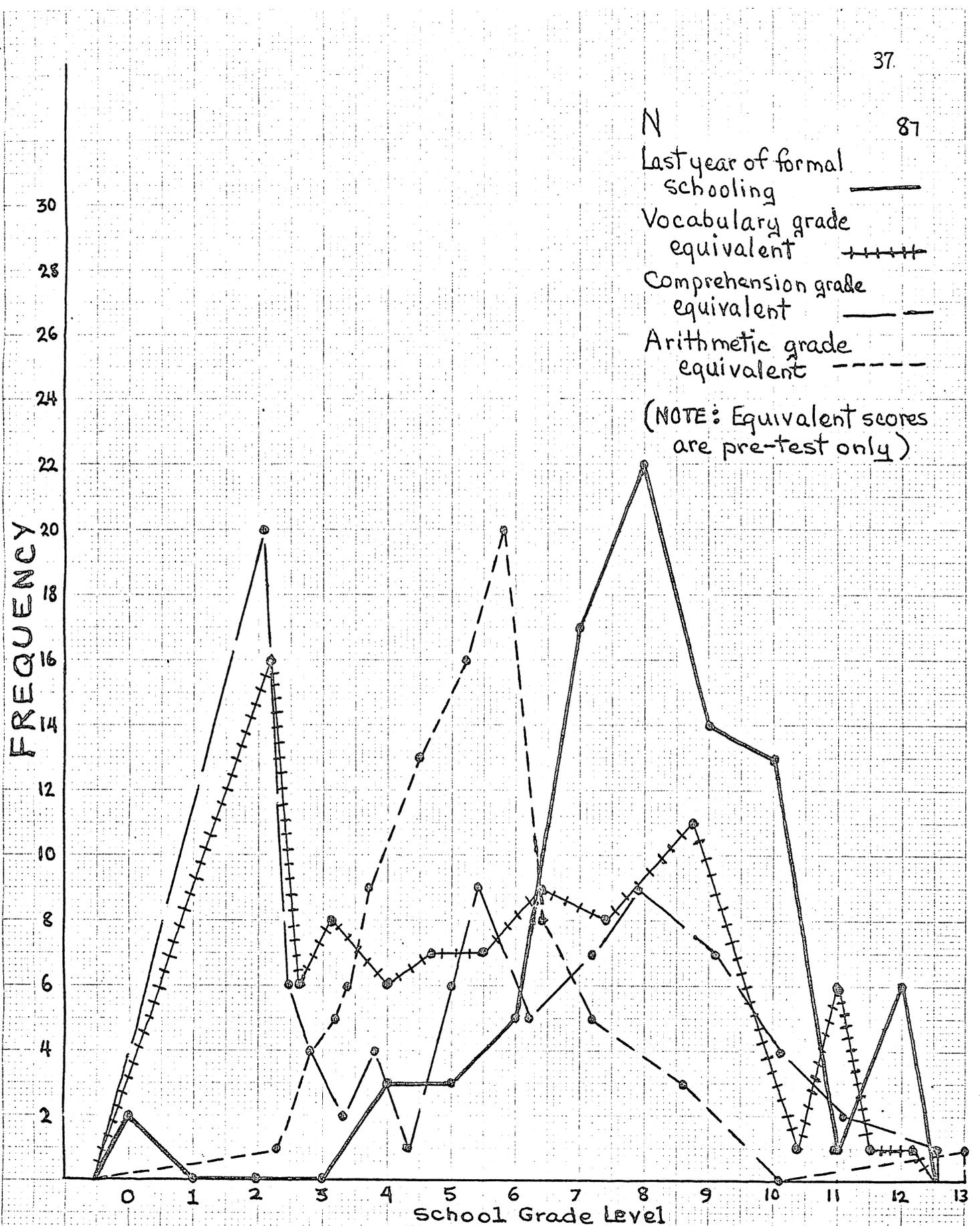


FIGURE 1
ACHIEVEMENT GAP

scores, and forty-two did so on their arithmetic raw scores. Greater movement in arithmetic may reflect the effect of handling money frequently, which can be said to constitute practice in arithmetic; however, seeking the significance of this difference was beyond the scope of the study. A few of the trainees who were above functional literacy level on their pre-test raw scores slipped slightly below this level on their post-test raw scores for reasons not readily apparent; temporal stability probably was operating in these cases. Other trainees fell far below functional literacy level upon enrollment and made very little progress toward that level by termination, according to their pre-test and post-test raw scores.

The third hypothesis of the study must stand. An achievement gap of approximately three grade levels was found between the mean last grade of schooling and the mean grade equivalents of the eighty-seven trainees in the three basic skills, a condition also found in other adult basic education programs cited in the literature.

