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ABSTRACT

This study was designed (1) to determine if the Wepman Auditory Discrimination Test and a group modification of the test would produce the same measure of auditory discrimination ability, (2) to determine if either the individual or group version of the test can be used to predict reading achievement, and (3) to obtain information relating auditory discrimination to age, race, and socioeconomic status. Subjects were 180 children from 4 to 8 years old who represented high and low socioeconomic status and the Caucasian and Negro races. From analysis of individual and group discrimination scores and Stanford Reading Achievement Test data came these four main results: (1) the individual Wepman Auditory Discrimination Test and its group modification cannot be used interchangeably; (2) neither version of the Wepman test predicts reading achievement reliably enough to use as a device for preselection of children for special reading therapy; (3) privileged Caucasian children have better auditory discrimination than underprivileged Negro children; and (4) underprivileged Caucasian children have better auditory discrimination than underprivileged Negro children. A bibliography is included. (Author/NH)

FINAL REPORT

RESEARCH PROJECT
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U. S. Department of Health, Education, and Welfare
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The research reported herein was performed pursuant to a grant with the Office of Education, U. S. Department of Health, Education, and Welfare. Contractors undertaking such projects under Government sponsorship are encouraged to express freely their professional judgement in the conduct of the project. Points of view of opinions stated do not, therefore, necessarily represent official Office of Eduaction position or policy.

U. S. Department of Health, Education, and Welfare
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SUMMARY

Tha major premise of this study was that many children are reading retardates because of auditory discrimination problems and that if they could be identified at an early enough age, the incidence of poor reading achievement might be eliminated or reduced by the use of auditory training and/or special reading teaching techniques. This study was designed to:

1. Determine if the Wepman Auditory Discrimination Test and a group modification of the test would produce the same measure of auditory discrimination ability.

2. Determine if either the individual or group version of the test can be used to predict poor reading achievement.

3. Obtain information relating auditory discrimination to age, race, and socio-economic status.

One hundred and eighty subjects ranging from four to eight years of age were selected. The subjects represented high and low socio-economic status and the Caucasian and Negro races. Individual and group discrimination scores were obtained early in the school year. Stanford Reading Achievement data was gathered at the close of the school year. The obtained data were subjected to analysis of variance and correlation analysis.

The results of statistical analysis suggested that:

1. The individual Wepman Auditory Discrimination Test and its group modification cannot be used interchangeably.

2. Neither version of the Wepman Auditory Discrimination Test predicts reading achievement reliably enough to use as a device for pre-selection of children for special reading therapy.

3. Privileged Caucasian children have better auditory discrimination than underprivileged Caucasian children.

4. Underprivileged Caucasian children have better auditory discrimination than underprivileged Negro children.

Research should be continued in an attempt to find a means of predicting poor reading achievement resulting from sub-normal auditory discrimination. The fact that Caucasian children exhibit better auditory discrimination than do underprivileged Negro children is a new finding with many socio-economic and educational ramifications. A study designed to determine if there is, in fact, a racial difference is highly desirable.

INTRODUCTION

REVIEW OF THE LITERATURE

A review of pertinent literature suggests that approximately 15% of the public school population is educationally and emotionally handicapped by inadequate reading skills (4, 24, 6, 2, 8, 7, 1). Lazar's study (7) found that 16-22% of eighth grade pupils were more than two years retarded in reading ability. Austin (1) reports that 16% of the pupils in the third through the ninth grades are in need of special help in reading. These findings are representative of the literature.

The effects of reading retardation are widespread. The pupil who does not read adequately is frequently an academic underachiever because he cannot compete in subject areas that utilize reading assignments as learning tools. Academic underachievement often results in teacher and parental pressure to improve academic standing. When these external pressures are added to the pupil's internal feelings of guilt and frustration, the resultant emotional problems can become yet another deterrent to satisfactory academic performance.

Inadequate readers create many teaching and curriculum problems. Prima facie support for this statement becomes evident if one attempts to answer the following questions. How does one teach History or English literature to the 15% of the class that cannot read the text adequately? If the teacher alters her teaching plan to accommodate the poor readers, what effect does this have on the 85% who do read adequately? How can school administrators devise a curriculum that accommodates poor readers without penalizing their normal reading peers? Conversely, how can they devise a curriculum for normal readers that is not punitive for reading retardates?

Pupils with reading disabilities are expensive in terms of educational underachievement and as a direct expense to school systems. These students require special teachers, special teaching techniques, special teaching materials, special equipment and, frequently, additional classroom space. In addition, they repeat grades more frequently than their normal reading peers. A single grade repetition can cost a school system $400 - $500.

Apart from direct expense to public school systems, poor readers are expensive to our society. As a group, they are less capable of competing for favorable employment. The resultant loss of income is punitive to the individual and costly to society in terms of reduced taxable income, increased need for welfare programs, rehabilitation centers, crime prevention, etc.

In view of these considerations, a means of reducing the incidence of reading retardation must be viewed as a contribution to education and to our society.

A large body of literature exists which relates poor reading achievement to subnormal hearing ability. The bulk of this literature deals with high frequency hearing loss and subnormal discrimination ability. Auditory memory span and auditory blending skills have also been linked to poor reading ability. The literature cited is representative.

