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The purpose of this study was to investigate one individual difference, i.e., rate of response, and the effect on student performance when teachers recognize this difference. Using disadvantaged third grade students as subjects, three null hypotheses were formulated as follows:

1. Slow responding accurate students' (Group LH) scores will show no significant difference over rapidly responding inaccurate students' (Group HL) scores on the Metropolitan Achievement Test when test time-limits are extended.
2. There will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year and those

students using regular daily work-limits during the school year.

3. There will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year and those students using regular daily work-limits during the school year when test time-limits are extended.

The t-test was applied for hypothesis number one and the analysis of variance F-statistic was used for both hypotheses two and three.

Findings

The findings of this study indicated the acceptance of null hypothesis number two and the rejection of null hypotheses numbers one and three. Rejection of hypothesis number one lends support to the belief that some children exist that are slow responding but not mentally low. Hypothesis number three lends support to the belief that time to work accurately is an important factor for some children and that test time-limits may impose a penalty on these children rather than measuring accurately the child's abilities or skills.

Further Findings

These disadvantaged third graders with an overall mean I. Q. of 97 managed to respond to practically every question on six subtests

and about half of the students finished the seventh subtest easily within the standard time limit. On one mathematics subtest, Mathematics Computation, only four students out of 230 did not complete the answer sheet within the standard test time-limit. Participating teachers remarked that some children were "finished" with the answer sheet before all of the test booklets had been distributed and that most of the children work for awhile, become totally frustrated, and then arbitrarily fill in the remaining answers.

Recommendations

In view of the findings of this study, the writer offers the following recommendations.

1. To testing departments of public schools and to test publishers:

   Standardized tests need to be redesigned to provide a strong incentive to the test taker to "try" each question, whether the incentive be a reward, recognition, or just fun to do. At the present time and using present standardized tests, these disadvantaged children really have no reason to do anything but use the answer sheet for drawing geometric designs.

2. To school boards and state legislators:

   Strong objections should be raised in the use of present

standardized achievement tests in fulfilling accountability law requirements.

3. To schools of education and students involved in research:

   With some gain apparent with informed groups (students given longer work-limits and aware teachers) in this study and with the successful research cited in Chapter II, further study into teacher expectancies with disadvantaged children is vital.

4. To school administrators and teachers:

   Revise testing procedures to improve teaching-testing feedback for children. This could be accomplished through in-service education of administrators and teachers.

Effects of Rate and Accuracy of Test Responses, Removal of Test Time-limits and Teacher Expectancies on Achievement Test Scores of Disadvantaged Third Grade Students in Denver

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I. INTRODUCTION

Need for the Study

Identifying and teaching for individual differences has been emphasized, elaborated, and epitomized by many educators during the past few decades. This investigator found an abundance of studies that have been innovated and implemented in special education for those students with visable or obvious differences, but unfortunately, children who appear normal and behave normally are regarded as totally normal. Most individual differences are thus attributed to personal or environmental problems to be solved by the student himself. Normalcy has come to imply a sameness of abilities and skills for all children who score within precise limits on one or more measuring instruments regardless of the measuring instrument's purpose. Any deviation from this unanimity of ability and skill in daily classroom performance is usually treated, not as an acceptable individual difference, but as purposeful nonconformity to the group with the major share of responsibility placed directly on the individual student.

The purpose of this study was to conduct research in an effort

to identify one individual difference, i.e., rate of response, and the effect on student performance when teachers recognize this difference.

This study was designed to determine whether some students can be slow in their rate of response, but not mentally low, and if teachers who are aware of this possibility will interact with the student to increase his test performance significantly.

For many years this investigator has observed what he considers to be two common syndromes and a paradox in many elementary schools.

The first syndrome begins before any testing has taken place at the primary level. A child who responds slowly to questions and other class activities will often be assumed to be mentally low by many teachers. When a timed test is administered, the slow moving child will usually score low, and the suspicions of the teacher will have been confirmed. There is a possibility, however, that this child could have correctly answered a very high percentage of test questions, but had attempted very few. Seldom does a teacher check a test's answer sheet for an item-attempted versus item-correct ratio. In many school systems, only the computed score is seen by the teacher when machine scoring is used. This syndrome becomes more firmly established as the child progresses through the elementary grades by continuing to perform at a low level on tests and his inability to complete daily assignments. Many of these symptoms may be directly related to the

treatment or labeling afforded this child by his teacher's expectancies, grouping, and non-challenging assignments.

The second syndrome appears after a test with a low speededness factor, or an untimed test, has diagnosed this particular child as being within the normal range. If this child frequently does not complete class assignments within a given period of time, cannot respond immediately to questions, and is not quick to understand directions, these symptoms are assumed, by many teachers, to identify a learning problem. A lack of motivation, drive, incentive, ambition, or native intelligence may be blamed, or the child may be branded as lazy. The child is then subjected to "corrective" pressures from the school, home, and peers to "speed-up" and conform with the group. These pressures may vary from indirect orders to sarcasm and ridicule. Some children, under unknown stress, manage to conform, but for others unable to respond rapidly, it usually means removal from the normal or average group and labeled as subnormal in ability and skills.

The common paradox is self-defeating for the most conscientious child, and especially frustrating for the slower moving child when, on the one hand, teachers are continually demanding accurate and concise work, but on the other hand, they establish impossibly short work periods. This paradox is even more profound and self-defeating on standardized tests, where time limits penalize the child who is

attempting to answer each question to the best of his ability. Some children feel a compulsion to complete difficult questions rather than skipping them, resulting in a lower test score.

Many slow responding students are subnormal, but this study was concerned with identifying those unknown numbers who need more time to show that they possess normal abilities and skills.

Quickness or speed of response is a necessary component of intelligence, but concern for overemphasizing speed has prevailed for years. L. L. Wynn Jones (76, p. 151) junior author for C. Spearman's Human Ability after presenting data showing that additional time allowed for tests did not significantly alter the results, still harbored a seed of doubt in quoting the English writer Walter Savage Landor who wrote in the early 1800's:

> Quickness is among the least of the mind's properties and belongs to her lowest estate. The mad often retain it; the liar has it; the cheat has it; we find it on the race-course and at the card table. Education does not give it and reflection takes away from it.

Jones (76, p. 151, 152) continued this doubt when he asked the Commandant of the Royal Naval College if he did not think it possible for a person to be very intelligent but slow. The commandant's answer was immediate and characteristic: "We do not want him in the Navy."

Even today, speed holds a prominent place as a controlling factor in many standardized tests. Moore (60, p. 175) observed that

many examinees on the Miller Analogies Test had not even completed the sample questions when time ran out. This writer has observed on the Kuhlmann-Anderson Group Intelligence Test, Form EF, that completing only one half of the test correctly will yield an IQ score of 129. Breaking this down, if a student had responded slightly faster to complete only one more question correctly on each of the test's eight parts, his score, or in this case his IQ, would rise approximately one point for each question. This writer first became aware of the question of speededness of tests upon checking answer sheets and finding some student's papers who scored low were caused by the small number of responses, but each answer attempted was correct. This does not necessarily guarantee a higher score if more time had been allowed, but this situation does present an interesting problem.

A multitude of studies have shown a high correlation exists between speed and altitude on intelligence tests. Most students that score low are therefore slow. The vast majority of these studies used subjects older than elementary school age, and most of them used college students, a select group. Practically all of these studies used only raw score totals rather than using a ratio of answers completed versus answers correct. Most of these studies also used measures of central tendency that eliminated extreme scores. Studies have not been conducted to ascertain how many students may be slow, but possess intelligence factors not related to speed or not included

in intelligence tests. Studies are still needed to identify causes for slowness that range from cultural differences to nutritional deficiencies to environments not conducive to sleep. How many students are "failures" in the first grade because assignments were not completed on time and are treated as low because of the speededness of a group intelligence test? How many are taught to assume the role of being low and lazy because they are slow? How many mentally "drop-out" or "turn-off" academic pursuits before finishing the elementary grades because the pace was too fast? How many slow students possess abilities to organize, to "see" relationships, to be inventive, to be creative, or to solve problems? How many are "counseled" and expected to complete vocationally throughout life, using their weakest ability, speed, because "non-thinking" jobs often require rapid production? How great is society's loss because valuable abilities are never identified and atrophy during the early school years?

This study used third grade students for three reasons. First, standardized tests are usually not considered as reliable and/or valid below the third grade level. Second, the labeling effect discussed earlier, hopefully, has had less time to affect the student's self concept. Finally, children at the third grade level and below generally have a positive attitude toward school and their teachers with relatively less peer influence. Disadvantaged children were used in this

study, because any differences should be more pronounced and/or more abundant due to cultural differences in the concept of time, and attitudes toward time as identified by Knapp (46, p. 20), who found that Mexican-Americans are not "geared to the clock." Nutritional standards are usually lower, less communication in the home, and generally a less scheduled existence were identified as significant factors affecting disadvantaged children in several studies.

Principle concerns of this study were to identify students who would benefit significantly if allowed more time along with those who would measure gains on tests if higher expectations were received from their teachers as based on Rosenthal and Jacobson (70).

Statement of the Problem

The purposes of this study are: (1) to identify individual students who are slow responding on tests but who may possess above average mental abilities by exhibiting a high degree of accuracy on test items on the Kuhlmann-Anderson Group Intelligence Test, (2) to measure the significance of time-limit removal on Metropolitan Achievement Test scores, and (3) to measure the effect of teacher expectancy on students who were allowed more time for classroom work during a major part of the school year using Metropolitan Achievement Test scores. To be more specific, the following hypotheses were proposed:

1. Slow responding accurate students' (Group LH) scores will

show no significant difference over rapidly responding inaccurate students' (Group HL) scores on the Metropolitan Achievement Test when test time-limits are extended.

2. There will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year and those students using regular daily work-limits during the school year.

3. There will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year and those students using regular daily work-limits during the school year when test time-limits are extended.

Significance of the Problem

The technological age has produced many changes in American society. Among these, two are particularly relevant to American public education. First, the complexities of machines and computers have increased, rather than decreased, the unique value of an individual. It is becoming obvious that man's interactions with man must assume greater importance than man's interactions with complicated machines. Human resources are steadily increasing in worth with every analysis of an individual lost to society through an education

inadequate to prepare that individual to make a contribution. MacKinnon (53) in reviewing the accomplishments of Dr. Walter Bingham, relates a story credited to Mark Twain about a man who sought the greatest general who ever lived and was shocked to find a man in heaven whom he had known as a cobbler in life. Saint Peter explained that, if the cobbler had been a general, he would have been the greatest. MacKinnon (53, p. 484) states:

> Dr. Bingham spent his life worrying about cobblers who might have been generals and indeed about all those who fail to become what they are capable of becoming because neither they nor others recognize their potentialities and nourish their realizations.

Society can no longer afford the loss of individual skills and abilities when the means of identification exist.

Second, the information explosion coupled with the unbelievable speed of the computer, has greatly accelerated the pace of everyday life. In education, the curriculum at all levels is being deluged with a demand for more subject areas, with more content to be covered, in the same block of allotted time. The time-is-money philosophy permeates education, not only in financial administration, but also in advanced placement, accelerated programs, subject time-allotment, length of the school day, length of the school year, and lowering of root courses by grade levels.

With emphasis in education being placed on "education throughout life" and identifying "types" of students (gifted and educationally

handicapped), the student whose pace is slower than the "quick" is being overlooked. Time and speed have become important commodities in today's school. The "fast" student finds many rewards in school by having a higher probability of scoring average or above on group intelligence tests, achievement tests, aptitude tests, and in completing daily assignments on time and, no doubt, through more overt and covert reinforcement from his teacher. The "slow" student is not only non-reinforced, but often is verbally punished for not "finishing" before an arbitrary bell sounds.

Definition of Terms

For the purposes of this study, the terms used in this investigation will be defined to mean the following:

1. Target School: The term target school will be used to refer to those Denver Public School buildings located in lower economic areas and qualifying for financial assistance as outlined under the Federal Elementary and Secondary Education Act of 1965.
2. Disadvantaged Student: In this study, disadvantaged students are those students who regularly attend a target school in their own neighborhood. The Denver Public School's "open" enrollment policy permits any student residing within the city and county of Denver to attend any public school as long

as his enrollment will improve the racial balance and room is available. The "open enrollment" students were not included in this study.

3. Mexican-American: Denver students with Spanish surnames often prefer being addressed as Chicanos or Hispanos, but since these terms are not as common in usage, the term Mexican-American will be used in this study.

4. Slow: The terms slow, slow responding, slow student, will refer only to the number of test items completed and not to a level of intelligence.

5. Slow Accurate: The term slow accurate refers to those students who complete a small number of test items, but who have a high percentage of correct answers in those items completed.

Limitations of This Study

1. This study was limited to third grade students in regular classes from Denver Public Schools elementary buildings.

2. The study was further limited to three target schools, two predominately Mexican-American and one predominately Negro in racial and ethnic origins. Racial and ethnic composition of the three schools is found in Appendix A.

3. Students attending target schools in their own neighborhood were assumed to be disadvantaged. Open enrollment students were

not included in this study.

4. The effect of additional time on standardized test scores was studied without regard for subject area, city, or national norms.

5. No attempt was made to determine the causes underlying slow responding students.

6. Observation and computing of additional time allowed students by their teachers was determined by each of the three building principals.