Summary of Findings

In the preceding analysis of the findings, it has been established that (1) the first hypothesis must stand since the study population did make significant achievement gains in three basic skills, (2) the first portion of the second hypothesis must stand since groups divided on the variable of time in training made significant gains as separate groups, (3) the second portion of the second hypothesis cannot be accepted or rejected with certainty because of conflicting statistical evidence on

whether longer time in training produced greater achievement gain, and (4) the third hypothesis must stand since an achievement gap of about three grade levels was found between the population's mean last grade of formal schooling and its mean grade equivalents in vocabulary, comprehension, and arithmetic skill.

CHAPTER V

IMPLICATIONS OF THE STUDY

As stated in Chapter I, this study had three important purposes: (1) to determine whether significant changes occurred in the reading vocabulary, reading comprehension, and arithmetic skills of trainees enrolled at the Duluth Comprehensive Facility during its first two years of operation; (2) to determine if possible the effect of time in training upon these changes; and (3) to obtain at least a partial measurement of any achievement gap between trainee skill level upon enrollment and the mean last grade of formal schooling. Although lack of experimental control over all variables did constitute a limitation upon the study, the findings are felt to be of sufficient importance to consider their several implications in Chapter V.

Implications of Achievement Change

Significant gains did occur in the vocabulary, comprehension, and reading skills of the study population during its attendance at the Duluth Comprehensive Facility. It was established that these gains were due to some other factor than mere chance, permitting an assumption that they were the outcome of learning. In terms of grade equivalents, the mean gains amounted to .7 grade level in vocabulary, .9 grade level in comprehension, and 1.2 grade levels in arithmetic. The mean number of hours in training required to produce these gains was 782.4 or about twenty-six weeks of thirty hours each. Since the normal school year for children is thirty-eight weeks, it can be seen that the

gains by the study population appear to equal or exceed the gains expected of elementary school children during a similar learning period. Furthermore, elementary school children do not have a disadvantage compounded by the passing years as did the study population; "The Coleman Report" contains dramatic evidence of how time compounds any initial disadvantage in school to reduce relative achievement later on. The achievement gains found in eighty-seven trainees at the Duluth Comprehensive Facility appear to compare favorably with the gains reported in Chapter II for MDTA adult basic education programs elsewhere in the United States.

Significant results are necessary, of course, to justify the expenditure of substantial federal funds upon any adult basic education program for that portion of the general population which heretofore had not completed the crucial developmental task of acquiring basic reading and arithmetic skills. Whether the results in the Duluth program are significant enough to satisfy national objectives may be open to some doubt; agencies or officials unacquainted with the hard realities of overcoming educational deficiencies in adults may insist that the results to date be improved. For at least those trainees who could not reach the functional literacy level during their enrollment period, the Duluth program probably has not fulfilled their hopes; whether the trainees themselves, the program content, limitation of enrollment time, or some combination of these factors is most responsible cannot be said with certainty.

This study did not seek to establish, nor do the findings in any

way indicate, whether even greater gains in trainee skills might be obtained through the use of instructional materials and methods other than those employed at the time of the study. Operating experience obtained during the first two years, experimenting with different materials, and altering instructional methods might well produce better results in the future.* Although the mean gains in skill may seem minimal, with some trainees failing to reach functional literacy level, in most cases there was enough skill improvement to qualify the trainee for further training or more satisfactory employment.

Implications of Training Time upon Achievement Gain

A second purpose of the study was to determine the effect of time in training upon achievement gain. If it is assumed that the significant changes in skill scores were due to learning, then the findings did indicate that more change could occur with more hours of training. There was evidence, for example, that doubling of mean training time more than doubled the mean skill change in reading comprehension. However, an ex post facto study such as this was unable to control all variables sufficiently for a definitive statement accepting or rejecting the hypothesis that longer training would produce more skill gain.

The limitation upon the time that any trainee can remain in an adult basic education program has caused controversy ever since the Congress authorized such programs. Initially, the maximum enrollment was twenty weeks. This maximum was then extended to forty weeks in cases

*Literature cited in Chapter II also raises some doubt about the efficacy of the standardized measurement instruments used in the present program. This doubt probably warrants separate research.

of demonstrated need, then was cut back again to twenty weeks with a possible ten-week extension in exceptional cases, and most recently has been increased again for trainees below functional literacy level who show continuing progress. However, many of the individual cumulative records examined in this study permit a conclusion that it may be completely unrealistic to expect any program to boost a trainee from zero literacy to functional literacy within 20, 30, or even 40 weeks; condensing six and a half years of elementary school skill-building into a school year or less just because the students happen to be adults involves some serious questions of learning psychology. Only additional research well beyond the limitations of this study can determine the best materials and methods for correcting adult educational deficiencies within the shortest possible time, whatever it may be.