Ewers (18) compared the performance of 140 high school children on several parameters of audition and on two reading tests. A high correlation was found between pitch discrimination, auditory discrimination and language development tests. The results of these tests were correlated with performance over several parameters of reading. Positive correlations were found between discrimination and reading.

Durrell (17), discussing his clinical experience with poor readers, states that "almost all children with reading achievement below the first grade are handicapped by a marked inability to discriminate sounds in words." Deutsch (15) has commented that "one is struck by the apparent importance of auditory discrimination and general auditory responsiveness for verbal performance and reading ability."

It has been shown that the ability to reproduce a word by synthesizing its component sounds is related to success in beginning reading (12). Synthesizing a word from its component sounds cannot be done if one cannot discriminate the sounds.

A comparison between normal and retarded readers over several factors presumed to relate to reading ability was done by Wolfe (35). He found that the reading retarded group was consistently inferior in the auditory functions of acuity, discrimination and memory span.

The work of Deutsch (15) has related an extremely high base rate of reading retardation and poor auditory discrimination ability in lower-status children. This relationship has led Deutsch to hypothesize that underprivileged children may have less auditory discrimination ability than their more advantaged peers (15, 13).

The hypothesis rests, in part, upon the assumption that the quantitative and qualitative auditory experiences of these children are inadequate for them to learn to discriminate well. Deutsch's hypothesis is logically derived and has been partially substantiated by the work of Clark and Richards (13).

The literature cited supports the conclusion that reading retardation and its attendant educational and emotional problems can be caused by sub-normal auditory discrimination.

Audiologists have utilized auditory training techniques for many years to improve the communications skills of the deaf and hard of hearing (16, 26, 29). Remedial reading specialists have used similar techniques to benefit slow readers with auditory discrimination

problems.

Murphy (25) has presented evidence that direct training in both auditory and visual discrimination can be beneficial relative to the acquisition of reading skill. Durrell (17) reports that ". . . pupils receiving 'sound' training made significantly greater gains in reading skill than controls who did not." Bond (4) has pointed out the fact that in learning to read, children must often make ". . . rather fine auditory discriminations between certain words and use auditory techniques in word analysis. The child who does not hear will be handicapped in these activities." He further states that "proper instructional adjustments will in most cases minimize the effects of hearing impairment on learning to read."

In view of the evidence, it seems clear that auditory discrimination training may, in many instances, reduce the incidence and/or degree of reading disability in children who have subnormal auditory discrimination.

Children who cannot benefit from such training may still be able to acquire adequate reading skill if a predominantly visual approach to reading is used. In this context Bond (3) has suggested that auditory ability is important in oral-phonetic reading instruction, but that it is less important in predominantly look-say techniques. Wepman (32) has also pointed out that some children learn better through one sensory modality than another and that reading instructions should be designed to allow the child to use the modality through which he learns best.

Theoretically, then, the incidence of reading retardation resulting from poor auditory discrimination can be reduced by improving discrimination ability, by negating the importance of auditory discrimination in reading instruction, or both. The literature strongly supports this theory.

THE PROBLEM

The negative effect of poor auditory discrimination upon the acquisition of adequate reading skill can be reduced or eliminated at two levels: 1) at the pre-school level before reading instruction begins, or 2) after reading instruction has begun in the primary grades.

In order to institute an effective program to cope with the effects of poor auditory discrimination at the pre-school and primary grade levels, one must first identify the children who have subnormal discrimination. This can only be accomplished with a test that meets two basic criteria. First, it must be capable of diagnosing subnormal discrimination ability, and secondly, it must be designed to take advantage of the economies provided by group testing. Such a test is not available at this time.

The Wepman Auditory Discrimination Test is capable of differentiating the discrimination ability of children (15, 13, 14). It is largely independent of intelligence, and it has been shown to correlate

highly with reading skill (15). In addition, it is easy to administer and score, it does not require expensive instrumentation, and it can be administered by existing personnel in most school systems.

The Wepman's only apparent shortcoming for group testing is that it may be too time consuming. It was originally designed for individual testing. A pilot study indicates that it takes approximately ten minutes to instruct a child, give him several practice items, and administer the test. At this rate, it would require eight hours to test 48 children. School administrators may be disinclined to spend this much time. If test time were reduced by 75%, it would be possible to test 24 children per hour, or 192 children in eight hours. It is unlikely that many administrators would object to spending this much time in identifying children with auditory discrimination problems.

It is felt that the Wepman can be modified so that its administration time can be cut 75% by instructing and administering the test to children in groups of four. It is not known if such modification would alter the reliability of validity of the test. Determining the effects of such modifications is one of the major purposes of this research project. If the test can be modified for group use, its potential uesfulness in identifying children with auditory discrimination problems would be greatly increased by multiplying the number of children that could be tested in a given amount of time.

Group testing and identification is necessary for both economic and educational reasons. From an educational viewpoint, it is desirable to find every child who would benefit from special education because of poor auditory discrimination ability. By definition, this can only be done if every child's discrimination ability is evaluated, en masse. The method of group identification must be economical relative to time and money so school administrators can justify and accept it.

OBJECTIVES

The desirability of a group auditory discrimination test cannot be seriously questioned. The overall objective of this proposal is to determine if group auditory discrimination testing is feasible using a procedural modification of the Wepman Auditory Discrimination Test.