Chapter II will discuss the related literature concerning the role of speed in testing, disadvantaged children's special problems encountered in testing, and teacher's expectations of student performance on tests.

II. REVIEW OF RELATED LITERATURE

The review of literature in this chapter covers three generally unrelated areas, in which the writer will attempt to indicate interrelationships significant to this study. The first section, a survey of the role of speed in testing, reviews historically and chronologically a representative sample of studies from the amplitude of data available in this field. Although the majority of studies reported findings of a direct relationship between slow responding students on tests with low mental ability, a small but persistent group of experimenters have continually maintained that it is possible for individuals to be physically slow moving but not necessarily mentally low. The second section presents a brief summary of selected studies concerned with disadvantaged children that present factors pertinent and applicable to the testing situation. Possible explanation of causes for subnormative test performance are explored in an effort to establish the complexities of a given test situation. The third section deals primarily with recent studies on teacher expectations of student performance, covert communication, and the human factor in a testing situation. This section proffers effects relating teacher's interpretations of test results to teacher's perceptions and interactions with their students.

Historical Survey of the Role of Speed in Testing

Concern over the influence of speed as a factor of intelligence originated before the first accepted measures of intelligence were developed. In 1894, J.A. Gilbert's study (29) is among the first reported reflecting the shift from the previous emphasis upon sensory reaction time toward the place of speed of reaction in relation to mental ability in the classroom. Gilbert's findings concluded that bright children reacted much more quickly with discrimination than did the dull and levels of mental ability could be assessed by the quickness or the rapidity with which a child is able to react. Criticizing Gilbert's study, Hunsicker (39, p. 4, 5) states:

> The description of the specific procedure followed and of the conditions prevailing in the experiments, is meager, too limited to enable the reader to pass discriminating judgment upon their effect on the measures obtained. From such facts as are given, it appears that both the procedure and the general conditions were loose, and examination of the minute description of the complicated and extensive apparatus used forces the impression that there was abundant opportunity for irregularities and discrepancies which would tend to invalidate the data. The sole criterion of "brightness" is the judgment of the classroom teacher. However acceptable this single standard may have been at that time, it is not now regarded as sufficiently precise to meet scientific requirements.

Other writers, McFarland (57) and Sisk (72), have since pointed out that children ranked for "brightness" (on the basis of quickness) would naturally show a reaction time which has a fairly high correlation with "brightness" in laboratory tests. Later investigators, such

as Brown (13), Burt (15), Highsmith (38), McCall (55), and Wyatt (91) have found rather low correlations, in the .30 to .40 range, between the speed in performing simple tasks and intelligence.

During this same time period, working in France, Binet attempted to measure factors of sensory discrimination, reaction times and other factors in which the rate of response was an important element according to Peterson (65). Peterson goes on to explain that many of Binet's contemporaries showed this same general approach and one of them, Henri, coauthored an article with Binet in 1896 which discussed the question of the interrelationships of different mental functions and concluded that persons who are slow in ordinary reactions, such as walking or writing, are probably slow in reaction experiments. Later, Binet qualified this statement by saying that this was only a probable conclusion. According to Peterson (65), in 1900, Binet concluded that speed in his tests was not related to the intelligence of the children whom he selected by other means as bright and dull. In 1905 and in 1908, when Binet developed his tests, he paid little attention to the amount of work that could be done in a given length of time. The Stanford Revision followed Binet's suggestion in requiring a time limit on only 17 of the 90 tests composing the test's scale. Although no time limits were imposed, no rewards were given for those who completed the tests early.

In 1901, Bagley (4) designed an experiment to test the motor

ability of 160 school children. The motor ability scores were correlated with each child's mental ability. Mental ability in this study was determined by the teacher's estimate independent of class reports and by the child's class standing. In summary, Bagley (4) found an inverse relation between motor and mental ability. Those physically strongest were deficient in mental ability, but Bagley discovered numerous individual exceptions. Gilbert's (29) assertion was upheld by Bagley in that "brightness" is directly related to reaction time. Hunsicker (39, p. 5, 6) points out that Bagley used two measures of mental ability and naturally found a correlation. McFarland (57) and Hunsicker (39) also level the same general criticisms of loose procedure and faulty interpretation at Gilbert which could also be applied to Bagley's study.

In the year 1902, Aikens, Thorndike and Hubbell (1) published an article dealing with the relationships of a number of perceptive and associative processes dependent on quickness and accuracy. Concluding their findings, Aikens, Thorndike and Hubbell (1, p. 374, 375) state:

> It has been the habit of psychologists to use the words "memory," "attention," "delicacy of discrimination," etc., as if they referred to general mental functions and the words "quickness" and "accuracy" and "ability" as if they referred to general mental qualities. But any consideration of the potent facts of human nature suggests that a priori it is more rational to look on the mind as a multitude of particular capacities, particular associations and particular acts, all of which may be highly independent of each other.

> Quickness of association as an ability determining the speed of all one's associations is a myth.

According to Lanier (47, p. 371, 372):

> This was perhaps the first expression of Thorndike's theory of the "specificity of mental functions," a view which has been opposed by Spearman's theory of a general factor.

Two years later, in 1904, Whipple (88) published his study of reaction times as an indicator of mental ability. His analysis concludes that results in reaction time experiments may be varied due to the lack of constancy in giving the stimulus and various subjective factors which are difficult to control. Whipple contributes faulty experimental design rather than a measurable factor in the studies of Gilbert and Bagley.

Following the earlier experimentation of Weber, Fechner, Muller, Wundt and Cattell, Henmon (36) reported his findings in the field of sensations. This 1906 study varied the intensity of the stimuli and length of reaction time as a measure of the difference in sense discrimination. Henmon's conclusions, based on 4,400 reactions by two observers, is that a measure of the reaction time is a measure of the ability in that sense category. He believed that the unit of measurement derived from a comparison and evaluation of reaction times in the various sense departments based upon the amount of stimulus necessary to produce each, gives rise to a common unit of measure in terms of reaction time. Commenting on Henmon's study, McFarland

(57, p. 598) is complimentary of the precise work and found significance in suggesting a method for the measurement of the higher mental processes by using reaction times.

In 1909, Burt (15) reported his study in which correlations were found between speed in various performances and intelligence. Criticism of Burt's study follows earlier studies in the method employed to arrive at a judgment of intelligence. Burt also received criticism on the tests used as being more a measurement of finger dexterity rather than mental quickness. The following year, Brown (13) reported a similar experiment and received very similar criticism.

Another year later, 1911, Henmon (35) published the results of a series of experiments with lines. Measurements on time of judgment, accuracy, and individual differences in judgment times were determined. Henmon found that the average times of correct judgments were shorter than for wrong judgments, and that there were marked individual differences among his subjects in accuracy, time of perception, and degree of confidence.

In 1913, Wyatt (91) experimented to find the correlation between different tests with subjective judgments of intelligence. Using 34 children as subjects, Wyatt obtained a correlation of .40 between quickness in canceling test "e-r" with intelligence and a correlation of .45 between the canceling test "a-n-o-s" and intelligence.

Although most of the research taking place between the years

1920 through 1924 in this field was devoted more to the nature of intelligence with regard to speed as a group factor unrelated to intelligence, one study stands out as a classic. In 1914, Hart and Spearman (33) reported their study which has become important because it defined the problem of "speed" even though their choice of tests and methods of isolating speed experimentally were open to criticism. Hart and Spearman administered four types of tests to both normal and abnormal subjects and failed to find any evidence for a group factor of speed which would be independent of general intelligence, but common to a number of specific abilities. Mathematically eliminating the common dependence on the entire cortex (G), Hart and Spearman obtained a "specific" correlation of -.09 between speed of different tests inferring that there is no constancy in the speed of executing different tasks. McFarland (57, p. 600) criticized this study on the grounds that accuracy was not held constant during the tests and he suggested that more care should have been taken to follow laboratory procedure in timing each individual item of the tests. Experimentally sound or unsound, Hart and Spearman opened the door to further exploration as explained by Lanier (47, p. 372):

> It was inevitable that active experimental interest should develop, both on account of the intrinsic importance of the problem and because of the objectivity of time as a unit of measurement or symbol of reaction.

The question of the superiority of "speed" tests to "power" tests

was raised in 1916 by McCall (55). McCall concluded that "power" tests give a much higher correlation with mental ability than do "speed" tests. McCall's definition of "power" meant a test with enough units of a high degree of difficulty to discover the maximal ability of the subjects within a time limit sufficiently long enough to reach their ability's limit. Replication of this study two years later yielded virtually the same results as reported by McCall and Ruger (56). In criticizing this study of McCall (55), Hunsicker (39, p. 8) pointed to the procedure followed and the tests used as lacking in refinement for the results to be trustworthy.

Anderson (3) in 1917 attempted to determine more precisely for children the rate of mental association in responding to words. Although controls and evidence to support her findings is lacking, she did state that more importance should be attached to the kind of responses rather than to the speed of reaction. The importance to this writer of Minnie Anderson's study is the first discovery of doubt in the reliability of a testing situation with children, when she stated (3, p. 102): "It is also remarkable that inhibition was confined to clever children."

Although the years 1919 and 1920 did not yield many significant studies, Thurstone's (82) report on techniques for scoring, establishing reliability and speededness of time-limit tests, and Bronner's (12) warning against the use of bare quantitative measure in estimating

mental ability are well worth noting.

The years 1924-1934 represent the period of greatest research activity to determine the place or role of speed in mental activity. These so-called "golden" years produced more than 100 studies related to the field of speed in intelligence. In the interest of brevity, this writer selected what he considers to be representative studies.

One of the most important and often quoted studies reported in 1924 was Bernstein's (9) experiment on whether speed is a "group" factor independent of general ability. Bernstein devised tests of completions, directions, analogies, concomitants, and moral classifications. These were administered under conditions of "leisure" and "haste." The results were interpreted by Bernstein to mean that speed ability does not exist apart from general intelligence. Criticism from McFarland (57) has centered around the complaint that Bernstein's "leisure" tests were of such short duration that it is doubtful they produced leisure conditions, hence, correlations were really between intelligence ratings and two different speed scores.

In 1925, overemphasis of speed for speed's sake and short test time limits received a warning from the editor of the Journal of Educational Research, B. R. Buckingham (14, p. 292) who stated:

> It is certain that a number of popular tests unduly emphasize the value of speed. When the success of pupils working under a time limit is recorded in

> "attempts" and "rights", the meaning is, of course, that the number of items attempted is a measure of achievement. Thus it comes about that speed is thought of as having an independent value, as being a substitute for accuracy, and as something which may stand in its stead. Nothing could be further from the truth. We are not interested in how rapidly a child can get something wrong.

Concern over the role of speed was also expressed by E. L. Thorndike (80, p. 9) who stated his ideas for improving mental measurements:

> Perhaps the commonest criticisms of our tests and of school achievements which sensible people who understand them make is that speed counts too much in determining the scores obtained. Those who are skeptical of the scores in present tests because of the speed element might be entirely satisfied with it if it were presented as a separate rating, and were used in any combined rating with only a small weight.

With much concern and many disputed answers, research in 1925 continued on speed. Highsmith (38) conducted a study concerned with the relation of the rate of response to intelligence. Using a speed test, a power test, and a combination of the two tests, Highsmith (38, p. 32) concluded that the rate of response to test material is not a safe measure of intelligence and that the National Intelligence Test is a much better measure of speed than of intelligence. He also pointed out that using the composite of group tests as a criterion by which the validity of a new group test is tested may increase the rate of response element in group tests at the expense of more significant factors of general intelligence.

With differing results, Hunsicker (39) reported her findings showing a similar, but not identical, relationship between rate and intelligence. Bennett (8, p. 265) criticized Hunsicker's study for concluding that arithmetic completion ability was a measure of general intelligence as being a very narrow interpretation of intelligence.

To illustrate the complexities of experimentation reached by 1927, details of Walters'(86) study are reported for this example. Using 165 New York school children in grades six and seven, Walters administered the National, Otis, Pintner Non-Language, Pressey Cross-Out, and Trabue and Stockbridge Mentimeter tests for mental ratings. Reading scores were obtained from the Stanford Achievement, IER, Burgess, Monroe, and Thorndike reading tests. Rate measure included two cancellation tests, a Courtis arithmetic test, and scores on the National and IER tests. Additional speed scores were obtained by calculating rate of work on the National and Otis from the amount of work attempted in half time and by recording the added time taken by the children to finish under unlimited time. Mental age was computed from the Stanford-Binet, school marks, teacher's ratings, and achievement test scores. In his conclusion, Walters (86, p. 78) states:

> The evidence of the study for sixth and seventh grade pupils is that some pupils, a considerable proportion in fact, may be slower than others in their rate of performance without necessarily being duller.

Referring to the turn of the century and the state of mental measurements, Thorndike (80, p. 1) states:

> A common view among teachers then, and for some time thereafter, was that you could not apply the methods of quantitative science to education. The mind of the child was alleged to be too ethereal and spiritual and unapproachable to be surveyed and charted.

With all of the many variables in educational measurement, the question was being asked by 1928 if one physiological reaction could be scientifically measured to correlate perfectly with intelligence? Will the "ethereal and spiritual mind" of a child show all of its mental power through the speed of nerve conduction? In 1928, Travis published his and Hunter's exciting study (84) on the relationship between the factors of intelligence and reflex time or speed in conduction of the nerve impulse in a reflex arc. Travis and Hunter found an apparent relationship between reflex time and mental ability while working with reflexes during stuttering periods of patients who differed widely in intelligence. Comparing reflex times with scores on Form A of the Otis test, an obtained correlation of .87 caused Travis and Hunter to attempt a verification. Again, a correlation of .87 was obtained. Was this the "golden key" of measuring mental ability?