Implications of the Achievement Gap

Enrollment in the Duluth Comprehensive Facility adult basic education program succeeded in closing only about one third of the three-grade achievement gap found among the eighty-seven trainees in the study population. This three-grade gap was the difference between functional illiteracy and functional literacy for the typical trainee; accepting the mean last grade of formal schooling at face value would have put the study population well above the functional literacy level of sixth grade when the pre-test mean raw scores established that it was below this level. Achievement gains during enrollment raised the mean level to about functional literacy, leaving the lower portion of the study

population still functionally illiterate despite the Duluth Comprehensive Facility's objective of striving for functional literacy among all completing trainees.

An achievement gap of three grade levels, the difference between functional illiteracy and literacy, in even so limited a young adult population as this one would appear to have some serious implications warranting further research. It might have been expected and accepted in an earlier day when, as "The Coleman Report" points out, the need for basic skills was not as apparent and when a farm-oriented social structure did not enforce school attendance. But for this to be true today of a study population with a mean age of only twenty-seven years hardly speaks well of the education establishment, whether inadequate rural schools or impersonal urban schools or any other factor might have been the main reason. One wonders how education's lofty ideals and sense of mission square with permitting a child who is not retarded to remain in school through the eighth grade and still leave school as a functional illiterate. For social class minorities or any other type of minority, "The Coleman Report" has found that, because their schools have not met the challenge,

inequalities imposed upon children by their home, neighborhood, and peer environment are carried along to become the inequalities with which they confront adult life at the end of school. Equality of educational opportunity through the schools must imply a strong effect of schools that is independent of the child's immediate social environment; that strong independent effect is not present in American schools. (1966, p. 325)

Manpower demands of this technological age, if not the demands of human dignity, require more effort by education to prevent achievement

gaps spanning the boundary between functional illiteracy and literacy.

Implications about "The Human Element"

The comments on Page 45 suggest a final question that may not be measurable but at least should be considered--how statistical research, important as it is, tends to overlook "the human element" behind the data. Like traffic accident statistics, educational statistics do not delve into the myriad human tragedies and dramas that make up the statistics. Some feeling for this "human element" proved inescapable during examination of the counseling record cards for the study population. Just two brief case histories, one from a rural background and one from an urban background, are presented below to illustrate the almost incredible range of human behavior in even the very limited range of this study population:

1. The record of a 29-year-old married man, born into a six-child rural family broken by divorce while he was still a boy, showed seventh grade as his last grade of formal schooling. But his years in school were marked by living with one relative or another or in foster homes; he recalled "never staying in one place long enough to learn anything." In addition, he had the physical handicap of a missing right hand. During 1,142 hours of attendance, he made only slight progress in improving his reading and arithmetic skills.

2. The record of a 53-year-old former ranch hand showed that he came from a broken urban home, had never attended a school, and had been divorced twice. He had lost one lung as a result of tuberculosis, which prohibited his ever working again at the only occupation he knew.

During 816 hours of attendance, he achieved functional literacy in reading but remained below fourth grade level in arithmetic.

Although these two examples have been cited to indicate the "human element" behind the study statistics, no attempt was made to review each of the eighty-seven counseling record cards in any more detail than was necessary to obtain the desired demographic data. It therefore would be mere speculation to assign reasons why some trainees whose skill changes were negative, nil, or well below the mean change did not make more of an improvement. It would be equally speculative to assign reasons why other trainees showed skill changes at or near the top of the change range. In the Chapter I discussion of the study limitations, many factors--self-concept, background, peer relationships, relationships with past authority figures, emotional stability, physical health, marital happiness, and financial status, to list a few important ones--were mentioned as being capable of a crucial effect upon the achievement change of any individual trainee. It was, however, beyond the purpose of this study to analyze such factors, if indeed they could be analyzed at all accurately when the trainees are no longer available for interview.

CHAPTER VI

SUMMARY OF STUDY

This study has sought to analyze the standardized testing results of the first two years of operation of the Duluth Comprehensive Facility, an adult basic education center serving trainees from all parts of Minnesota under the federal Manpower Development and Training Act. The emphasis has been upon statistical measurements of the pertinent data available although the study has discussed several limitations upon such an emphasis, including some serious questions about the best instruments to measure results in this type of educational endeavor.