The specific objectives of this research are to: 1) investigate the reliability and validity of a screening version of the Wepman Auditory Discrimination Test, 2) to extend knowledge relative to the auditory discrimination ability of privileged and underprivileged Caucasian children from four to eight years of age, 3) to investigate the relative auditory discrimination ability of underprivileged Caucasian and Negro children from four to eight years of age, and 4) to secure additional data relative to auditory discrimination ability and reading ability in privileged and underprivileged Caucasian children and in underprivileged Caucasian and Negro children in the second and third grades.

The following hypotheses will be tested:

1. There is no correlation between scores obtained with the Wepman Auditory Discrimination Test and its screening version in:

   a. Four to eight year old male Caucasian children who are privileged and underprivileged.

   b. Four to eight year old male Caucasian and Negro children who are underprivileged.

2. There is no difference between scores obtained with the Wepman Auditory Discrimination Test in four to eight year old Caucasian children who are privileged and underprivileged.

3. There is no difference between scores obtained with the Wepman Auditory Discrimination Test in four to eight year old Caucasian and Negro children who are underprivileged.

4. There is no correlation between scores obtained with the Wepman Auditory Discrimination Test and the sub-tests of the Stanford Reading Achievement Test in first, second and third grade Caucasian children who are privileged and underprivileged.

5. There is no correlation between scores obtained with the Wepman Auditory Discrimination Test and the sub-tests of the Stanford Reading Achievement Test in first, second and third grade Negro and Caucasian children who are underprivileged.

METHODOLOGY

SUBJECTS

Initially, 180 subjects were drawn from schools in the Tulsa Public School System and from a pre-school population residing in corresponding neighborhoods. To serve as a subject, each child met the following criterion:

1. He was male.
2. He had normal hearing acuity.
3. He was at an appropriate grade and age level.
4. He was classifiable relative to socio-economic status and race.

For the purposes of subject classification and accpetance, the following definitions and considerations were applied:

I.Q.: Performance on the Wepman Auditory Discrimination Test has been shown to be virtually free of dependence on I.Q. (15); consequently, this variable was not specifically controlled.

Age and Grade Level: These variables were important to the internal design of this study. Consideration of time and availability of subjects, when related to the objectives of this study, dictated that each subject must meet both an age and an enrolled grade criterion. Consequently, pupils were accepted as subjects only if they were enrolled in a grade equal to their chronological age, i.e., the eighth birthday of third graders fell between November 1, 1967 and October 31, 1968. It was recognized that this criterion excluded children from the subject sample who may have repeated a grade.

Sex: Sex, auditory discrimination and reading ability interact. Boys tend to discriminate and read less well than girls. This difference was not considered significant to the objectives of this study, but it was controlled in that only male pupils were selected as subjects.

Normal Hearing Acuity: All subjects who were used as subjects in this study had normal hearing acuity. Normal hearing was defined as the ability to pass a hearing acuity screening test at the frequencies of 500, 1000 and 2000 cycles per second in both ears. Test tones were presented at an intensity level of 25 dB hl. ISO, 1964. It should be noted that this criterion did not exclude children with sub-normal discrimination.

Socio-Economic Status: This study required a sample of children stratified by socio-economic status. Subjects were classified as privileged if they resided in a neighborhood school with a median income of $10,000 or more per year. Subjects were classified as underprivileged

if they resided in a neighborhood school with a median income of $3,000 or less per year.

Sampling Procedures: There were several schools within the Tulsa Public School System with median incomes equal to or greater than $10,000. Privileged subjects were drawn from this population by random selection without regard to individual schools excepting that the total number of subjects from a single school was a multiple of four. There were also several schools in the Tulsa Public School System with median incomes of $3,000 per year or less which were mixed relative to Caucasian and Negro students. The underprivileged subjects were drawn from these schools in the manner described above. Pre-school subjects were obtained in cooperation with the Tulsa Hearing Auxiliary which conducts pre-school hearing acuity screening tests semi-annually. Pre-school children were selected alternately as they appeared for pre-school hearing screening tests. Note that the Hearing Auxiliary worked within the geographic bounds of neighborhood schools, thus, the school age and pre-school age subjects were drawn from the same socio-economic environments.

MATERIALS

The materials for this study consisted of two tape recorded versions of the Wepman Auditory Discrimination Test and a scoring form for recording subjects responses.

Tape Recordings: The Wepman Auditory Discrimination Test consists of forty pairs of stimulus words. Initially, the stimuli were recorded by a professional radio announcer in such a way that an alerting beep preceded each pair of stimulus items by one second. The time interval between stimulus pairs was five seconds. Four practice stimuli pairs preceded the experimental items. The intensity of all auditory stimuli were presented at 40 dB HL, ISO, 1964. After this tape was cut, a duplicate was made from it. The duplicate tape was cut and spliced to alter the order of stimulus pairs. Tapes I and II were identical except for the order of stimulus word pairs. A preliminary trial with these tapes revealed that the time lapse between stimulus words within pairs apparently measured memory span instead of discrimination ability. For this reason, these tapes were not used to gather experimental data. Instead, two experimental tapes made by a female speech therapist who had used these tapes successfully in a prior experiment were used. The experimental tapes subsequently used in this investigation were similar to the original tapes excepting that the time lapse between stimulus words within stimulus pairs was one second. The first version of the experimental tape was used in the individual experimental conditions. the second version was used in the group experimental conditions.