Moving ahead to 1930, Whitehorn, Lundholm, and Gardner (89) attempted a verification of Travis and Hunter's study only to find no measurable difference in reflex times (knee-jerk) between normal and feebleminded subjects and only found that physically shorter people

have quicker reactions.

Travis attempted two more experiments (Travis and Dorsey (83) and Travis and Young (85)) with unsuccessful results in finding any correlation between intelligence and reflex time. The questions still remain unanswered how the speed of conduction of the nerve impulse in the mechanisms operating in the reflex compared with that in the central nervous system and whether any relationship exists between the rate of conduction in complex mental processes and intelligence.

In 1932, Beck (6, p. 793) made a comment to the effect that experiments on speed of reaction as a contributing factor in intelligence had ambiguous results. Ambiguity did not end in 1932, but two rather distinct camps had developed, those who followed Spearman, and in opposition the followers of Thorndike. Spearman (75) was the chief proponent of the notion that speed of response in a mental task is a true indication of intelligence. He started with the assumption that performance in intellectual work depends upon a combination of two kinds of factors--general intellective ability and specific factors peculiar to given tasks. The letter "g" represents general ability and Spearman's contention was that goodness (accuracy) and speed of response are interchangeable measures of "g". In demonstrating this relationship between accuracy and "g", he cites high correlations between "measures of g" and scores on tests where speed of response is not a factor in success. He further cites the correlation of .66

between fineness of pitch discrimination and an accuracy score in addition is attributed to "g" and taken as evidence for the dependence of goodness of responses on general intellective ability. Using relatively high correlations between scores on speed tests in addition and cancellation, Spearman found evidence for the presence of "g" and concludes that this factor enters into the speed of response. He also presents correlations between speed scores and accuracy scores as the basis for his argument that since accuracy is correlated with "g", speed must be as well. As his general conclusion, Spearman says speed and goodness are equal in respect to their dependence on general intellective ability, but he does admit that in practice one of the two is often emphasized more than the other. Later, in 1937, Spearman makes a distinction between speed ability and speed preference. He claims that a general speed preference may be revealed in performance of mental tasks, but no general speed ability has been demonstrated in terms of the eductive processes only. Spearman does admit that in some tasks, such as the rate of tapping or the rate of reacting, there may be one or several speed factors independent of "g".

Thorndike (81) presents the theory that individuals possess specific traits, namely speed, range, and altitude. Each specific trait is a separable aspect of mental ability and not a general trait possessed in greater or less degree by a given individual. Thorndike defines altitude as the level of difficulty which the individual can attain.

He defines range as the number of tasks a person can encompass at any particular level of difficulty and speed is defined as the individual's rate of performance. Thorndike points out that altitude is the only indispensable aspect of intelligence and that it is imperfectly, though positively, correlated with speed.

Thorndike's theory of "speed as a trait" sparked a mass of studies in the years 1932, 1933, and 1934. After 1934, research on the trait theory dropped off, but a few studies appeared up to as late as 1953. Often it is difficult to discern whether a study originated as an attempt to "prove" one theory, in this case Thorndike's, or to "disprove" the opposing theory of Spearman. Apparently, the example chosen to represent the "speed as a trait" studies, was conducted more out of disbelief in Spearman's theory. Line and Kaplan (51) conducted two experiments using public school children as subjects. The first experiment, using 44 fourth grade students, consisted of administering the National Intelligence Test (Form A) using half the standard time, standard time, and extended time or one and one-half the standard time. The findings showed that duller students had not reached their limit or as much of their limit as had the brighter ones at the end of standard time. The duller students improved more in relation to the brighter ones during the extended time period. Several reasons are offered for this phenomenon, but the major outcome was the suggestion that speed other than speed of thinking played a part in

the results when easier material was used. For this reason, Line and Kaplan designed their second experiment, this time using junior high age subjects. Two groups were formed that were equivalent as classified on the basis of mental and chronological age, IQ, scholastic attainments, and behavior records. Controls of motivation were attempted and each group took a battery of tests. Line and Kaplan (51, p. 7) found evidence of a factor called speed other than "g", this speed factor was not related to mental age, and that this factor speed is subject to improvement with practice. Line and Kaplan also suggest that the speed factor may prove to be identical to the one mentioned by Hargreaves (32) as being significant in creative activities.

Following the great surge of experimentation in this field which dropped off dramatically after 1934, the later studies for the most part were replications of earlier attempts using more refined experimental and measuring techniques. Experiments were still being conducted on such topics as time-limit versus no-time-limit scores, speed versus power within a test, intelligence versus speed in various tasks, speed as a trait, and correlates of speed.

Slater (73) in 1938 reported findings in support of Bernstein's (9) 1924 conclusions only to have Baxter (5) in 1941 and Davidson and Carroll (22) in 1945 dispute Slater's findings.

The late 1940's and early 1950's found some research examining the individual's speededness as he responds to a testing situation.

Cronbach (19) published an article on the effects of "response sets" and test validity. Cronbach (19, p. 482) points out that speed is an important element in many tests, but the student has a choice to respond carefully or to answer rapidly. He chooses either to achieve a score through quantity or quality depending upon the individual's response set. Rimoldi (67, p. 302) uses the term "personal tempo" to describe the speed trait. Rimoldi found that each individual follows a specific temporal pattern when performing a particular act. This pattern is the most economical for that individual and others imposed externally usually have a detrimental effect. Rimoldi views this tempo to be psychobiological and based on the expenditure of energy.

Concern over establishing time limits regarding the speededness of tests has become the main direction of experimentation from approximately 1950 to the present time. Mollenkopf (59) in 1950 found that verbal test material was affected little by time-limits, but mathematical test material was greatly affected. He also draws attention to the probable importance of the verifiability of response correctness for determining the effects of time limits. Cronbach and Warrington (20) and Myers (63) also expressed concern for having test descriptions include specifications describing the speededness of the test. Other authors, Crowder, Morrison and Demaree (21) in 1954, Lord (52) in 1956, and Bennett and Doppelt (7) in 1956, have found that score variance on time-limit tests seem to contain separate portions attributable

to speed and altitude which are neglected in both scoring and interpretation.

Summary of Selected Studies of Learning Problems of Disadvantaged Children Relevant to a Testing Situation

The term "disadvantaged child" has traditionally included children from families of low-socio-economic status as measured by the occupation of the head of the household, lack of an occupation (welfare assistance), educational attainment of the parents, income, and place of residence. In more recent years, the term disadvantaged child has been enlarged to encompass racial status and cultural origin. Of particular importance to this study are two such groups, the Negro and the Mexican-American. Both groups have experienced a caste-like status due to discrimination. Both groups have been isolated from the mainstream of American culture either within the inner city or through migration to the city from rural areas, as identified by Havighurst (34).

In reviewing research of the disadvantaged child, six areas will be examined: general intelligence, specific mental abilities, school achievement, laboratory learning, cognitive development, and explanations or causes for subnormative performance.

General Intelligence

Research is quite plentiful to document the low performance of

disadvantaged children on tests of intelligence. Mean differences between intelligence test scores of the high socio-economic status children have been consistently higher than those children's scores from the low socio-economic group. These differences are measurable at age four and have been occasionally demonstrated at even earlier ages as reported by Bloom (10). Mean differences dramatically increase as the disadvantaged child becomes older. Intelligence test score differences between members of the two socio-economic groups increase through elementary school and become widely divergent by adolescence, as reported by Bloom (10). Mexican-Americans tend to cluster around an IQ score of 80, which shows no improvement with advancing schooling, as found by Coers (17). With the use of a Spanish translation of the Stanford-Binet, bilingual Mexican-Americans were not able to improve their scores appreciably, indicating their problem is deeper than language alone, as reported by Keston and Jiminez (45).

The question of cultural bias, conditions of test administration, plus the inability of available tests to measure intelligence in diverse populations were first reported in the work of Eells and Davis (26). This 1951 study exposed the middle-class bias so prevalent in tests of intelligence. Influencing factors such as rapport, speed, motivation, and reward conditions were studied by Haggard (31). Attempts to develop a culture-free measure of intelligence which would measure

only the innate ability, independent of cultural and experiential factors were then conducted as reported by Charters (16).

The move from "culture-free" to "culture-fair" testing is exemplified by Lesser, Fifer, and Clark (49) who constructed mental ability items based on a pool of experiences common to the subject population to be studied. A review of factors to be considered in testing minority groups has been published by Deutsch et al. (25).

Work in the 1950's changed the concept of intelligence with only a few authorities maintaining that intelligence tests measure something innate, fixed, and predetermined. These ideas were reviewed by Hunt (40) in 1961. The use of intelligence tests for predicting school achievement is still valid, but the ability versus achievement distinction has been attenuated. Stodolsky and Lesser (78, p. 548) state that intelligence tests measure the richness of a child's milieu and the extent to which he has profited from that milieu.

Differences between races on intelligence test performance has been found when Negroes and whites are compared. Earlier studies found wide differences between the two races with the Negro scoring much lower than whites, but when social class is controlled, the differences are lessened but still present as found by Deutsch and Brown (24). Anastasi (2) reviewed studies including comparisons between other minority groups and whites and the findings generally indicate similar mean differences as with Negro versus white findings.

Karnes et al. (44) and McCabe (54) are two recent studies that have attempted to locate and study the disadvantaged child who is superior to the normative status of the disadvantaged. These researchers are attempting to characterize successful disadvantaged children and to study environmental factors which may account for their success.

Specific Mental Abilities

As mentioned earlier with Mexican-American children, research started on the assumption that lower test performance by minority groups was largely due to the verbal nature of most intelligence tests. The results of investigations which utilized tests of a less verbal character are equivocal as reported by Fowler (28). Although some differences exist between the findings of these studies, generally they concluded that group differences were reduced somewhat by eliminating verbal components from the tests, factors such as speed, experiential differences, and attitudes toward test-taking still affected test performance. For some groups such as the Negro, removing verbal items resulted in a lower test performance.

The Coleman et al. (18) study, as part of a massive national survey, administered a verbal and nonverbal reasoning measure to first graders of various backgrounds at the beginning of the school year. He found that children of low social status and children of

minority groups (Negroes, Mexican-Americans, Puerto Ricans, and American Indians) start school at grade one with mean scores on verbal and nonverbal tests of general ability that are below the national white average.

Except for comparisons of verbal and nonverbal abilities, little has been done on other mental abilities especially with younger children. One exception is the work of Lesser, Fifer and Clark (49) who studied verbal ability, reasoning, number facility, and space conceptualization with Chinese, Jews, Negroes, and Puerto Rican first-grade children. Lesser, Fifer and Clark (49, p. 82) reported findings that differences in social-class placement and ethnic-group membership do produce significant differences in the absolute level of mental ability with ethnicity producing significant differences in patterns among these abilities as well.

Selmer and Iscoe (71) administered the WISC and Progressive Matrices to white and Negro children who were seven to nine years of age and found sufficient incongruity in the intercorrelations of the WISC subtests by race to warrant separate factor analyses. Intercorrelations among the Progressive Matrice's subtests, however, were highly similar for both groups.

School Achievement

The Coleman Report (Coleman et al., 18) has provided a

national sample of children in grades one, three, six, nine, and twelve in regard to school achievement with findings mentioned earlier of disadvantaged children beginning school with scores below the national average. The findings from this study are consistent with one reported earlier by Brazziel and Terrell (11). Brazziel and Terrell (11) also found that as minority children progressed through school, grade level discrepancies increase. Deutsch (23) termed this increase in the number of grade levels below the norm as the "cumulative deficit."

Although the Coleman survey was cross-sectional, the few longitudinal studies reported reflect essentially the same pattern as reported by Osborne (64).

Laboratory Learning

Semler and Iscoe (71) compared the performance of elementary aged Negro and white children on four conditions of paired-associate learning tasks along with WISC results. Their findings indicated significant racial differences only on the WISC.

Using reward conditions, Zigler and DeLabry (92) compared groups of middle-class, lower-class, and retarded subjects on a concept-switching task. Under the optimal reward condition, there were no group differences in performance. The optimal reward for the middle-class was intangible, and tangible rewards were considered

optimal for both the lower-class and retarded groups. A similar study was conducted by Terrell, Durkin, and Wiesley (79) using a discrimination task and two types of rewards. They found that material rewards produced better performance in lower-class children and non-material rewards proved more effective with middle-class children.

Jensen's (42) laboratory study used fourth and sixth grade Mexican-Americans and Anglo-Americans on several learning tasks consisting of immediate recall, serial learning, and paired-associates. He found that on direct measure of learning ability used in his study, Anglo-American children of low IQ are slow learners as compared with Mexican-Americans of the same IQ. Jensen found high IQ's among Mexican-Americans to be very rare. This study suggests that the majority of Mexican-Americans with low IQ's are actually quite normal in basic learning ability, though they may be poor in scholastic performance for other reasons rather than inherently poor learning ability.