Nevertheless, the study findings do appear to be meaningful since the pre-test and post-test nature of the data can be assumed to spread the impact of the limitations over the entire study period. The findings showed significant mean change in the reading vocabulary, reading comprehension, and arithmetic skills of the eighty-seven trainees comprising the study population; this change partially closed a basic skill achievement gap between the mean last grade of schooling and the skill level of the trainees at the time of enrollment.

The statistical emphasis, however, warrants a final comment that what Pallone said in the foreword of his study also applies to this one:

A research study is required to maintain a detached neutrality and certain sterility of affect. It hardly expresses the truly human and surely most significant values derived--the personal encounter between those who had been beaten and those who cared.
(1965, unnumbered page)

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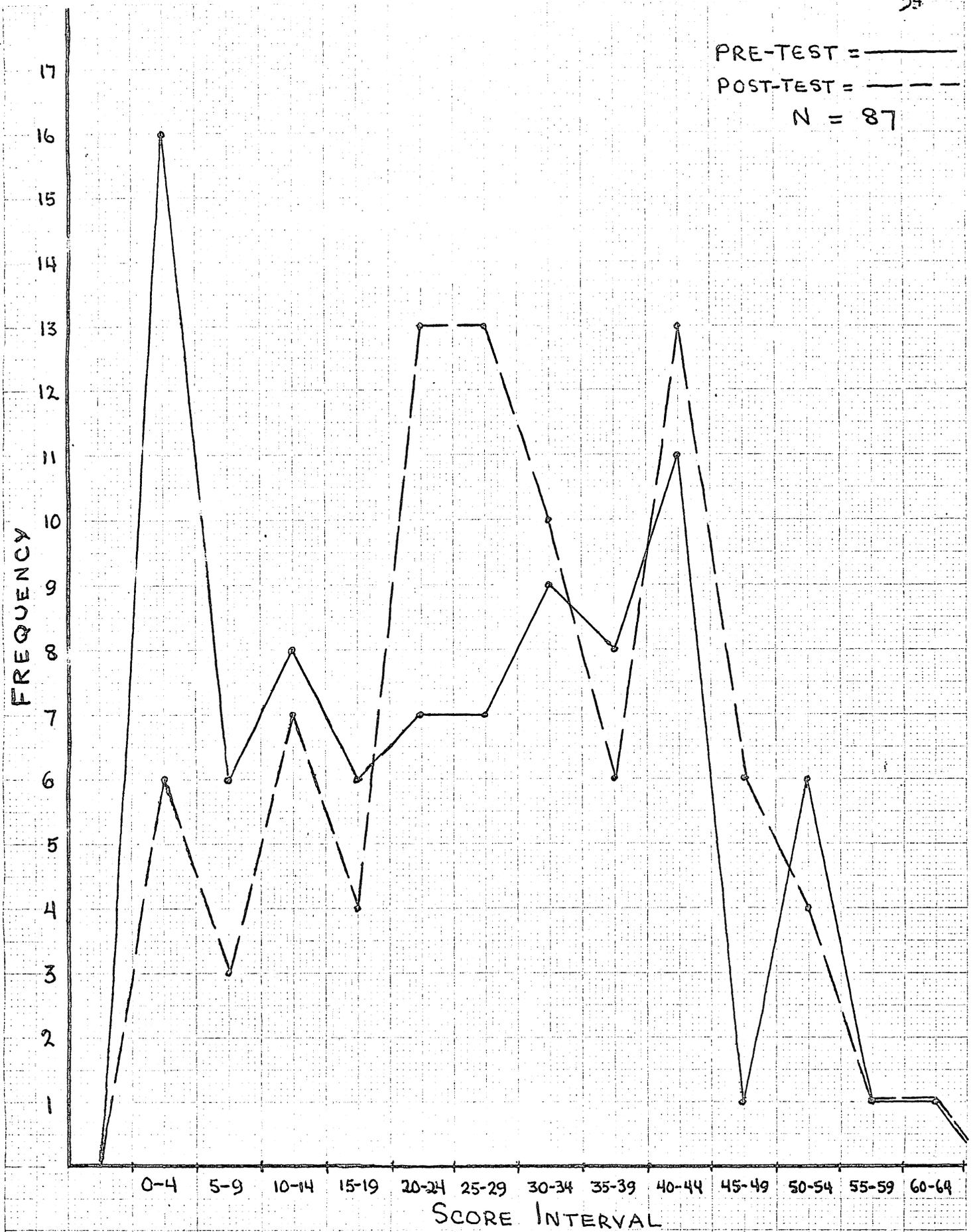
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APPENDIX