Scoring Forms: Scoring forms were designed to permit rapid and accurate scoring of subject responses. They provided identifying information for four subjects perform and a place to record each subject's response to each of the stimulus items. The forms were coded relative to the correct response for each stimulus pair. Note that individual subjects responded by pushing a button which turned on a color-coded light on a scoring panel. The light remained on until the

investigator turned it off, thus permitting ease of scoring.

Reading Achievement Tests: The Stanford Reading Achievement Test, Primary 1, was given to all first grade subjects, and Primary 11 was given to all second grade subjects by the investigator. The Tulsa Public School System administered the Primary 11 test to all third grade subjects.

EQUIPMENT

A description of the equipment used in this study follows:

Tape Recorders: Two Sony 230 tape recorders were used in this study. This study wished to use equipment which is commonly available in public school systems. Consequently, the tape recorders used to present stimulus material had performance characteristics approximating tape recorders currently used in the Tulsa Public School System. They had a frequency range of 100 to 15,000 cycles per second and were capable of feeding four pair of earphones. The earphones had a frequency response range of 100 to 12,000 cycles per second. Each tape recorder was equipped with an instant stop switch which made it possible for the investigator to stop the tape in the event that it was desirable.

Fiber Board Divider: A fiber board divider, set on a table top, was used to provide visual isolation for four subjects during group data collection.

Response Box: A response box was placed on the table in front of each subject. Each response box contained two paired visual stimuli, i.e., a picture of a girl and a boy and a picture of two girls. A signal button was located beneath each pair. The signal button controlled a light behind the paired visual stimuli and an appropriately colored light on the examiner's scoring board. Once turned on by a subject, each light remained lit until the examiner turned it off from the scoring board. Research by Park and Richards (13) suggested that young children may attend to the Wepman Test better if they are rewarded. it was anticipated that turning on the light in response to the auditory stimuli would serve as a behavorial reward and would aid in maintaining interest. The use of similar and disimilar visual symbols was expected to aid the child in understanding the task of discriminating similar and dissimilar auditory stimuli. A pilot run revealed that the children pushed their signal buttons indiscriminately if they could see their response lights. Consequently, these lights were removed during the data collection period.

Scoring Box: A scoring box was constructed in such a way that each subject's responses were indicated by a colored light on the box. The scoring forms previously mentioned were used in conjunction with the scoring box.

PROCEDURES OF DATA COLLECTION

Age, race, grade, and socio-economic status data were collected for each subject. Subjects were classified as follows:

AGE	GRADE	PRIVILEGED CAUCASIAN	UNDERPRIVILEGED CAUCASIAN	UNDERPRIVILEGED NEGRO
8	3	12	12	12
7	2	12	12	12
6	1	12	12	12
5	-1	12	12	12
4	-2	12	12	12

Discrimination scores were obtained by individual and group testing techniques. Reading achievement scores were obtained with the Stanford Reading Achievement Test and its subtests.

Order of Data Collection: The Wepman Auditory Discrimination Test was administered in a group situation to all subjects in September and October of 1968. The Wepman Auditory Discrimination Test was administered individually to all subjects in November and December, 1968. Following collection of the discrimination data, the Stanford Reading Achievement Test was administered to the first, second, and third grade subjects in April and May, 1969.

Discrimination Data: Discrimination scores were obtained in two experimental conditions, individual and group. In the group condition, four subjects were taken to a room provided by the cooperating schools. They were shown a response box and familiarized with the task expected of them. That is, they were given paired auditory stimuli that were the same (cow - cow) and grossly different (cow - dog) in a free field while the examiner indicated the relationship between the word pairs and the appropriate visual stimuli (girl - girl or girl - boy) on the response board. When this concept was clear, the subjects were instructed to push the appropriate button on the response box. The subjects were then introduced to the earphones. During the experimental condition, tape two was used. Subject responses to the test items were registered on the scoring board and recorded on the scoring form. Individual scores were calculated at the end of the experimental day.

In the individual experimental condition, data was collected as outlined above with two exceptions. Any instructional technique the examiner could devise to produce an acceptable response from the subjects was permitted. Secondly, tape one was used as the experimental stimulus. It was hoped that the use of group testing techniques would prove useful in predicting reading ability. It was also anticipated that if there were differences between group performance and individual performance on the discrimination test, it would favor the individual testing situation. Because it was hoped to establish that group tests could be used in public school systems, group data was collected first and individual data was collected second. This design permits direct generalization to the use of group tests in school systems.

The acoustical environment in which discrimination data were collected approximated that of a "quiet" classroom and fluctuated over time and between the respective schools.

Discrimination data collection began in September, 1968 and was completed in December, 1968.

Reading Data: The Tulsa Public School System routinely administers the Stanford Reading Achievement Test (Primary Battery Two, Form X) to third grade pupils in April of each school year. They made this data available to the investigators for the subjects in this study. The investigators administered the Stanford Achievement Test, Primary Battery One, Form W, to first grade subjects and the Stanford Achievement Test, Primary Battery Two, Form X, to second grade subjects in May, 1969. Thus, the reading achievement data was available for each subject. The reading achievement data used in this study comprised: word meaning, paragraph meaning, vocabulary, spelling, and word study skills.