Cognitive Development

Classificatory behavior, one dimension of cognitive functioning, was used by John (43) in a picture-sort study. First and fifth grade Negro children of varying social class were used as subjects. John's findings showed that with fifth graders of the lower-class, more piles were made, but fewer verbalizations were given about their sorting

than did the middle-class children. A similar study by Hess and Shipman (37) used the Sigel Sorting Task with four-year-old Negro children of varying social class and also found that the level of abstraction was related to social class. Hess and Shipman noted that the number of unscorable responses was extremely high for all of the children at this age level.

As an outgrowth of Piaget's theories of cognitive development, Laurendeau and Pinard (48) have developed tests which allow statements about individual differences and also provide information about the cognitive processes of children.

Stodolsky and Lesser (78) suggest the need for longitudinal studies with older children to test Piaget's stage theory. They argue that if older children were used, they may display the sequence to a point and then disadvantaged children may level off while their more advantaged peers would continue to achieve.

Explanations for Subnormative Performance

Although physiological studies on the effects of malnutrition, low protein - high carbohydrate diets, and low mineral - vitamin diets as they apply to school achievement are lacking, psychological environmental studies have been reported. Isolating for study the unique characteristic observable in disadvantaged children and not present in achieving advantaged children has been the main focal point for

research in this area.

Beginning this type of research, Milner (58) assessed parent-child relationships and certain attributes of the home environment in relation to reading readiness using the interview technique. Wolf (90) developed indices of home environment to school achievement and intelligence test scores for a fifth grade white population of varying social class. A similar study reported by Peterson and DeBord (66) used eleven-year-old Negro and white lower-class boys in a southern city to compare various home factors with school achievement. Performing separate multiple regressions on their data by race, Peterson and DeBord found high correlations for both groups between certain home variables and achievement.

Hess and Shipman (37) studied pre-school Negro children in an extensive project that assessed numerous maternal characteristics including language and teaching style. The mother's teaching style was assessed to be the key to the child's learning at home.

The Harvard University's Pre-School Project, under the direction of Burton White, is planned as a long-term study of pre-school children at home and in school environments. This project will study the development of various abilities which promote educability. Starting with first-hand observations, this study will test developmental regularities through longitudinal studies, and hopefully generate hypotheses concerning environmental factors' interaction with

developmental phenomena that can be tested through manipulations of environmental conditions.

Summary of Selected Studies on Teacher Expectancies of Student Performance and Related Subjects

Although this writer found research in the area of teacher expectancies of student performance from indirect stimuli to be somewhat limited, the work of Robert Rosenthal of Harvard University provides the major contribution for this review.

To locate the very beginning of an idea is difficult in reviewing research, but in teacher expectancies of students, a logical starting point seems to focus on the concepts developed by George Herbert Mead in the early thirties. His emphasis on the importance of "self" while interacting with others led to "self-perception", "self-image", "self-concept", "self-fulfilling prophecy", and eventually to the "Role Theory." T. R. Sarbin writing in Lindzey (50, p. 223) on the Role Theory states:

> The general formula is: when A initiates an action to B, B's response to A serves as a stimulus for A, etc. The unit of action is the person.

Many studies on the self-concept exist, even more relevant studies on teacher-student (self) interactions, but they have not been included in this review because the vast majority report observable actions between subjects. Rosenthal has drawn a finer distinction

which emphasizes the unconscious or covert interactions between subjects. To this writer, these "unsaid" actions are more relevant to this study, especially for disadvantaged children whose communication is often nonverbal and whose safety is many times dependent upon a "look", "movement", or "signal" which makes up an important portion of the language of the streets.

A study published in 1963, Rosenthal and Fode (69) found that student experimenters who were told to expect superior performance from "maze-bright" rats did experience excellent results and those with "maze-dull" rats were told to expect poor performance which they did. Using the same basic idea, experimenter bias, Rosenthal (68) used human subjects and varied the experimenters between male and female. His findings showed that the sex of the experimenter evoked differing responses from the subjects leaving him with the conclusion that the experimenter's hypothesis can be communicated quite unintentionally to his subjects.

Rosenthal's last study to be reviewed is without doubt the most relevant to this paper. Rosenthal and Jacobson (70) working with the hypothesis that disadvantaged children perform poorly in our educational systems because their mostly middle-class teachers expect them to, and in effect, they are taught to fail. Selecting a school in the lower socio-economic area of a middle sized city, Rosenthal and Jacobson provided a new intelligence test, unknown to the teachers,

and asked the teachers to administer it. Before school opened the next fall, about 20 percent of the children were randomly selected and designated as "spurters". These names were given to the teachers and they were told to expect unusual intellectual gains from these children during the coming school year. The same test was later administered twice again and the results indicated strongly that children who were expected to show gains showed such gains. Teacher appraisal of classroom behavior indicated that the "spurters" were better adjusted and in less need of social approval. Undesignated children who also gained in IQ scores were rated less favorably. Rosenthal and Jacobson (70, p. 22) attempted to provide some answers by stating:

> It would seem that the explanation we are seeking lies in a subtler feature of the interaction of the teacher and her pupils. Her tone of voice, facial expression, touch and posture may be the means by which--probably quite unwittingly--she communicates her expectations to the pupils. Such communication might help the child by changing his conception of himself, his anticipation of his own behavior, his motivation or his cognitive skills.

Another study with implications closely aligned to those of Rosenthal's is reported by Gordon and Thomas (30). Testing the hypothesis that teachers would tend to over-estimate the intelligence of children who react positively and quickly to a new situation, and to underestimate the intelligence of children who react negatively to most new situations and who require long acclimatization periods before becoming full participants, the teachers made judgments on a seven

point scale. The findings indicated that teachers' judgments of their children's intelligence are significantly distorted by their perceptions of specific aspects of the children's behavioral style or temperament. Gordon and Thomas (30, p. 299) conclude by stating:

> Theoretically, the results of this study tend to support an interactional view of child development, in which characteristics of the child himself, as experienced by an adult, evoke responses in the adult that are likely, in turn, to influence significantly the future course of the child's development.

Summary

The review of the literature related to the role of speed in testing presents a voluminous array of studies spanning three-quarters of a century. Seemingly, no limits or bounds were sacred for the direction of research whose diversification included the lifting of weights, discrimination of pitch and clang, thrusting at targets, maze tracing, and the drawing of straight lines.

The earliest research studies, pertaining to sensation as the chief classification for the study of reaction time, were significant to mental measurement in that they provided a vehicle, the reaction time method, for future studies. After 1900, the direction of research moved from the psychology laboratory to the classroom where studies compared "brightness" to "quickness." These early attempts were plagued by laxity of procedure, subjective judgments, and lack of refinement in techniques.

Studies conducted from 1910 to 1920 attempted to find relationships between the speed of reaction to ability as identified by mental tests. Again, confusing results were obtained due primarily to the gross methods of procedure lacking experimental controls.

To overcome the criticism of small samples, the early 1920's witnessed a move to extensive studies in attempts to disprove the claims of the existence of a slow but accurate person. Doubt was thrown on the results of these studies because of the test employed and selectivity of subjects used.

The late 1920's saw the introduction of Spearman's theory of a group factor of speed independent of general intelligence. This implied that it does not matter whether a subject's abilities are measured against a scale of difficulty or a scale of speed, or a combination of the two, the true standard scores in the group should remain the same. Sparked by this theory, research began an upsurge when Thorndike's theory in 1932 countered Spearman's by introducing speed as a trait. The two theories caused a mass of studies with conflicting findings and confusing results.

With the development of factorial analysis techniques, studies from the late 1930's to the present time have been devoted largely to the possibility of speed being an independent ability.

After 75 years of research, the following three conclusions can be safely drawn:

1. Reaction time and "test intelligence" vary independently.
2. An individual's speed on similar tasks does not vary.
3. An individual's speed of response is consistent on test material of a low order of difficulty.

Still presently unresolved and existing in a state of confusion and disagreement are three vital concerns of the relation of speed to altitude, the relation of speed to accuracy, and test time-limits relative to speededness. Regarding this last point, writing in the Sixty-second Yearbook of the National Society for the Study of Education, Engelhart and Beck (27, p. 186, 187) state:

> RECOMMENDATION 8. There should be more research aimed at the development of a meaningful and effective rationale governing the imposition of time limits on test performance.
>
> There is no clear consensus of the extent to which test scores should be influenced by time limits or speed. In practice, the setting of time limits is too often a matter of administrative convenience determined by the length of class periods. The time-limit test has the advantage of serving to discourage idleness and time-wasting on the part of faster students, but speed is a legitimate element in achievement tests only when speed is an objective of the course. Speeded tests have lowered validity for measuring the knowledge or intellectual skills of individual students since many able students are slow workers.
>
> The trend in educational achievement testing is to minimize the speed factor. This is to be welcomed in the measurement of complex activities, such as those involving problem-solving or productive thinking. There should be research, however, to discover how best to measure those traits for which speed is a necessary aspect of ability. In certain areas, such as reading, arithmetic,

> and typewriting, the ability to work rapidly is a worthwhile objective.
>
> Test-makers have a need for research to establish the amount of time to be set for different types of test material. There is an almost virgin field for research on the optimum rates of test administration in many subject fields and at different educational levels.

Test constructors themselves have expressed concern on the question of speededness and time-limits. Wesman (87, p. 267) states:

> If we are to understand the nature of speed as a variable in psychological testing, we must first understand that speed is a dimension rather than a trait. In all too many instances, we find a tendency to reify speed--to think of it as a kind of unitary skill, like strength of grip, which we may expect will function similarly whenever called upon. This way of thinking about speed has led to the inclusion of inappropriate tests in selection batteries and misinterpretation of data in research aimed at investigating the nature of tests.

Morrison (61, p. 234) states:

> Research of the type described will be facilitated, and a ubiquitous source of confusion will be eliminated from the study of speed in psychological tests, if we can agree on a measurement definition for the speededness of a test. We must recognize at the outset that the mere existence of a time limit, or the fact that less than all subjects complete all items, is no guarantee that the test is speeded. A meaningful definition of speededness must be in terms of the measurements obtained.

As a final comment on the role of speed in testing, Myers (62, p. 221, 222) states:

> An effect of tests in general which has been of some concern to test makers is that frequently achievement tests serve as influential definitions of the purposes of education. To the extent that such tests are speeded we may be defining the purposes of education as including,

> perhaps emphasizing, the teaching of the value of snap judgment and educated guessing over the value of deliberate, careful thought. Our tests rarely, if ever, encourage the students to sit in meditation, to "be still and know." Our evaluations of students' abilities are rarely, if ever, designed to pick out the explorer of new ideas, the creator of artistic expressions, or the dreamer of great dreams. A standardized test, for example, must maximize the usefulness of a class period in order to be a financial success.

The review of literature related to learning problems of the disadvantaged child presents a picture of the very beginnings of research in an area too long overlooked. Of course, the disadvantaged child has existed in American educational systems since their beginnings, but it wasn't until the mass migration of minority groups from scattered rural areas to highly concentrated urban centers following World War II, that the disadvantaged child received notice as a "problem." The movement of majority groups to the suburbs, with the void being filled by an ever higher concentration of minority groups, changed the sociological make-up of many schools very suddenly and vastly compounded the problem. In the 1950's, sociological surveys and reviews were initiated and reported, such as those found in Stanley, Smith, Benne, and Anderson (77), which aided in identifying and clarifying the nature and extent of the problem. Finally, with pressures forcing federal funds to become available, experimental research began on a noteworthy level in the 1960's. The early 1960's saw multi-variable studies attempting to "catch-up" and find swift

solutions for existing problems. During the middle and late 1960's, delimited problems and refined experimental techniques were employed with solutions being more realistically viewed as possibilities still incorporated in trial programs.

In reviewing the literature related to teacher expectancies of students, one man, Robert Rosenthal, has provided the leadership and direction in an almost virgin field. Using covert communication as his base, Rosenthal opens the door of doubt on the validity of any experiment involving interaction between the experimenter and his subjects. For education, Rosenthal suggests that the previously mystical and unmeasurable qualities of a good teacher are simply superior means of covert communication which can be identified and measured. Rosenthal and Jacobson (70, p. 23) state:

> For almost three years the nation's schools have had access to substantial Federal funds under the Elementary and Secondary Education Act, which President Johnson signed in April, 1965. Title I of the act is particularly directed at disadvantaged children. Most of the programs devised for using Title I funds focus on overcoming educational handicaps by acting on the child - through remedial instruction, cultural enrichment and the like. The premise seems to be that the deficiencies are all in the child and in the environment from which he comes.
>
> Our experiment rested on the premise that at least some of the deficiences--and therefore at least some of the remedies--might be in the schools, and particularly in the attitudes of teachers toward disadvantaged children. In our experiment nothing was done directly for the child. There was no crash program to improve his reading ability, no extra time for tutoring, no program

> of trips to museums and art galleries. The only people affected directly were the teachers; the effect on the children was indirect.
>
> Perhaps, then, more attention in educational research should be focused on the teacher. If it could be learned how she is able to bring about dramatic improvement in the performance of her pupils without formal changes in her methods of teaching, other teachers could be taught to do the same.

The chapter which follows describes the design of the research study the writer used in order to investigate the effects of the rate and accuracy of test responses, removal of test time-limits and teacher expectancies on the achievement test scores of disadvantaged children.

III. DESIGN OF THE STUDY

This study differs from the rate of response studies frequently reported in the literature in two significant ways: (1) Individual data will be preserved by grouping rather than measuring mean differences of unidentified groups causing the removal of extremes, and (2) results represent composite variables rather than the almost impossible task of isolating and measuring a single variable.