SCORE INTERVAL

FIGURE 2

FREQUENCY DISTRIBUTION OF VOCABULARY RAW SCORES

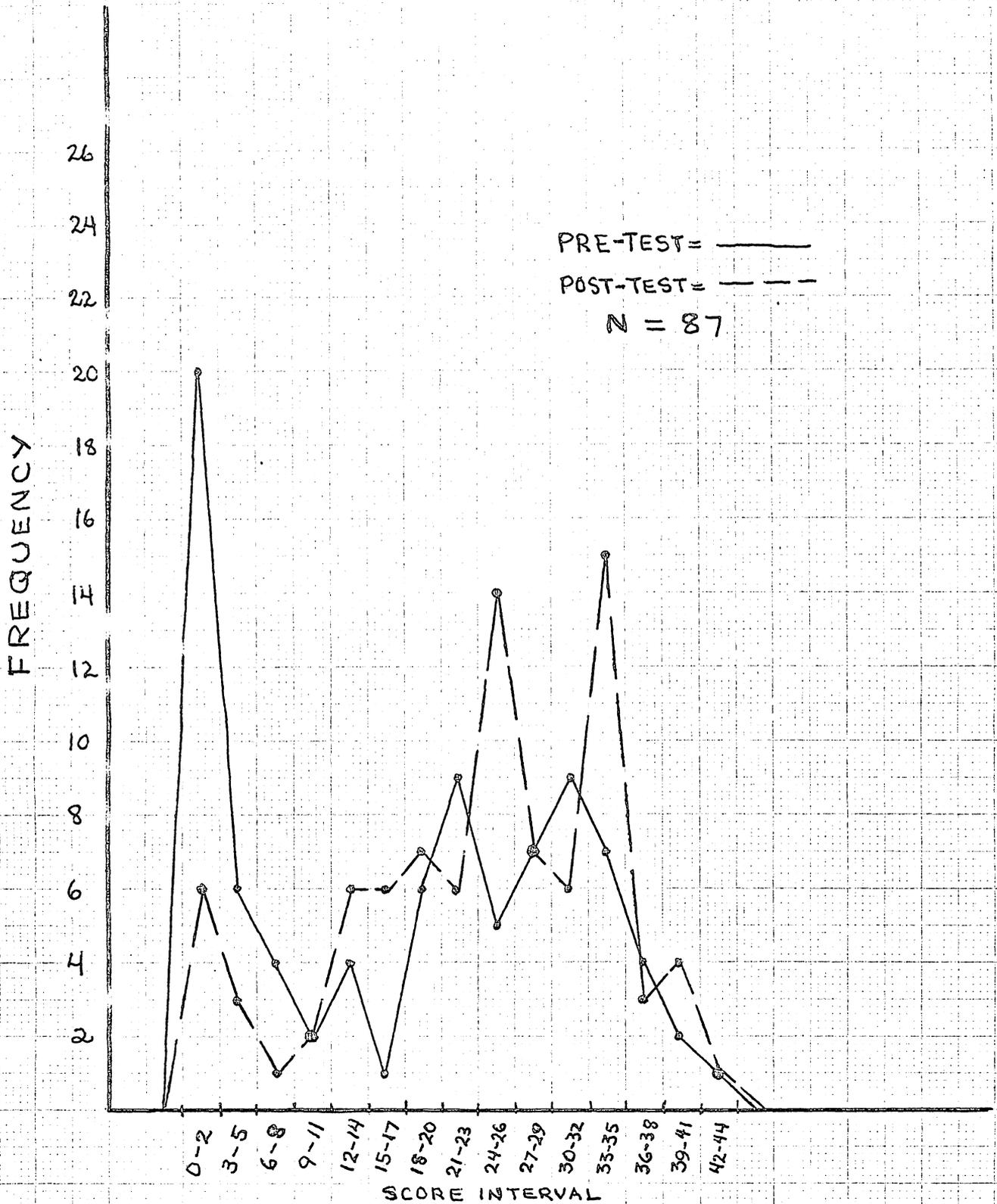


FIGURE 3

FREQUENCY DISTRIBUTION OF COMPREHENSION
RAW SCORES

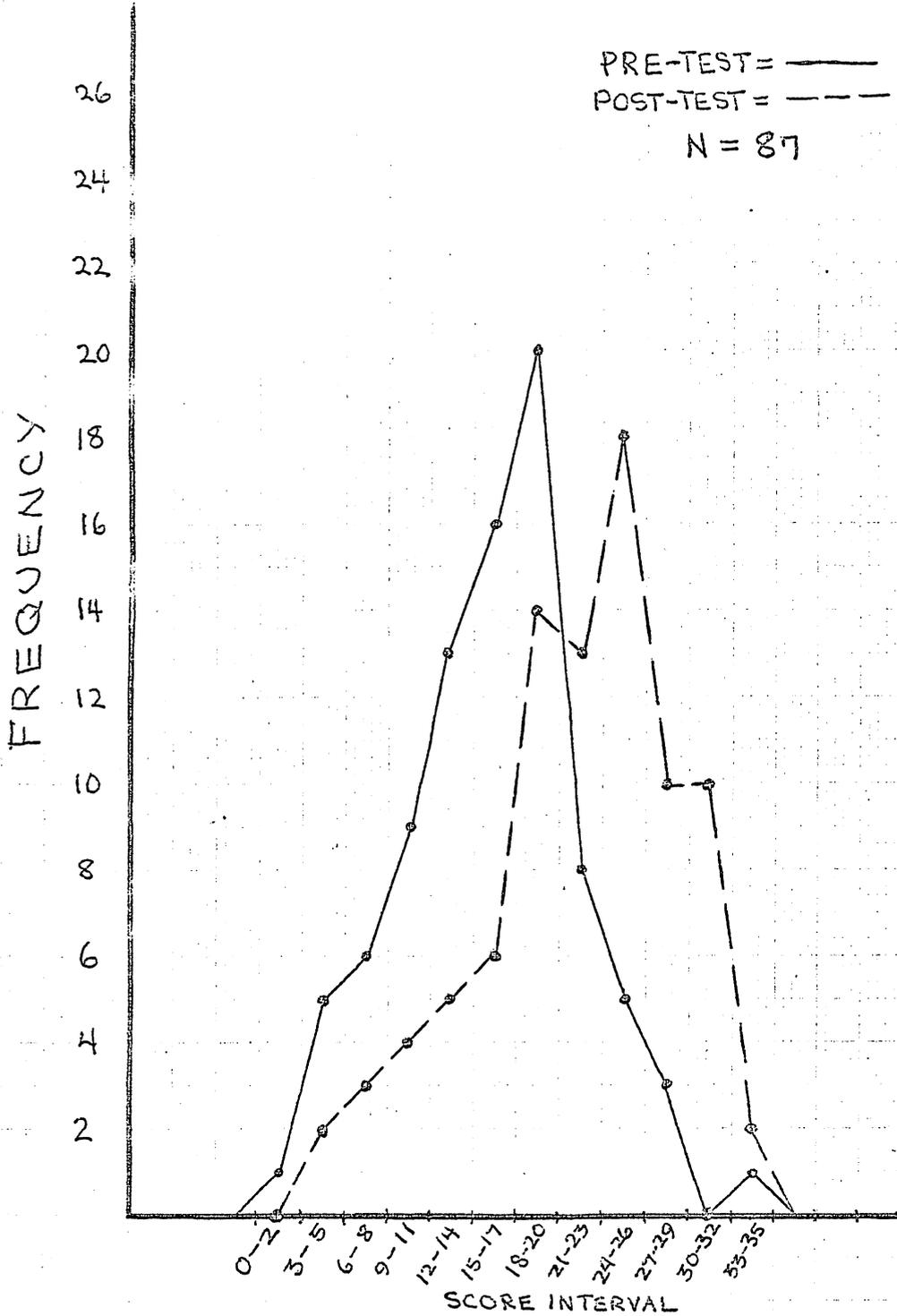


FIGURE 4
FREQUENCY DISTRIBUTION OF ARITHMETIC
RAW SCORES

	POST	0-4	5-9	10-14	15-19	20-24	25-29	30-34	35-39	40-44	45-49	50-54	55-59	60-64	f	y'	fy'	fy' ²	x'y'
		0	1	2	3	4	5	6	7	8	9	10	11	12					
60-64	12													1	12	12/0	144/0	144/0	
55-59	11											1			11	11/0	121/0	110/0	
50-54	10									x	1	xx	x		10	10/30	100/300	90/490	
45-49	9									x					9	9/0	81/0	0/72	
40-44	8							x	xx	xxx	iii				8	24/64	192/512	216/480	
35-39	7					x		1xx		xx	1x				7	14/42	98/294	105/237	
30-34	6					1	1xx	1x	1x	x					6	24/30	144/180	132/186	
25-29	5					xx	xx	1		1x					5	10/25	50/125	70/130	
20-24	4					xx	xx	x	1x						4	4/24	16/96	23/124	
15-19	3			1x		1x	x								3	9/9	27/27	30/33	
10-14	2		1	1x	x	1	xx								2	6/10	12/30	14/40	
5-9	1	xx	1	x		11									1	3/3	3/3	9/2	
0-4	0	11xx	x	xx	xx	x	xx	x		x					0	0/0	0/0	0/0	
PRE	f	2/4	2/1	2/5	0/4	6/7	1/2	3/7	2/4	1/2	5/1	1/3	0/1	1/0	25/61		127/266	907/1338	943/1844
	x'	0	1	2	3	4	5	6	7	8	9	10	11	12					$\Sigma x_1 = .90$ (Group 1)
	fx'	0	2/1	4/10	0/12	24/28	5/60	18/42	14/28	8/96	45/9	10/30	0/11	12/0	142/327				$\Sigma x_2 = .67$ (Group 2)
	fx' ²	0	2/1	8/20	0/36	96/112	25/300	108/252	98/196	64/768	405/81	100/300	0/121	144/0	1050/2187				