Socio-Economic Status, Age, Etc.: Information relative to age, race, grade, and socio-economic status was collected prior to the experimental procedures. This data was obtained from school records.

RESEARCH PERSONNEL

All data was collected by the author, a doctoral level audiologist certified by the American Speech and Hearing Association, with the assistance of two masters' level graduate students majoring in audiology.

ANALYSIS OF DATA

The data for this investigation were collected in the manner described in the preceding chapter. The analysis of data will be presented in the same order as the research hypotheses.

HYPOTHESIS I

The first hypothesis states that there is no correlation between scores obtained with the Wepman Auditory Discrimination Test and its screening version in:

A. Four to eight year old male Caucasian children who are privileged and underprivileged.

B. Four to eight year old male Caucasian and Negro children who are underprivileged.

Inspection of the preliminary data revealed that the four year old children responded to the experimental stimuli in a highly erratic fashion. The subjects in this age group were highly distractible and seemed incapable of comprehending the experimental task. For this reason, they were excluded from the statistical analysis. It was concluded that neither the group or the individual version of the Wepman Auditory Discrimination Test was applicable for children in this age group.

Part A of Hypothesis I was subjected to statistical analysis by obtaining correlation coefficients for discrimination scores obtained with individual and with group tests. The results of this statistical computation appear as Table One.

TABLE I

Correlation and Explained Variance Between Individual and Group Versions of Wepman Auditory Discrimination Test For Privileged and Underprivileged Caucasian Children

Age	Privileged		Underprivileged	
	r	% of Variance Explained	r	% of Variance Explained
5	.21	4.5	.59	34.7
6	.56	31.8	.50	25.3
7	.24	5.6	-.12	1.5
8	.31	9.7	.50	25.0

Examination of Table One reveals a low order correlation for both privileged and underprivileged Caucasian children. One of the major purposes of this investigation was to determine if the Wepman Test could be given to groups of children. The low order of correlation between the individual and group tests suggests that it would be inadvisable to use the group test and compare its results with the results obtained with individual tests. For this reason, Part A of Hypothesis I is accepted.

Discrimination score means and standard deviations for both individual and screening versions of the Wepman Auditory Discrimination Test are displayed in Table Two.

TABLE 2

Discrimination Score Means and Standard Deviations for Individual and Screening Versions of the Wepman Auditory Discrimination Test For Privileged and Underprivileged Caucasian Children

Age	Privileged				Underprivileged			
	Individual		Group		Individual		Group	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
5	32.8	[illegible] 3	24.0	5.2	24.0	5.7	13.1	5.6
6	34.4	5.9	26.3	6.3	27.3	7.1	22.9	5.5
7	36.5	1.4	31.8	3.6	35.4	3.0	29.7	4.6
8	35.8	3.4	32.8	3.1	36.1	2.0	32.3	5.4

Examination of Table Two reveals that the individual test produced consistently higher discrimination scores than did the group test. It may also be noted that privileged Caucasian children consistently obtained better discrimination scores than did underprivileged children. It is of interest to note that these discrimination scores invariably improved with age irrespective of the type of test or status of subjects.

HYPOTHESIS I-B

Hypothesis I-B was designed to obtain information related to the correlation of individual and group discrimination tests as well as possible differences related to the discrimination ability of Caucasian underprivileged and Negro underprivileged children. The data were treated with a correlation analysis. The results of this analysis appear as Table Three.

TABLE 3

Correlation and Explained Variance Between Individual and Group Versions of the Wepman Auditory Discrimination Test For Underprivileged Caucasian and Negro Children

Age	Caucasian Underprivileged		Negro Underprivileged	
	r	% of Variance Explained	r	% of Variance Explained
5	.59	34.7	-.002	0.0001
6	.50	25.3	.11	1.22
7	-.12	1.5	.66	44.3
8	.50	25.0	.48	23.7

The correlation coefficients for both racial groups were considered to be of low enough order to accept the hypothesis for the purposes of this study, i.e., the correlations are too low to use the two test versions interchangeably.

Table Four presents the discrimination score means and the standard deviations for the independent and screening versions of the discrimination test for underprivileged Caucasian and underprivileged Negro children.

TABLE 4

Discrimination Score Means and Standard Deviations for Individual and Group Versions of the Wepman Auditory Discrimination Test For Underprivileged Caucasian and Negro Children

Age	Caucasian Underprivileged				Negro Underprivileged			
	Individual		Group		Individual		Group	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
5	24.0	5.7	13.1	5.6	18.6	6.4	16.8	6.4
6	27.3	7.1	22.9	5.5	25.1	4.1	20.3	3.4
7	35.4	3.0	29.7	4.6	29.8	6.8	22.7	5.6
8	36.1	2.0	32.3	5.4	35.5	2.9	28.3	4.3

Examination of this data reveals that discrimination scores improved with age irrespective of the type of test given or the race of the subjects. The individual test version always produced higher scores than did the group test. With the exception of five year old Caucasian children in the group condition, underprivileged Caucasian children always produced better discrimination scores than did the underprivileged Negro children.