The Setting

The study took place in three elementary schools of the Denver Public Schools, Denver, Colorado. Each of the three schools has been designated as a target school and has received Federal assistance under the Elementary and Secondary Education Act of 1965. Two of the schools, Fairmont and Garden Place, have enrollments of Mexican-Americans greater than 65 percent of their total membership. The other school, Mitchell, has an enrollment of Negroes greater than 69 percent of its total membership.

Fairmont School, built in 1924, is located on the near west-side not too far from wholesale warehouses and a railroad yard. A recent Federal Court order, presently blocked by the local school board, has called for integration of seven elementary schools by the Fall of 1971 to provide a minimum enrollment balance of at least 51 percent Anglo

students. Fairmont is one of these seven schools with a present (1970-1971) Anglo enrollment of 25 percent while 74.49 percent are Mexican-Americans. Fairmont's total membership has steadily increased over the past five years by 65 students bringing the total enrollment to a capacity 588 students. School Board plans have called for the closing of Fairmont while a new building is constructed, but many parents in the area have protested, reasoning that many of the school's teachers and special bilingual programs would be lost. These parents have suggested that the present building remain in operation during construction of the new building realizing that noise, dirt and other distractions of construction would make a normal school routine difficult, but they would prefer this to losing their special programs and teachers. The School Board has taken this proposal from the community under advisement. Fairmont's student attendance figures have been at 89.4 percent of membership compared to the city's average of 92.3 percent. The citywide average teacher-pupil ratio is 24.5 students per teacher with Fairmont's ratio at 23.4.

Garden Place School, built in 1905 with an addition completed in 1924, is located within sight of two busy interstate highways and only a few city blocks from the stockyards and packing house district. Although not directly involved by the blocked Federal Court order for 1971, Garden Place has been included in future integration plans with an Anglo membership of 19.56 percent, a Negro membership of 14.17

percent, and a Mexican-American membership of 65.09 percent. Garden Place's total enrollment has also increased over the past five years by 29 students bringing the 1970-71 total to 782 students. Student attendance has been 88 percent of membership with a teacher-pupil ratio of 20.8.

Mitchell School, the original building built in 1898 and still in use along with three additions, is located within the inner city or core area. Predominately a poor Negro area, recent years has seen a migration of the more successful Negroes eastward within the city leaving a void that is being filled by poor Mexican-American families. Also involved in the presently blocked Federal Court order, Mitchell's racial and ethnic membership is 1.02 percent Anglo, 69.86 percent Negro, and 28.78 percent Mexican-American students. Enrollment over the past five years has declined by 182 students to a present membership of 861. Part of this decline was due to additional construction at neighboring schools to relieve overcrowding at Mitchell. Attendance compared to membership is 88.6 percent and the teacher-pupil ratio is extremely low, 19.8 students per teacher, due in part to federally sponsored and supported reading programs.

Additional information on the racial and ethnic composition of these three schools can be found in Appendix A.

This study tested only third grade classes at each of the three schools. Fairmont has two complete third grade classes which were

used in this study and one combination second-third grade class which was not used. Garden Place has three third grade classes all used in this study as well as all four of Mitchell's third grade classes.

Procedures Used

For this study, 230 third grade students were used out of an original enrollment of 270 students from three Denver elementary schools. Due to the high rate of mobility among disadvantaged students 15 percent of the original enrollees moved to other schools during the 1970-71 school year. The two predominately Mexican-American schools, Fairmont and Garden Place, each lost 20 percent of their original students while the predominately Negro school, Mitchell, lost only 8 percent of its original enrollees.

The first step in grouping for this study was done by the principals of each of the three schools to select one or two teachers, dependent upon school population, to be "informed" by the principal throughout the school year about the importance of additional time for certain students, especially disadvantaged students. Selection of teachers was left to the principals because of their familiarity with each teacher's philosophy, receptibility to suggestion, teaching methods, and student-teacher rapport. The writer made suggestions to each principal, both orally and by letter (see copy of letter in Appendix C), to generally have their "informed" teachers allow more time in all daily

work and assignments to ascertain if disadvantaged students, because of cultural, physical, and environmental differences, would profit from a less hurried classroom climate. Other third grade teachers in each school were aware of this study being conducted, but were not informed to teach any differently than any other year. Two of Garden Place's teachers were "informed" and one was not. Fairmont had one teacher informed and the other one not informed while Mitchell had two teachers informed and the remaining two not. This first grouping formed five "informed" classes (N = 127) and four uninformed classes (N = 103).

Late in the first semester, each Denver elementary school administered the Kuhlmann-Anderson Intelligence Test to every third grade. In most schools, including the three schools involved in this study, the tests are administered by the classroom teacher in her own room. Following is a chart showing I. Q. scores to compare "informed" and "uninformed" classes from each of the three schools.

School	Informed Group Mean I. Q.	Uninformed Group Mean I. Q.	Entire 3rd Grade Mean I. Q.
Fairmont	101	91	96
Garden Place	99	100	100
Mitchell	92	98	95
Total Mean I. Q. Score N = 230	97	96	97

From the individual test booklets, after scoring was completed by the district's testing office, the number of responses by each individual was tallied plus the number of correct responses. Using these two figures, the number of correct responses to the number of attempted responses, a percent score was computed. Dividing the number of attempted responses into thirds and the percent score into thirds, a second grouping was established. The following chart presents the composition of these groups:

	Number of Attempted Responses (193 possible)	Percent of Responses Correct
High Group	121 or more completed	52% or higher
Low Group	89 or fewer completed	44% or lower
N = 230		

Being concerned only with those students who work fast but who incorrectly answer many questions (high completion + low percentage correct), along with those students who work slowly but incorrectly answer many questions (low completion + low percentage correct) and finally those students that work slowly but answer many questions correctly (low completion + high percentage correct), the following chart illustrates the composition of the third division for grouping.

	Informed Group N = 127	Uninformed Group N = 103	Totals
Group I	Low Completion + Low Percentage Correct N = 16	Low Completion + Low Percentage Correct N = 15	31
Group II	Low Completion + High Percentage Correct N = 12	Low Completion + High Percentage Correct N = 10	22
Group III	High Completion + Low Percentage Correct N = 11	High Completion + Low Percentage Correct N = 16	27
		Total	80

Those students not included in the above chart (N = 150) scored in the middle range on either or both the completion or percentage scores. They are, however, still part of the study and will be used for statistical comparisons in Chapter IV.

Near the end of the school year, the Metropolitan Achievement Tests were administered as part of a citywide testing program. Sample teachers administered the battery of tests following the standard directions and allowing the prescribed amount of time, but at the end of the standard time limit, teachers marked each student's last response with a colored pencil line and then 50 percent additional time was given the students.

Description of Testing Instruments and Their Uses in this Study

In order to obtain data for grouping and measuring individual differences, the following tests were used: (1) the Kuhlmann-Anderson Intelligence Test, and (2) the Metropolitan Achievement Tests. A brief description of each test and its purpose for this study follows.

Kuhlmann-Anderson Intelligence Test

The Kuhlmann-Anderson Intelligence Test was used in this study to group students by speed of response and accuracy as well as to establish equivalency of groups. Form CD, seventh edition, which was used in this study, has 193 possible responses and a possible score of 125 on eight tests. Information regarding validity and reliability is found in Appendix B.

Metropolitan Achievement Tests

The Metropolitan Achievement Tests were used to test all hypotheses. Elementary Form F, which was used in this study, consists of seven subject area tests of which, only Test 1 Word Knowledge was used experimentally. Information regarding reliability is found in Appendix B.

Summary

In this chapter the writer has identified the setting in which the study took place, has described the specific details of how the study was organized, and provided a brief description of the testing instruments used for grouping of subjects and for testing the hypotheses. In Chapter IV the data collected with these testing instruments are presented and analyzed.

IV. PRESENTATION AND ANALYSIS OF DATA

This study was conducted for the purpose of investigating the effect of additional test time on previously identified types of students. Three measures were considered : raw scores on the Metropolitan Achievement Test for standard time limit, raw scores on the MAT test using extended time limits, and proportion of correct responses for those questions answered in the extended time period. Appropriate statistical tests were used to compare the group responses for each measure. The effect of teachers being more concerned with working time on students' test performance was also investigated.

Analysis Procedure

The analysis of variance F-statistic (74, p. 96) was used to compare more than two group means and when significant differences were identified, the t-test was employed to measure differences between two groups. This two-stage procedure was used to control type 1 error as well as avoiding numerous pair by pair comparisons when the group means are close together. The t-test method can be found in Huntsberger (41, p. 317).

Equivalence of Groups

Three main groups were established in Chapter III using the

following criteria:

(1) Students completing 46 percent or fewer test responses with 44 percent or less of those responses correct on the Kuhlmann-Anderson Intelligence Test were classified as the LL (low completion + low percentage correct) Group.

(2) Students completing 46 percent or fewer test responses with 52 percent or more correct on the Kuhlmann-Anderson Intelligence Test were classified as the LH (low completion + high percentage correct) Group.

(3) Students completing 63 percent or more test responses with 44 percent or less correct on the Kuhlmann-Anderson Intelligence Test were classified as the HL (high completion + low percentage correct) Group.

Using only the Kuhlmann-Anderson Intelligence Test for comparison at this time, the LL Group was statistically removed because of the group's low mean I. Q. score of 82. 8 and a t-test was applied for the I. Q. scores of Groups LH and HL and a value for t was found to be . 45, which was not significant at the . 05 level (See Table 1). Therefore, the equivalence of the two groups was demonstrated.

Table 1. Intelligence Quotient Means for Group LH and Group HL.

Group	Number	Intelligence Quotient	Difference
LH	22	94.54	.75*
HL	27	95.29	

* Not significant at .05 level

Analysis of the Data for Hypothesis Number One

Hypothesis number one states that slow responding accurate students' (Group LH) scores will show no significant difference over rapidly responding inaccurate students' (Group HL) scores on the Metropolitan Achievement Test when test time-limits are extended. Table 2 below shows the mean scores of Groups LH and HL at standard test time-limits on the Word Knowledge Subtest. A t-test was applied to the comparison and the difference was found to be statistically significant at the .05 level.

Table 2. Achievement Test Mean Scores for Groups LH and HL Using Standard Test Time.

Group	Number	Mean Score	Difference
LH	22	2.52	.23
HL	27	2.29	

t = 2.32 (Significant at .05 level)

Table 3 below shows the mean scores for Groups LH and HL with extended test time-limits on the Word Knowledge Subtest of the Metropolitan Achievement Test. A t-test was applied to the comparison and the difference at the end of extended time-limits was found to be statistically significant at the .01 level.

Table 3. Achievement Test Mean Scores for Groups LH and HL Using Extended Test Time.

Group	Number	Mean Score	Difference
LH	22	2.86	.47
HL	27	2.39	

$t = \underline{4.76}$ (Significant at .01 level)

These results rejected the null hypothesis that there was no significant difference between the LH and HL Groups when test time-limits are extended. Therefore, hypothesis one was rejected.

Analysis of the Data for Hypothesis Number Two

Hypothesis number two states that there will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year (Informed Group) and those students using regular daily work-limits during the school year (Uninformed Group). The three groups mentioned earlier (p. 59), Groups LL, LH and HL, were also subdivided

into three additional groups using students with "Informed" teachers and those students with "Uninformed" teachers. An analysis of variance was then applied (see Table 4) to test for differences in group mean scores on the Word Knowledge Subtest of the Metropolitan Achievement Test under standard test conditions between the "Informed" and "Uninformed" groups.

Table 4. Achievement Test Means Using Standard Test Time.

Group	MAT (Standard)	Group	MAT (Standard)
LLU	$\bar{x}_1 = 2.307$	LLI	$\bar{x}_2 = 2.212$
	$s_1^2 = .246$		$s_2^2 = .117$
	$n_1 = 15$		$n_2 = 16$
LHU	$\bar{x}_3 = 2.400$	LHI	$\bar{x}_4 = 2.620$
	$s_3^2 = .495$		$s_4^2 = .369$
	$n_3 = 10$		$n_4 = 12$
HLU	$\bar{x}_5 = 2.380$	HLI	$\bar{x}_6 = 2.160$
	$s_5^2 = .112$		$s_6^2 = .054$
	$n_5 = 16$		$n_6 = 11$
	$\bar{\bar{x}} = 2.342$		

Anova

Source	d.f.	s.s.	m.s.	F
Groups	5	1.656	.331	1.536*
Error	74	15.959	.216	
Total	79	17.616		

* Not significant at .05 level

With no significant difference in achievement level appearing between the "Informed" and "Uninformed" groups, the null hypothesis number two was accepted.

Analysis of Data for Hypothesis Number Three

Hypothesis number three states that there will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year (Informed Group) and those students using regular daily work-limits during the school year (Uninformed Group) when test time-limits are extended. Table 5 shows the results of an analysis of variance used to determine if extending the test time-limits would show any significant differences of mean scores on the Word Knowledge Subtest for the Informed and Uninformed Groups.

With a significant difference in achievement level appearing between the "Informed" and "Uninformed" groups at the .05 level, the null hypothesis number three is rejected.

Summary

In this chapter the data collected for this study were presented and analyzed. Data for hypothesis number one was analyzed by the application of a t-test to measure differences between two groups. Participating teachers were prepared to allow additional test time

Table 5. Achievement Test Means Using Extended Test Time.