Figure 5. Vocabulary scattergram based upon grouped raw scores. 57

	POST	0-2	3-5	6-8	9-11	12-14	15-17	18-20	21-23	24-26	27-29	30-32	33-35	36-38	39-41	42-44	f	f'	$f'f'$	$f'f'^2$	$\Sigma f'$
		0	1	2	3	4	5	6	7	8	9	10	11	12	13	14					
	42-44	14											1				1/0	14	14/0	196/0	154/0
	39-41	13													1	1	1/1	13	13/13	169/169	169/169
	36-38	12										xx		1	1	2	2/2	12	24/24	252/252	252/252
	35-35	11							1			x	xxx				3/5	11	23/55	242/165	220/574
	30-32	10									x	1	xx				4/5	10	40/50	400/500	430/540
	27-29	9							1			1	xx				2/5	9	18/45	162/405	153/322
	24-26	8						x	x	xx	1						1/4	8	8/32	64/256	72/232
	21-23	7					x	1	xx		x						2/7	7	14/49	98/343	93/385
	18-20	6						x	1	xx	x						3/4	6	12/24	72/144	90/186
	15-17	5									x						0/1	5	0/5	0/25	0/40
	12-14	4			1		x		x			x					1/3	4	4/12	16/48	12/84
	9-11	3					x	x									0/2	3	0/6	0/18	0/55
	6-8	2			1			x		x							2/2	2	4/4	8/8	16/28
	3-5	1	x		1		1										3/3	1	3/3	5/3	12/16
	0-2	0	xxx		1	xx	x	x	1	xx	x						2/17	0	0/0	0/0	0/0
PRE	f	1/5	1/2	1/0	1/1	2/4	2/4	1/6	3/3	2/12	2/5	2/4	5/10	1/2	1/3	1/0	26/61	176/322	1718/2312	1759/3069	
	$\Sigma f'$	0	1	2	3	4	5	6	7	8	9	10	11	12	13	14					
	$f'f'$	0	1/2	2/0	3/3	8/16	10/20	6/36	21/21	16/96	18/45	20/40	55/10	12/24	13/39	14/0	199/452				$\Sigma f' = .90$ (Group 1)
	$f'f'^2$	0	1/2	4/0	9/9	32/64	50/100	36/216	147/147	128/768	162/405	200/400	608/1210	144/388	169/507	196/0	1883/4116				$\Sigma f_x = .74$ (Group 2)

Figure 6. Comprehension scattergram based upon grouped raw scores. 55

POST		0-2	3-5	6-8	9-11	12-14	15-17	18-20	21-23	24-26	27-29	30-32	33-35	f	y'	fy'	fy'^2	$\alpha'y'$
		0	1	2	3	4	5	6	7	8	9	10	11					
33-35	11										/			1/10	11	1/10	121/100	99/100
30-32	10													0/10	10	0/10	0/100	0/100
27-29	9											/x	/x	1/2	9	9/18	81/162	99/189
24-26	8									/x	/x	/xx		1/4	8	8/32	64/256	64/296
21-23	7									/x	//xx	/x		4/4	7	28/28	196/196	252/252
18-20	6							/xx	//xx	//xx	/x	/xx		6/14	6	36/84	216/504	252/634
15-17	5						//	//xx	/xx	/xx	/xx	/x		6/10	5	30/50	150/250	185/380
12-14	4					/xx	/xx	/xx	/x	/xx				2/11	4	8/44	32/176	56/256
9-11	3				/	/x	/x	/x	/xx	/x				2/7	3	6/21	18/63	30/141
6-8	2		/		/xx	/		/x						3/3	2	6/6	12/12	16/24
3-5	1		/x	/xx	/x	/x								0/5	1	0/5	0/5	0/12
0-2	0			/x										0/1	0	0/0	0/0	0/0
PRE	f	0	1	0/3	1/3	2/3	2/4	4/10	3/10	7/11	4/6	1/9	1/1	26/61		142/238	890/1624	1083/2154
	α'	0	1	2	3/9	4	5	6	7	8	9	10	11	180				
	fx'	0	1	0	3/9	8/12	10/20	24/60	21/70	56/88	36/54	10/90	11/11	421				
	fx'^2	0	1	0/2	9/27	32/48	50/100	144/360	147/490	448/704	324/486	100/810	121/121	1376/3259				