HYPOTHESIS 2

Hypothesis 2 states that there is no difference between scores obtained with the Wepman Auditory Discrimination Test in four to eight year old Caucasian children who are privileged and underprivileged. When the analysis of the data for the data of Hypothesis I was completed, it became obvious that discrimination scores obtained in this investigation were substantially different than the norms published for the test by Dr. Wepman. Dr. Wepman was consulted and it was learned that the normative data for the Wepman Test used a different sampling technique than this investigation. In order to collect data that would be more comparable to the normative data, subjects with four or more "Y" score errors were taken from the experimental group and replaced by new subjects from the same schools who had three of less "Y" error scores. During the process of seeking substitute subjects, it was discovered that approximately 50% of the five year old pupils had "Y" error scores of four or more. It was concluded that a screening version of the Wepman Auditory Discrimination Test would not be feasible for children in this age range. As a consequence, five year old subjects were dropped from further statistical analysis. Table Five portrays the number of children substituted by age, race, and status.

TABLE 5

Number of Children Replaced by Revised Sampling Procedure

Age	Caucasian Privileged	Caucasian Underprivileged	Negro Underprivileged
5	Dropped From Investigation		
6	3	3	6
7	0	0	3
8	0	0	0

It is interesting to note that Table Five suggests age, status, and racial auditory discrimination differences. Said differences appear to indicate that discrimination ability, or at least the ability to perform on the Wepman Test:

1. Increases with age,
2. Is better for Caucasian than it is Negro children,
3. Is better for privileged than it is for underprivileged children.

Hypothesis 2 was altered so that it states that there is no difference between scores obtained with the Wepman Auditory Discrimination Test in six, seven, and eight year old Caucasian children who are privileged and underprivileged. The data was analyzed using a single classification analysis of variance design and by computing means and standard deviations for the various parameters of the investigation. Individual discrimination test score data appears in Appendix A. Group test score data appear in Appendix B.

Tabling the value of the F ratios provides a convenient method of summarizing the data used to analyze this hypothesis. This appears as Table Six for individual and group data.

TABLE 6

F Ratios for Discrimination Scores Obtained
For Caucasian Privileged Versus Caucasian Underpribileged
Children Using Individual and Group
Wepman Auditory Discrimination Tests

Age	Individual Test *	Group Test *
6	2.868	2.563
7	1.157	1.488
8	.043	.049

* No F ratios were significant at the .05 level of confidence.

It will be noted that none of the F ratios were statistically significant. The hypothesis is accepted relative to differences between individual tests and group tests for discrimination.

Discrimination score means and standard deviations were computed for Caucasian privileged and Caucasian underprivileged children relative to individual and group tests. These data were summarized in Table Seven.

TABLE 7

Discrimination Score Means and Standard Deviations
For Caucasian Privileged and Caucasian Underprivileged Children
Using Individual and Group Wepman Auditory Discrimination Tests

Age	Caucasian Privileged				Caucasian Underprivileged			
	Individual		Group		Individual		Group	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
6	34.6	5.8	28.4	4.8	30.6	5.7	25.2	3.9
7	36.5	1.4	31.8	3.6	35.5	3.0	29.7	4.6
8	35.8	3.4	32.8	3.1	36.1	2.1	32.3	5.4

Inspection of the Table reveals that:

1. Individual test scores were always better than group test scores at all ages and for both racial groups.

2. Caucasian privileged children tended to have better discrimination scores than did underprivileged Caucasian children.

3. In all instances, discrimination improved as a function of age.

In order to more closely analyze this data, a two way analysis of variance was done for individual and group tests in order to more closely determine the effects of age and status. Significant F ratios, at the 5% level of confidence, were obtained for age on both individual and group discrimination tests. With age held constant, there was a significant difference between discrimination scores, favoring privileged Caucasians for both tests. The interaction between age and status was also statistically significant. Table Seven suggests that discrimination ability improves with age for both status groups through age eight. The rate of increase is apparently more rapid for the underprivileged group in that the mean discrimination scores are markedly different between status groups at age six and quite similar at age eight. A summary of the analysis of variance tables related to this data appears as Appendix C.

HYPOTHESIS 3

Because of changes in the data collection method (See page 14), data for five year old children could not be used to test the third hypothesis as originally stated. Consequently, Hypothesis Three was altered to read that: There is no difference between scores obtained with the Wepman Auditory Discrimination Test in six to eight year old Caucasian and Negro children who are underprivileged. The data was analyzed using a single classification analysis of variance design for both individual and group tests, a two way analysis of variance for individual and group tests over age and race and by displaying means and standard deviations for the various parameters of the investigation. The analysis of variance summary tables appear as Appendix D, E, and F.

Tabling the values of the F ratios resulting from single classification of analysis is a convenient method of surveying the data used to analyze the hypothesis. The information appears as Table Eight for individual and group data. Astericked F ratios were significant at or beyond the .05% level of confidence. Means and standard deviations are shown in Table Nine.

TABLE 8

F Ratios for Discrimination Scores Obtained for Underprivileged Caucasian Versus Underprivileged Negro Using Individual and Group Wepman Auditory Discrimination Tests

Age	Individual Test	Group Test
6	7.9123*	.8509
7	3.2702	1.2147
8	.2918	3.8551

* Significant at the .05% level of confidence

TABLE 9

Discrimination Score Means and Standard Deviations for Underprivileged Caucasian and Underprivileged Negro Children Using Individual and Group Wepman Auditory Discrimination Tests

Age	Caucasian Underprivileged				Negro Underprivileged			
	Individual		Group		Individual		Group	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
6	30.6	5.7	25.2	3.9	29.4	5.7	23.3	5.6
7	35.5	3.0	29.7	4.6	31.4	6.7	26.8	7.2
8	36.1	2.1	32.3	5.4	35.5	2.9	28.3	4.3

Inspection of Table Eight reveals that the only significant F ratio was the one obtained for six year old underprivileged children using the individual discrimination test. With this exception, the hypothesis is accepted. Inspection of Table Nine reveals that:

1. Discrimination scores improve with age without respect to the type of discrimination test or race,

2. Individual discrimination tests produce better discrimination scores than do group tests,

3. Caucasian underprivileged children tend to have better auditory discrimination than do Negro underprivileged children.