Group	MAT (Extended)	Group	MAT (Extended)
LLU	$\bar{x}_1 = 2.373$	LLI	$\bar{x}_2 = 2.3875$
	$s_1^2 = .288$		$s_2^2 = .1345$
	$n_1 = 15$		$n_2 = 16$
LHU	$\bar{x}_3 = 2.75$	LHI	$\bar{x}_4 = 2.950$
	$s_3^2 = .485$		$s_4^2 = .288$
	$n_3 = 10$		$n_4 = 12$
HLU	$\bar{x}_5 = 2.506$	HLI	$\bar{x}_6 = 2.227$
	$s_5^2 = .1366$		$s_6^2 = .0862$
	$n_5 = 16$		$n_6 = 11$

Anova

Source	d.f.	s.s.	m.s.	F
Groups	5	4.295	.859	4.06*
Error	74	15.653	.2115	
Total	79	19.949		

* Significant at .05 level

on the complete battery of the Metropolitan Achievement Test, but only on the Word Knowledge Subtest did any appreciable number of students make use of the extended time-limits. This analysis showed a significant difference on mean scores on the Word Knowledge part of the Metropolitan Achievement Test between the LH and HL Groups when test time-limits were standard and an increased significant difference when test time-limits were extended. The null hypothesis number one was rejected.

The analysis of variance was used in the analysis of the data for hypotheses numbers two and three. Hypothesis number two was accepted because no significant differences appeared between the Informed and Uninformed Groups using the standard test time-limit on the Word Knowledge Subtest. Hypothesis number three was rejected because significant difference was measured between the Informed and Uninformed Groups using extended test time-limits on the Word Knowledge Subtest.

Chapter V, which follows, reports the findings which relate to these data, summarizes the study and makes recommendations for further investigations.

V. SUMMARY, ANALYSIS OF FINDINGS, AND RECOMMENDATIONS

Summary

Individual differences, especially the speed of response, has held a prominent place in education over the past few decades. In more recent years, low achieving disadvantaged children have received increasing interest. The purpose of this study was to investigate one individual difference, i.e., rate of response, and the effect on student performance when teachers recognize this difference. This study differed from previous investigations reported in the literature in two significant ways: (1) only third graders were used rather than the most frequently used ages of high school and college, and (2) this study used a comparison of answers completed versus answers correct instead of only raw score totals.

Three null hypotheses were formulated which compared slow responding accurate students with rapid responding inaccurate students and two comparisons between groups whose teachers were more aware of the importance of time for some children to those teachers not as aware. Specifically, hypothesis number one states, slow responding accurate students' (Group LH) scores will show no significant difference over rapidly responding inaccurate students' (Group HL) scores on the Metropolitan Achievement Test when test time-limits

are extended. Hypothesis number two states, there will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year and those students using regular daily work-limits during the school year. Hypothesis number three states, there will be no significant difference on Metropolitan Achievement Test mean scores between students allowed longer daily work-limits during the school year and those students using regular daily work-limits during the school year when test time-limits are extended.

The review of the literature in Chapter II covered three broad and generally unrelated topics: a survey of the role of speed in testing, a brief survey of recent studies concerned with disadvantaged children, and recent studies on teacher expectations of student performance. The unrelatedness of the three topics disappears after presented evidence in the literature draws the topics together in seeing how cultural differences of the disadvantaged effects the time concept and their improved responses to positive teachers.

Chapter III presented the design of the study showing that 230 disadvantaged third graders from three Denver target schools were used as the sample population. Grouping began with the three school principals designating about half of their third grade teachers to be "Informed" on the importance of allowing more time for student classroom work. From the Kuhlmann-Anderson Group Intelligence Test

administered citywide, groupings were made according to the number of attempted test responses and the percentage of correct responses. Near the end of the school year, the Metropolitan Achievement Test battery was administered with responses recorded at the end of standard test time and then 50 percent more time was to be added to each subtest, but only on the Word Knowledge subtest did students take advantage of additional time since all other subtests were completed within the standard time limits.

Analysis of Findings

Presentation and analysis of data for this study can be found in Chapter IV. The t-test was applied for hypothesis number one and the analysis of variance F-statistic was used for both hypotheses two and three.

Rejected Null Hypotheses

Hypothesis Number One: Mean differences were significant for the slow responding accurate students (Group LH) on the Metropolitan Achievement Test when compared to the rapidly responding inaccurate students (Group HL) at standard test time-limits and more significant differences were measured when the test time-limits were extended. Therefore, null hypothesis number one was rejected.

Hypothesis Number Three: Mean differences were significant

on the Metropolitan Achievement Test between students allowed longer daily work-limits during the school year and those students using regular daily work-limits during the school year when the test time-limits were extended. Therefore, the null hypothesis number three was rejected.

Implications for Hypotheses One and Three: Chapter II cited opposing research as to the existence of children that can be slow responding but not mentally low. The rejection of hypothesis number one lends support to the belief that such a child does exist. Along with hypothesis number one, hypothesis number three lends support to the belief that time to work accurately is an important factor for some school children and that test time-limits may impose a penalty on these children rather than measuring accurately the child's abilities or skills.

Accepted Null Hypothesis

Hypothesis Number Two: No significant mean difference was measurable between the informed and uninformed groups on the Metropolitan Achievement Test when standard time-limits were used. Therefore, the null hypothesis number two is accepted.

Implications for Hypothesis Number Two: No significant differences were apparent between the treated and untreated groups, therefore, no implications for null hypothesis number two can be drawn.

Further Findings

These disadvantaged third graders with an overall mean I. Q. of 97 managed to respond to practically every question on six subtests and about half of the students finished the seventh subtest easily within the standard time limit. On one mathematics subtest, Mathematics Computation, only four students out of 230 did not complete the answer sheet within the standard test time-limit. Participating teachers remarked that some children were "finished" with the answer sheet before all of the test booklets had been distributed and that most of the students work for awhile, become totally frustrated, and then arbitrarily fill in the remaining answers. When considering the uses and importance often placed on these tests, the implications are sobering and shocking.

Recommendations

With the findings of this study in mind, the writer offers the following recommendations:

1. To testing departments of public schools and to test publishers:

   Standardized tests need to be redesigned to provide a strong incentive to the test taker to "try" each question, whether the incentive be a reward,

recognition, or just fun to do. At the present time and using present standardized tests, these disadvantaged children really have no reason to do anything but use the answer sheet for drawing geometric designs.

2. To school boards and state legislators:

   Strong objections should be raised in the use of present standardized achievement tests in fulfilling accountability law requirements.

3. To schools of education and students involved in research:

   With some gain apparent with informed groups in this study and with the successful research cited in Chapter II, further study into teacher expectations with disadvantaged children is vital.

4. To school administrators and teachers:

   Revise testing procedures to improve teaching-testing feedback for children. This could be accomplished through in-service education of administrators and teachers.

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APPENDICES

APPENDIX A

Racial and ethnic school composition

Racial and Ethnic School Composition.

Determination of origins followed guidelines of the Civil Rights Act, Title VI.

Computation of population figures completed on October 2, 1970.

School	Negro	Mexican-American	Oriental	American Indian	Anglo and Other	Total Enrollment
Fairmont	1 .17%	438 74.49%	0	2 .34%	147 25%	588
Garden Place	108 14.17%	496 65.09%	0	9 1.18%	149 19.56%	762
Mitchell	619 69.86%	255 28.78%	3 .34%	0	9 1.02%	886

APPENDIX B

Validity and Reliability of Test Instruments

Validity of Kuhlmann-Anderson Test

The authors of the Kuhlmann-Anderson Test claim that the validity of the Sixth Edition tests was built into the Seventh Edition tests. Evidence presented for the Sixth Edition showed that the tests discriminate item-by-item between the performance of groups of pupils by small, successive increments of chronological age. The authors further claim the Sixth Edition tests discriminate between average and retarded or accelerated pupil groups, not only over a wide grade range, but also within each grade from the first to the twelfth.

Citing several studies, the author's findings show a variation of from one or two points between the Kuhlmann-Anderson and the Stanford-Binet median IQ's, and a correlation of .84 between the Kuhlmann-Anderson IQ's and the "educational quotient" on widely used achievement tests.

Item analysis rejected or retained each item on how well it discriminated between the top and bottom 27 percents of the item-analysis group. Median correlations between the items and the criterion range from .33 to .53 for Booklet CD.

The Seventh Edition increased the ceilings over the Sixth Edition in the higher maximum IQ's. In ten comparisons between the Sixth and Seventh Editions, the range of S.D.'s of the Seventh Edition

Booklets is 13.18 to 16.90 in comparison with an S.D. range of 7.31 to 11.06 on the Sixth Edition Booklets.

Evidence of the construct and concurrent validity of the CD Booklets show correlations of .65 and .67 with the Otis Quick-Scoring Mental Ability Test, .75 and .81 with the California Test of Mental Maturity, .55 with the Lorge-Thorndike Intelligence Test, .81 with the Science Research Associates Primary Mental Abilities Test, and a correlation of .69 with the Wechsler Intelligence Scale for Children.

Reliability of the Kuhlmann-Anderson Test

Evidence on the reliability of the CD Booklets shows a coefficient of .86 for test-retest reliability, and a coefficient of .95 on odd-even score reliability. A third indication of reliability was found on the K and A Booklets with pupils of the norm sample by administering the two Booklets concurrently. The range of coefficients showed .82 for children aged 5 years 11 months to 6 years 1 month to a coefficient of .78 for children aged 6 years 8 months to 6 years 10 months.

Factor analytic studies derived confidence bands for the CD booklets for Grade 3 of ±8 for 90% included to ±12 for 99% included. Overall reliability measured .909 with a Standard Error of Measurement of 4.8.

Validity of the Metropolitan Achievement Tests

The Metropolitan Achievement Tests were subjected to item analysis in April of 1968 with approximately 12, 000 test items divided into five forms at each of the five battery levels. Approximately 50, 000 pupils from 25 different school systems participated in the test program. Schools were selected to represent geographic regions, city size, and socio-economic status. The pupils included in the sample for item analysis had an average IQ of 100 on the Otis-Lennon Mental Ability Test.

The authors state that validity on an achievement test is defined in terms of content validity. Therefore, each school needs to evaluate its own curriculum in relation to content covered by an achievement test in order to judge validity. The publishers can provide content outlines and the results of an item analysis program to assist the school.

Reliability of the Metropolitan Achievement Test

The coefficients of reliability using the split-half (odd-even) method corrected by the Spearman-Brown formula ranged from .88 for Mathematics Computation to .96 for Spelling. The Word Knowledge coefficent was .94. Saupe's estimate of Kuder-Richardson Formula 20 reliability showed a range of .91 to .97 with .95 for Word Knowledge.

Data are based on all pupils tested with Form G in the Fall standardization at Grade 4.

APPENDIX C

Sample Letters

November 22, 1970

Principal
Mitchell School
1335 East 32nd. Ave.
Denver, Colorado 80205

Dear Mr. _____:

I very much appreciated the opportunity to talk with you last Thursday and I sincerely thank you for your cooperation in allowing me to conduct research in your school.

The following outline details the suggested principal's role and the extent of involvement of your school in my research project:

1. As the school's principal, if you would select two of your third grade teachers and inform them to be particularly conscious of time with their daily teaching. The remaining two teachers should have full knowledge of the project, but please suggest to them that they should not make any changes or allowances for time because of this project.

   You probably have better ideas, but I would suggest the following points to the two "informed" teachers to remind them throughout the year of the importance of time:

   a. Give the students a longer time to formulate and verbalize answers even if the silence seems threatening.

   b. Lengthen the time allowed for written work so that more students have a chance to finish assignments.

   c. Lengthen the interval between pronouncing spelling words.

   d. Hear a student out if he is trying to tell a story even if the circumstances limit time.

   e. Check the length of the arthmetic work periods to see if they are realistic.

f. Relate cultural differences in regard to the concept of time and organizing tasks in relation to time.

These suggestions may not be useable in their entirety, but I'm sure they present the main idea. Please feel free to inject your own ideas.

2. The Kuhlmann-Anderson Test will be used for statistical grouping and can be processed in Mr. Cavanaugh's office without involving your school.

3. Extending the time-limits on the third grade's spring Metropolitan Achievement Test can be worked out directly with the teachers and should not interfere with the test's validity on student scores since standard-time scores will also be available for recording.

I am providing a letter of directions for each of your third grade teachers explaining their roles in this project. From them, I am asking for their class list in order to determine numbers and to record names for future use in processing tests.

Please feel free to contact me anytime at Ash Grove School (757-1215) or at my home (422-0137).

Thank you again.

Sincerely,

William E. Lewis

March 22, 1971

Dear Miss _____,

Just a note to explain the administration procedure I'd appreciate your using on the Metropolitan Achievement Tests.

Since my research project is based on test time-limits, if you would just administer the tests as usual up to the end of the normal time-limits, and then while the students are stretching, you could go around the room and draw a red or blue pencil line under each student's last response. After the little break, then allow them 50% more time on each section of the test.

These tests will be corrected locally at the testing office and I plan to check them as they are being scored so you will get back the true scores.

Thank you so much for your trouble.