$\bar{y}'_1 = .82$ (Group 1)
 $\bar{y}'_x = .64$ (Group 2)

Figure 7. Arithmetic scattergram based upon grouped raw scores 59

TABLE VII
TEST RAW SCORES OF STUDY POPULATION

S	Vocabulary		Comprehension		Arithmetic	
	Pre	Post	Pre	Post	Pre	Post
1.	9	23	3	15	18	23
2.	30	26	34	32	19	31
3.	0	0	0	1	2	8
4.	52	55	39	41	26	31
5.	36	45	0	26	7	11
6.	30	39	29	30	11	13
7.	0	4	0	5	9	19
8.	2	32	0	18	19	28
9.	3	17	0	5	8	9
10.	0	26	0	25	27	30
11.	32	29	31	33	24	25
12.	26	23	25	19	14	20
13.	39	34	29	34	14	14
14.	44	41	37	31	19	30
15.	34	30	18	18	18	26
16.	0	4	0	0	20	23
17.	6	9	4	6	7	10
18.	44	41	35	34	17	28
19.	3	22	2	12	11	23
20.	40	37	29	23	18	20
21.	17	22	8	14	18	28
22.	7	22	7	14	17	19
23.	38	48	36	39	20	24
24.	37	41	27	37	17	31
25.	50	52	29	41	17	24
26.	14	29	9	17	11	21
27.	0	0	0	0	3	5
28.	20	23	20	28	12	23
29.	18	14	18	21	21	27
30.	40	46	33	28	19	24
31.	4	18	0	12	3	13
32.	3	19	0	15	9	18
33.	21	39	23	34	26	31
34.	14	18	5	12	11	24
35.	13	26	14	15	15	19
36.	13	14	13	10	7	4
37.	24	24	32	32	10	16
38.	16	12	9	19	16	22
39.	6	3	4	2	5	6
40.	28	28	24	25	21	29

TABLE VII (continued)

S	Vocabulary		Comprehension		Arithmetic	
	Pre	Post	Pre	Post	Pre	Post
41.	18	23	7	19	19	30
42.	32	41	26	24	20	23
43.	6	11	0	1	17	22
44.	0	13	0	11	4	6
45.	41	43	30	35	13	20
46.	54	54	36	32	29	33
47.	39	22	21	19	23	26
48.	29	40	23	25	14	25
49.	44	40	34	33	16	25
50.	30	38	12	28	19	20
51.	30	32	24	28	23	28
52.	11	14	0	4	14	15
53.	6	4	0	1	13	14
54.	29	41	19	25	7	18
55.	42	30	12	21	12	20
56.	35	33	32	29	19	25
57.	40	37	35	33	19	26
58.	0	12	0	14	19	32
59.	1	31	4	38	9	21
60.	3	40	0	23	13	15
61.	40	40	28	34	12	26
62.	50	52	30	39	14	24
63.	45	40	17	25	5	9
64.	24	25	23	25	21	27
65.	41	46	38	37	22	26
66.	11	5	0	21	17	16
67.	17	26	19	24	16	27
68.	25	30	21	19	17	17
69.	33	27	32	33	26	26
70.	57	54	43	34	29	33
71.	22	36	30	35	23	30
72.	35	31	28	23	14	20
73.	3	6	0	24	26	27
74.	54	44	35	35	13	15
75.	0	25	0	28	9	21
76.	15	20	18	24	7	13
77.	26	28	24	22	19	23
78.	12	26	6	25	19	24
79.	11	24	5	16	15	24
80.	39	41	21	28	18	22
81.	50	49	30	33	17	22

TABLE VII. (continued)

S	Vocabulary		Comprehension		Arithmetic	
	Pre	Post	Pre	Post	Pre	Post
82.	34	23	31	30	19	24
83.	23	30	23	26	16	20
84.	27	24	22	26	16	19
85.	24	25	22	15	21	30
86.	44	49	34	35	16	20
87.	60	64	40	43	33	28