A two way analysis of variance analysis in which age and race were held constant revealed significant F ratios at the .05% level of confidence for both age and race when the individual discrimination test was used. When the group test was used to obtain discrimination scores, the factor of race was significant at the .05% level but age was not.

HYPOTHESIS 4

Hypothesis 4 states that there is no correlation between scores obtained with the Wepman Auditory Discrimination Test and the subtest of the Stanford Reading Achievement Test in first, second, and third grade Caucasian children who are privileged and underprivileged. The data related to discrimination test scores, grade level, and the various subtests of the Stanford Reading Achievement Test were subjected to correlation analysis.

Correlation coefficients obtained with the use of the individual Wepman Auditory Discrimination Test appear as Table Ten.

TABLE 10

Correlation Coefficients for Individual Wepman Auditory Discrimination Tests and Stanford Reading Achievement Subtests for Privileged and Underprivileged Caucasian Children

Age	Grade	Word Meaning		Paragraph Meaning		Vocabulary		Spelling		Word Study Skills	
		P	UP	P	UP	P	UP	P	UP	P	UP
6	1	-.07	-.16	-.20	-.20	.04	.08	-.01	-.40	.03	-.57
7	2	.06	.27	-.10	.60	-.12	.51	-.20	.20	-.05	-.06
8	3	.18	.12	.10	.18	-.10	.00	.07	.10	-.10	-.20

P - Privileged
UP - Unprivileged

Inspection of this Table reveals low order positive and negative correlations throughout the data. The magnitude of the correlations and the almost random direction of correlation do not reveal any strong relationship between discrimination ability, grade level, status, and achievement as measured by the subtests of the Stanford Reading Achievement Test. For the purposes of this study, the hypothesis is accepted for individual tests. Table Eleven provides the same information as Table Ten excepting that discrimination scores were obtained using the group version of the Wepman Auditory Discrimination Test.

TABLE 11

Correlation Coefficients for Group
Wepman Auditory Discrimination Tests and Stanford Reading Achievement
Subtests for Privileged and Underprivileged Caucasian Children

Age	Grade	Word Meaning		Paragraph Meaning		Vocabulary		Spelling		Word Study Skills	
		P	UP	P	UP	P	UP	P	UP	P	UP
6	1	-.32	-.16	-.50	-.20	-.14	-.36	-.22	-.10	-.21	-.15
7	2	.13	.18	.57	.05	.11	.14	-.03	.03	.15	-.23
8	3	-.04	.55	-.08	.58	-.29	.37	-.09	.35	.07	.26

P - Privileged
UP - Underprivileged

Inspection of Table Eleven reveals the same essential findings as discussed relative to Table Ten. The low order of correlation for both the individual and group tests suggests that, for the purposes of this investigation, the Wepman Auditory Test would not be valuable in predicting sub-normal reading achievement. Hypothesis Four is accepted for both individual and group discrimination data.

HYPOTHESIS 5

Hypothesis 5 states that there is no correlation between scores obtained with the Wepman Auditory Discrimination Test and the subtests of the Stanford Reading Achievement Test in first, second, and third grade Caucasian and Negro children who are underprivileged. The data related to discrimination test scores, grade level, and the various subtests of the Stanford Reading Achievement Test were subjected to correlation analysis.

Correlation coefficients obtained with the use of the individual Wepman Auditory Discrimination Test appear in Table Twelve.

TABLE 12

Correlation Coefficients for Individual
Wepman Auditory Discrimination Tests and Stanford Reading Acheivement
Subtests for Underprivileged Caucasian and Underprivileged Negro Children

Age	Grade	Word Meaning		Paragraph Meaning		Vocabulary		Spelling		Word Study Skills	
		C	N	C	N	C	N	C	N	C	N
6	1	-.16	.54	-.20	.38	.08	.52	-.39	.07	-.58	.37
7	2	.27	.67	.59	.56	.51	.57	.20	.71	-.06	.49
8	3	.12	.46	.18	.09	.00	.56	.09	.64	-.20	.17

C - Caucasian N. Negro

Inspection of this table reveals low order positive and negative correlations throughout the data. The magnitude of the correlations and the almost random direction of correlation do not reveal any strong relationship between discrimination ability, grade level, status, and achievement as measured by the subtests of the Stanford Reading Achievement Test.

Table Thirteen provides the same information as Table Twelve excepting that discrimination scores were obtained using the group version of the Wepman Auditory Discrimination Test.