Sincerely,

William E. Lewis

APPENDIX D

Tables 6-20

Table 6. Teacher Number 1, Mitchell School, Informed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON No. of Responses	KUHLMANN-ANDERSON No. of Correct Responses	% Correct	I.Q.	METROPOLITAN ACHIEVEMENT TEST Word Knowledge Test 1 Standard Time	Extra Time	Gain	Questions Completed Std.	Ext.	Group
1	89	35	39%	91	2.6	2.7	1	28	50	LL
2	74	27	36%	85	2.0	2.4	4	30	50	LL
3	95	30	31%	79	2.2	2.4	2	40	50	ML
4	102	35	34%	81	2.2	2.2	0	50	50	ML
5	80	35	44%	86	2.2	2.2	0	42	50	LL
6	79	32	40%	86	1.9	2.2	3	31	50	LL
7	87	45	54%	95	1.9	2.5	6	36	50	LH
8	86	35	41%	91	1.8	1.8	0	50	50	LL
9	118	54	46%	103	2.3	2.3	0	50	50	HM
10	68	25	37%	77	1.8	2.5	8	34	50	LL
11	74	27	36%	85	2.3	2.9	6	38	50	LL
12	114	54	47%	103	2.3	2.3	0	50	50	MM
13	102	36	35%	91	2.0	2.0	0	50	50	ML
14	115	50	43%	104	2.5	2.8	3	41	50	HL
15	95	38	40%	87	1.9	1.9	0	50	50	ML
16	98	43	44%	91	2.8	3.4	9	25	50	ML
17	85	43	50%	94	1.9	1.9	0	50	50	LM
18	83	31	37%	86	2.2	2.7	5	30	50	LL
19	88	43	49%	97	2.3	2.6	3	28	50	LM
20	100	33	33%	87	2.0	2.6	6	36	50	ML
21	119	44	37%	97	1.9	2.1	2	43	50	HL
N = 21	1951	795	851	1896						
	M = 93	M = 38	M = 47%	M = 90						

Table 7. Teacher Number 2, Mitchell School, Informed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON				METROPOLITAN ACHIEVEMENT TEST					
					Word Knowledge Test 1					
	No. of Responses	No. of Correct Responses	% Correct	I.Q.	Standard Time	Extra Time	Gain	Questions Completed		Group
								Std.	Ext.	
1	73	36	49%	88	2.8	3.0	2	32	37	LM
2	109	62	57%	96	3.0	3.0	0	50	50	MH
3	103	55	53%	89	2.8	3.2	5	26	50	MH
4	88	55	62%	97	3.6	3.7	1	46	50	LH
5	98	49	50%	100	2.7	2.7	0	40	50	MM
6	118	51	43%	96	2.4	2.6	2	42	50	HL
7	125	66	53%	103	2.7	2.7	0	50	50	HH
8	67	39	58%	96	2.3	3.0	8	29	50	LH
9	96	51	53%	96	2.2	2.8	6	30	50	MH
10	81	42	52%	99	3.0	3.1	1	41	50	LH
11	114	53	46%	100	2.4	2.4	0	50	50	MM
12	106	51	48%	91	3.5	3.5	0	50	50	MM
13	83	46	55%	98	2.2	2.7	5	30	50	LH
14	82	43	52%	91	2.6	3.2	7	29	50	LH
15	105	64	61%	105	2.6	2.8	2	42	49	MH
16	110	47	43%	96	2.2	2.2	0	50	50	ML
17	105	49	47%	90	2.2	2.5	3	40	50	MM
18	98	49	50%	95	2.7	3.1	5	38	50	MM
19	103	54	52%	100	2.2	2.5	3	36	50	MH
20	75	35	47%	81	2.2	2.7	5	37	50	LM
21	100	45	45%	86	2.6	2.6	0	50	50	MM
22	98	52	53%	92	2.8	2.8	0	50	50	MH
23	94	43	46%	100	2.4	2.4	0	50	50	LM
24	106	58	55%	98	1.8	1.8	0	50	50	MH
25	111	51	46%	101	2.5	2.5	0	49	50	MM
26	94	38	40%	82	2.5	2.7	2	28	50	LL
	2542	1284	1316	2466						
N = 26	M = 98	M = 49	M = 51%	M = 95						

Table 8. Teacher Number 3, Mitchell School, Uninformed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON				METROPOLITAN ACHIEVEMENT TEST					Group
					Word Knowledge Test 1					
	No. of Responses	No. of Correct Responses	% Correct	I.Q.	Standard Time	Extra Time	Gain	Questions Completed		
								Std.	Ext.	
1	114	41	36%	89	2.7	2.7	0	41	50	ML
2	124	68	55%	111	3.3	3.3	0	50	50	HH
3	128	81	62%	130	3.7	3.7	0	50	50	HH
4	89	55	62%	97	3.2	3.8	8	32	50	LH
5	134	65	48%	109	2.9	2.9	0	50	50	HM
6	126	64	51%	105	1.9	2.0	1	33	50	HM
7	135	75	56%	120	3.7	3.7	0	50	50	HH
8	134	49	37%	87	2.8	3.0	2	42	50	HL
9	111	51	46%	101	2.7	2.7	0	50	50	MM
10	126	76	60%	115	3.7	3.7	0	50	50	HH
11	145	83	57%	121	3.7	3.7	0	50	50	HH
12	120	69	57%	118	4.1	4.1	0	50	50	HH
13	107	53	49%	98	3.3	3.3	0	50	50	MM
14	132	75	57%	120	3.7	3.7	0	50	50	HH
15	96	55	57%	101	3.2	3.2	0	50	50	MH
16	121	58	48%	110	3.2	3.3	2	46	50	HM
17	123	64	52%	105	3.6	3.6	0	50	50	HH
18	97	49	50%	95	2.6	2.6	0	50	50	MM
19	138	75	54%	117	3.7	3.7	0	50	50	HH
20	133	73	55%	116	4.4	4.4	0	50	50	HH
21	116	65	56%	103	3.7	3.7	0	50	50	HH
22	133	61	46%	105	2.2	2.2	0	50	50	HM
23	117	55	47%	104	3.2	3.2	0	50	50	HM
24	132	71	54%	111	4.1	4.1	0	50	50	HH
25	118	65	55%	103	2.4	2.4	0	50	50	HH
26	102	57	56%	100	2.9	2.9	0	50	50	MH
	3151	1653	1363	2791						
N = 26	M = 121	M = 63	M = 52%	M = 107						

Table 9. Teacher Number 4, Mitchell School, Uninformed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON				METROPOLITAN ACHIEVEMENT TEST					Group
					Word Knowledge Test 1					
	No. of Responses	No. of Correct	% Correct	I.Q.	Standard Time	Extra Time	Gain	Questions Completed		
								Std.	Ext.	
1	131	45	34%	93	2.4	2.7	3	38	50	HL
2	111	40	36%	87	1.9	1.9	0	50	50	ML
3	121	49	40%	87	1.9	2.0	1	42	50	HL
4	92	42	46%	96	3.2	3.2	0	50	50	MM
5	60	23	38%	74	2.2	2.2	0	37	50	LL
6	108	36	33%	86	2.5	2.5	0	50	50	ML
7	134	40	29%	94	2.5	2.7	2	41	50	HL
8	92	30	33%	87	1.8	1.9	2	34	50	LL
9	90	41	45%	98	2.6	2.6	0	50	50	LM
10	83	28	34%	86	2.2	2.3	1	29	50	LL
11	65	40	61%	94	1.5	2.0	6	28	50	LH
12	103	53	51%	98	3.0	3.0	0	50	50	MM
13	61	28	46%	84	2.3	2.3	0	50	50	LM
14	130	42	32%	83	2.2	2.3	1	43	40	HL
15	76	39	51%	93	1.9	1.9	0	50	50	LM
16	96	31	32%	87	1.5	1.5	0	50	50	ML
17	79	44	56%	94	3.0	3.3	4	35	50	LH
18	94	58	62%	110	3.0	3.3	5	30	50	LH
19	124	46	37%	95	2.3	2.5	2	41	50	HL
20	133	35	26%	84	2.7	2.7	0	46	50	HL
21	77	27	35%	73	2.8	3.0	2	26	50	LL
22	110	30	27%	85	2.2	2.2	0	50	50	ML
23	129	46	46%	98	2.8	3.0	2	40	50	HL
24	86	35	41%	86	1.9	1.9	0	50	50	LL
25	107	24	22%	73	2.6	2.6	0	50	50	ML
26	104	32	31%	83	2.3	2.3	0	50	50	ML
	2596	984	1014	2308						
N = 26	M = 100	M = 38	M = 39%	M = 89						

Table 10. Teacher Number 5, Garden Place School, Informed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON No. of Responses	KUHLMANN-ANDERSON No. of Correct Responses	% Correct	I.Q.	METROPOLITAN ACHIEVEMENT TEST Word Knowledge Test 1 Standard Time	Extra Time	Gain	Questions Completed Std.	Questions Completed Ext.	Group
1	95	49	51%	95	3.0	3.0	0	50	50	MM
2	140	68	48%	108	2.9	2.9	0	50	50	HM
3	108	67	62%	116	3.3	3.3	0	50	50	MH
4	96	53	55%	91	2.9	2.9	0	50	50	MH
5	115	48	42%	90	2.0	2.0	0	50	50	HL
6	139	79	57%	114	3.3	3.3	0	50	50	HH
7	103	51	49%	96	2.6	2.6	0	50	50	MM
8	72	41	57%	95	2.0	2.0	0	50	50	LH
9	76	58	76%	106	3.5	3.5	0	50	50	LH
10	115	62	54%	101	2.4	2.4	0	50	50	LH
11	134	72	54%	101	2.2	2.2	0	50	50	HH
12	119	63	53%	101	2.3	2.3	0	50	50	HH
13	89	39	44%	88	1.9	1.9	0	50	50	LL
14	100	36	36%	81	3.0	3.0	0	50	50	ML
15	142	50	35%	94	1.9	1.9	0	50	50	HL
16	88	38	43%	82	2.0	2.0	0	50	50	LL
17	115	53	46%	100	2.3	2.3	0	50	50	HM
18	110	51	46%	91	2.6	2.6	0	50	50	MM
19	126	52	41%	102	2.2	2.2	0	50	50	ML
20	101	57	56%	93	3.0	3.0	0	50	50	MH
21	137	80	58%	115	3.2	3.2	0	50	50	HH
22	99	55	56%	108	2.6	2.6	0	50	50	MH
23	105	54	51%	98	2.7	2.7	0	50	50	MM
24	146	63	42%	114	2.4	2.4	0	50	50	HL
25	97	34	35%	90	2.3	2.3	0	50	50	ML
	2767	1373	1248	2470						
N = 25	M = 111	M = 55	M = 50%	M = 99						

Table 11. Teacher Number 6, Garden Place School, Informed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON				METROPOLITAN ACHIEVEMENT TEST					Group
					Word Knowledge Test 1					
	No. of Responses	No. of Correct Responses	% Correct	I.Q.	Standard Time	Extra Time	Gain	Questions Completed		
								Std.	Ext.	
1	73	37	51%	83	2.2	2.2	0	50	50	LM
2	93	45	48%	101	1.6	1.6	0	50	50	LM
3	143	91	64%	119	3.9	3.9	0	50	50	HH
4	75	18	24%	75	1.9	1.9	0	50	50	LL
5	115	76	66%	118	3.7	3.7	0	50	50	HH
6	113	56	49%	97	1.4	1.4	0	50	50	MM
7	119	56	47%	104	3.2	3.2	0	50	50	HM
8	107	58	54%	106	2.2	2.2	0	50	50	MH
9	108	30	28%	80	1.4	1.4	0	50	50	ML
10	147	65	44%	99	2.2	2.2	0	50	50	HL
11	106	50	47%	89	2.3	2.3	0	50	50	MM
12	80	41	51%	92	2.6	2.6	0	50	50	LM
13	118	59	50%	107	2.2	2.2	0	50	50	HM
14	123	52	42%	92	2.3	2.3	0	50	50	HL
15	137	69	50%	106	2.4	2.4	0	50	50	HM
16	102	36	35%	86	2.0	2.0	0	50	50	ML
17	127	64	50%	105	3.3	3.3	0	50	50	HM
18	94	38	40%	84	2.5	2.5	0	50	50	LL
19	98	41	42%	84	1.6	1.6	0	50	50	ML
20	127	61	48%	105	2.4	2.4	0	50	50	HM
21	99	55	55%	101	2.7	2.7	0	50	50	MH
22	136	65	48%	100	2.4	2.4	0	50	50	HM
23	118	48	41%	103	1.8	1.8	0	50	50	HL
24	159	73	46%	110	2.6	2.6	0	50	50	HM
25	80	46	57%	88	2.7	2.7	0	50	50	LH
26	113	65	57%	115	3.3	3.3	0	50	50	MH
27	151	100	66%	142	4.2	4.2	0	50	50	HH
28	116	49	42%	103	2.2	2.2	0	50	50	HL
	3177	1544	1342	2794						
N = 28	M = 113	M = 55	M = 48%	M = 100						

Table 12. Teacher Number 7, Garden Place School, Uninformed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON				METROPOLITAN ACHIEVEMENT TEST					
					Word Knowledge Test 1					
	No. of Responses	No. of Correct Responses	% Correct	I.Q.	Standard Time	Extra Time	Gain	Questions Completed Std.	Questions Completed Ext.	Group
1	77	38	49%	92	3.2	3.2	0	50	50	LM
2	130	51	39%	94	1.9	1.9	0	50	50	HL
3	146	63	43%	114	2.8	2.8	0	50	50	HL
4	64	19	30%	79	2.0	2.0	0	50	50	LL
5	90	30	33%	77	2.9	2.9	0	50	50	LL
6	131	23	17%	80	2.2	2.2	0	50	50	HL
7	59	28	47%	84	2.0	2.0	0	50	50	LM
8	76	58	76%	106	3.1	3.1	0	50	50	LH
9	140	63	45%	107	2.4	2.4	0	50	50	HH
10	66	27	41%	78	1.7	1.7	0	50	50	LL
11	56	29	52%	81	1.9	1.9	0	50	50	LH
12	128	55	43%	92	2.5	2.5	0	50	50	HL
13	99	55	55%	101	3.2	3.2	0	50	50	MH
14	118	59	50%	107	2.4	2.4	0	50	50	HM
15	129	63	49%	110	2.6	2.6	0	50	50	HM
16	118	47	39%	96	1.9	1.9	0	50	50	HL
17	72	33	46%	89	2.3	2.3	0	50	50	LM
18	76	28	37%	81	2.9	2.9	0	50	50	LL
19	137	80	58%	115	4.1	4.1	0	50	50	HH
20	119	56	47%	104	3.7	3.7	0	50	50	HM
21	143	91	64%	119	3.7	3.7	0	50	50	HH
22	68	35	51%	88	2.5	2.5	0	50	50	LM
23	127	64	50%	105	3.0	3.0	0	50	50	HM
24	107	58	54%	106	3.3	3.3	0	50	50	MH
25	113	65	57%	115	3.5	3.5	0	50	50	MH
	2589	1218	1172	2490						
N = 25	M = 103	M = 49	M = 47%	M = 100						

Table 13. Teacher Number 8, Fairmont School, Informed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON				METROPOLITAN ACHIEVEMENT TEST					
					Word Knowledge Test 1					
	No. of Responses	No. of Correct Responses	% Correct	I.Q.	Standard Time	Extra Time	Gain	Questions Completed		Group
								Std.	Ext.	
1	94	59	63%	101	3.3	3.7	4	36	50	LH
2	91	27	30%	75	2.7	2.7	0	50	50	LL
3	106	72	68%	112	5.2	5.2	0	50	50	MH
4	105	49	47%	90	3.7	3.7	0	50	50	MM
5	112	65	58%	103	3.2	3.2	0	50	50	MH
6	120	60	50%	108	2.2	2.2	0	50	50	HM
7	125	70	56%	113	3.7	3.7	0	50	50	HH
8	101	63	62%	107	3.3	3.3	0	50	50	MH
9	101	63	62%	104	3.0	3.0	0	50	50	MH
10	125	56	45%	101	3.5	3.5	0	50	50	HM
11	91	39	43%	93	2.9	2.9	0	50	50	LL
12	112	70	62%	110	4.4	4.4	0	50	50	MH
13	93	53	57%	93	1.9	2.3	4	33	50	LH
14	115	68	59%	114	2.8	2.8	0	50	50	HH
15	132	73	55%	110	5.0	5.0	0	50	50	HH
16	109	45	41%	98	3.0	3.0	0	50	50	ML
17	122	63	52%	101	3.0	3.0	0	50	50	HH
18	83	40	48%	82	1.9	1.9	0	50	50	LM
19	103	60	58%	102	2.2	2.2	0	50	50	MH
20	112	72	64%	118	3.7	3.7	0	50	50	MH
21	120	63	52%	110	4.1	4.1	0	50	50	HH
22	86	34	39%	83	2.2	2.2	0	50	50	LL
23	118	63	53%	107	3.2	3.3	1	41	50	HH
24	111	61	55%	105	3.7	3.7	0	50	50	MH
25	113	67	59%	104	4.2	4.2	0	50	50	MH
26	129	62	48%	96	2.2	2.2	0	50	50	HM
27	50	30	60%	82	2.5	3.0	6	28	50	LH
	2879	1547	1446	2722						
N = 27	M = 107	M = 57	M = 53%	M = 101						

Table 14. Teacher Number.9, Fairmont School, Uninformed, Class Test Record.

STUDENT	KUHLMANN-ANDERSON		% Correct	I.Q.	METROPOLITAN ACHIEVEMENT TEST					Group
					Word Knowledge Test 1					
	No. of Responses	No. of Correct Responses			Standard Time	Extra Time	Gain	Questions Completed		
								Std.	Ext.	
1	100	55	55%	94	2.3	2.3	0	50	50	MH
2	59	31	52%	80	1.3	1.8	5	34	50	LH
3	126	50	39%	86	2.0	2.3	3	40	50	HL
4	81	37	46%	92	3.2	3.2	0	50	50	LM
5	107	52	49%	97	3.7	3.7	0	50	50	MM
6	104	61	59%	97	2.7	2.7	0	50	50	MH
7	64	32	50%	88	2.9	2.9	0	50	50	LM
8	75	44	59%	90	2.7	3.1	5	36	50	LH
9	127	40	31%	91	2.5	2.7	2	40	50	HL
10	79	33	42%	79	2.8	2.8	0	50	50	LL
11	94	34	36%	83	2.5	2.5	0	50	50	LL
12	90	42	47%	84	1.9	1.9	0	50	50	LM
13	129	57	44%	105	2.7	2.9	2	42	50	HL
14	87	48	55%	97	2.4	2.9	5	32	50	LH
15	78	31	39%	87	2.8	2.8	0	50	50	LL
16	86	38	44%	83	2.7	2.8	1	31	50	LL
17	77	38	49%	89	2.5	2.5	0	50	50	LM
18	93	46	49%	93	2.3	2.3	0	50	50	LM
19	110	67	69%	104	2.9	2.9	0	50	50	MH
20	74	39	53%	90	1.9	2.3	4	35	50	LH
21	67	27	40%	83	2.0	2.3	3	30	50	LL
22	111	35	31%	82	2.3	2.3	0	50	50	ML
23	89	45	50%	98	2.4	2.4	0	50	50	LM
24	93	42	45%	96	1.8	1.8	0	50	50	LM
25	61	26	43%	82	1.4	1.6	2	28	50	LL
26	102	49	48%	103	1.8	1.8	0	50	50	MM
	2363	1099	1224	2353						
N = 26	M = 91	M = 42	M = 47%	M = 91						

Table 15. High Completion + Low Percentage Correct Group Test Record - HL Group

Student	I. Q.	MAT Std.	Ext.	Gain	Questions Completed	
					Std.	Ext.
			UNINFORMED			
1	114	2.8	2.8	0	50	50
2	105	2.7	2.9	2	42	50
3	98	2.8	3.0	2	40	50
4	96	1.9	1.9	0	50	50
5	95	2.3	2.5	2	41	50
6	94	1.9	1.9	0	50	50
7	94	2.5	2.7	2	41	50
8	93	2.4	2.7	3	38	50
9	92	2.5	2.5	0	50	50
10	91	2.5	2.7	2	40	50
11	87	1.9	2.0	1	42	50
12	87	2.8	3.0	2	42	50
13	86	2.0	2.3	3	40	50
14	84	2.7	2.7	0	46	50
15	83	2.2	2.3	1	43	50
16	80	2.2	2.2	0	50	50
	M = 92	38.10	40.10			
		M=2.38	M=2.50			
			INFORMED			
1	114	2.4	2.4	0	50	50
2	104	2.5	2.8	3	41	50
3	103	2.2	2.2	0	50	50
4	103	1.8	1.8	0	50	50
5	102	2.2	2.2	0	50	50
6	99	2.2	2.2	0	50	50
7	97	1.9	2.1	2	43	50
8	96	2.4	2.6	2	42	50
9	94	1.9	1.9	0	50	50
10	92	2.3	2.3	0	50	50
11	90	2.0	2.0	0	50	50
	M = 99	23.80	24.50			
		M=2.16	M=2.22			

Table 16. Low Completion + High Percentage Correct Group Test Record - LH Group

Student	I. Q.	MAT Std.	Ext.	Gain	Questions Completed	
					Std.	Ext.
			UNINFORMED			
1	110	3.0	3.3	5	30	50
2	106	3.1	3.1	0	50	50
3	97	3.2	3.8	8	32	50
4	97	2.4	2.9	5	32	50
5	94	3.0	3.3	4	35	50
6	94	1.5	2.0	6	28	50
7	90	2.7	3.1	5	36	50
8	90	1.9	2.3	4	35	50
9	81	1.9	1.9	0	50	50
10	80	1.3	1.8	5	34	50
	M = 94	24.00 M=2.40	27.50 M=2.75			
			INFORMED			
1	106	3.5	3.5	0	50	50
2	101	3.3	3.7	4	36	50
3	99	3.0	3.1	1	41	50
4	98	2.2	2.7	5	30	50
5	97	3.6	3.7	1	46	50
6	96	2.3	3.0	8	29	50
7	95	2.0	2.0	0	50	50
8	95	1.9	2.5	6	36	50
9	93	1.9	2.3	4	33	50
10	91	2.6	3.2	7	29	50
11	88	2.7	2.7	0	50	50
12	82	2.5	3.0	6	28	50
	M = 95	31.50 M=2.62	35.40 M=2.95			

Table 17. Low Completion + Low Percentage Correct Group Test Record - LL Group

Student	I. Q.	MAT Std.	Ext.	Gain	Questions Completed	
					Std.	Ext.
			UNINFORMED			
1	87	1.8	1.9	2	34	50
2	87	2.8	2.8	0	50	50
3	86	2.2	2.3	1	29	50
4	86	1.9	1.9	0	50	50
5	83	2.7	2.8	1	31	50
6	83	2.0	2.3	3	30	50
7	83	2.5	2.5	0	50	50
8	82	1.4	1.6	2	28	50
9	81	2.9	2.9	0	50	50
10	79	2.0	2.0	0	50	50
11	79	2.8	2.8	0	50	50
12	78	1.7	1.7	0	50	50
13	77	2.9	2.9	0	50	50
14	74	2.2	2.2	0	37	50
15	73	2.8	3.0	2	26	50
	M = 81	34.60	35.60			
		M=2.30	M=2.37			
			INFORMED			
1	93	2.9	2.9	0	50	50
2	91	2.6	2.7	1	28	50
3	91	1.8	1.8	0	50	50
4	88	1.9	1.9	0	50	50
5	86	1.9	2.2	3	31	50
6	86	2.2	2.7	5	30	50
7	86	2.2	2.2	0	42	50
8	85	2.0	2.4	4	30	50
9	85	2.3	2.9	6	38	50
10	84	2.5	2.5	0	50	50
11	83	2.2	2.2	0	50	50
12	82	2.5	2.7	2	28	50
13	82	2.0	2.0	0	50	50
14	77	1.8	2.5	8	34	50
15	75	2.7	2.7	0	50	50
16	75	1.9	1.9	0	50	50
	M=84	35.40	38.20			
		M=2.21	M=2.38			

Table 18. Other Group's MAT Record - Not Used in Study

UNINFORMED GROUP MEDIUM COMPLETION + HIGH % CORRECT		MH GROUP	N = 8
I. Q. M = 102	MAT Std. Time M = 2.97	Extra Time M = 2.98	
INFORMED GROUP MEDIUM COMPLETION + HIGH % CORRECT		MH GROUP	N = 23
I. Q. M = 103	MAT Std. Time M = 3.07	Extra Time M = 3.14	
UNINFORMED GROUP HIGH COMPLETION + HIGH % CORRECT		HH GROUP	N = 15
I. Q. M = 115	MAT Std. Time M = 3.70	Extra Time M = 3.70	
INFORMED GROUP HIGH COMPLETION + HIGH % CORRECT		HH GROUP	N = 15
I. Q. M = 111	MAT Std. Time M = 3.31	Extra Time M = 3.32	
UNINFORMED GROUP HIGH COMPLETION + MEDIUM % CORRECT		HM GROUP	N = 10
I. Q. M = 107	MAT Std. Time M = 2.75	Extra Time M = 2.77	
INFORMED GROUP HIGH COMPLETION + MEDIUM % CORRECT		HM GROUP	N = 13
I. Q. M = 104	MAT Std. Time M = 2.61	Extra Time M = 2.61	
UNINFORMED GROUP MEDIUM COMPLETION + MEDIUM % CORRECT		MM GROUP	N = 7
I. Q. M = 98	MAT Std. Time M = 2.90	Extra Time M = 2.90	
INFORMED GROUP MEDIUM COMPLETION + MEDIUM % CORRECT		MM GROUP	N = 15
I. Q. M = 95	MAT Std. Time M = 2.61	Extra Time M = 2.66	
UNINFORMED GROUP MEDIUM COMPLETION + LOW % CORRECT		ML GROUP	N = 8
I. Q. M = 84	MAT Std. Time M = 2.25	Extra Time M = 2.25	
INFORMED GROUP MEDIUM COMPLETION + LOW % CORRECT		ML GROUP	N = 13
I. Q. M 87	MAT Std. Time M = 2.20	Extra Time M = 2.30	
UNINFORMED GROUP LOW COMPLETION + MEDIUM % CORRECT		LM GROUP	N = 14
I. Q. M = 91	MAT Std. Time M = 2.41	Extra Time M = 2.41	
INFORMED GROUP LOW COMPLETION + MEDIUM % CORRECT		LM GROUP	N = 9
I. Q. M = 91	MAT Std. Time M = 2.21	Extra Time M = 2.32	