TABLE 13

Correlation Coefficients for Group
Wepman Auditory Discrimination Tests and Stanford Reading Achievement Subtests for Underprivileged Caucasian and Underprivileged Negro Children

Age	Grade	Word Meaning		Paragraph Meaning		Vocabulary		Spelling		Word Study Skills	
		C	N	C	N	C	N	C	N	C	N
6	1	-.16	-.07	-.18	.01	-.36	.01	-.10	-.15	-.15	-.07
7	2	.18	.59	.04	.36	.14	.45	.03	.50	-.23	.42
8	3	.54	.61	.58	.40	.37	.37	.35	.46	.25	.47

C - Caucasian
N - Negro

Inspection of Table Thirteen reveals the same essential findings as discussed relative to Table Twelve. The low order of correlation for both the individual and group tests suggests that, for the purposes of this investigation, the Wepman Auditory Test would not be valuable in predicting sub-normal reading achievement. Hypothesis 5 is accepted for individual and group discrimination data.

DISCUSSION

This study was undertaken in an attempt to obtain information in several areas. Primarily, it was undertaken with the hope that it would establish that the Wepman Auditory Discrimination Test could be given to groups of children instead of individually. If it could be established that the results of individual and group tests were the same, it would then be feasible to screen large groups of children for auditory discrimination problems in much the same way that they are currently screened for pure tone hearing losses.

A second primary goal of the study was to determine if poor performance on the individual and group versions of the Wepman Auditory Discrimination Test correlated with reading achievement in the sense that one could predict potentially poor readers on the basis of the Wepman Auditory Discrimination Test. If this were possible, it would permit school systems to identify potentially poor readers rapidly and economically. Given a known group of potentially poor readers, the literature suggests that the expected incidence of reading retardation could be materially reduced by the early application of appropriate auditory training and special reading-teaching techniques.

A secondary goal of this study was to investigate auditory discrimination as it relates to age, race, and status. The factors of age and socio-economic status have been investigated by others (13, 15, 32). A review of the literature failed to reveal information relating the auditory discrimination ability of underprivileged Caucasian children and underprivileged Negro children. Consequently, specific information was sought relative to the auditory discrimination of Caucasian underprivileged and Negro underprivileged children.

The data presented in the analysis section of this paper will be discussed relative to the goals stated above.

DISCRIMINATION AS MEASURED BY INDIVIDUAL AND GROUP TESTS

Both group and individual tests of auditory discrimination produced low order correlations for both Caucasian privileged and underprivileged children (Table One) and for underprivileged Caucasian and underprivileged Negro children (Table Three). The amount of unexplained variance between group and individual discrimination tests obtained in this study suggests that one could not accurately use scores obtained by the group test and relate them to scores obtained with the individual test. Consequently, it is not felt that the use of the group Wepman test, as operationally defined by this study, can be used interchangeably with the individual test. If the group version of the Wepman Auditory Discrimination Test is to be used in

subsequent research, statistical norms will have to be determined for it first.

It was of interest to note that discrimination scores obtained individually tended to be higher than those obtained with the group test. This trend was consistent over age, race, and socio-economic status (Tables Two, Four, Seven and Nine).

During the data collection period, it was noted that four year old children, irrespective of race or status, could not perform adequately on either version of the discrimination test. Five year old children, on the whole, performed better than four year old children, but did not perform well enough to conclude that either the Wepman or its group version can be used with them routinely. The five year old children tended to perform in the test situation much more adequately when the individual test was used. For these reasons, it is concluded that the Wepman test probably cannot be used adequately with four year old children and if it is to be used with the five year old population, the individual test will produce superior results to the group version. For the purposes of this study, it is germaine to state that the data indicates that neither version of the test would be a useful means of screening pre-school populations for auditory discrimination problems, because neither version of the Wepman Test can be given routinely to children five years of age and younger. This fact virtually precludes the test as an instrument for detecting discrimination problems on a large scale basis, if the end objective is to do so rapidly and economically.

RELATIONSHIP OF AUDITORY DISCRIMINATION AND READING ACHIEVEMENT

The discrimination data for this study was gathered near the beginning of the school year. Reading achievement data was gatnered for the same subjects at the close of the school year. The reading achievement data consisted of sub-sections dealing with word meaning, paragraph meaning, vocabulary, spelling, and word study skills.

Discrimination data, gathered in both individual and group conditions, were compared with the subtests of the reading achievement Test. These data were also available as they related to the parameters of age, race, and status. These data were subjected to correlation analysis. The obtained correlation coefficients were all similar in that they were basically low order correlations and that the magnitude of correlation varied between the investigated parameters in a random fashion. Considering the data as a whole, the correlation coefficients ranged from a -.58 to .71. The mode of the correlation coefficients approximated .10 to .20 with an almost equal number of positive and negative correlations. In view of these findings, it was concluded that neither version of the Wepman Auditory Discrimination Test were useful in predicting poor reading achievement as defined by this study. It is felt that the goal of this study, that is, to find a means of predicting poor reading achievement so that the potential for adequate achievement can be improved is a germaine one. It does not seem that the Wepman Auditory Discrimination Test will help attain this goal.

RELATIONSHIP OF AUDITORY DISCRIMINATION AND AGE

The results of this study support the findings of other investigations (15, 17, 31, 32) in that auditory discrimination ability increased with age (Tables Two, Four, Seven, and Nine). The data obtained in this study suggests that auditory discrimination is a function of both maturation and learned skills. A progression of discrimination ability could be clearly seen. Four year old children were unable to perform adequately on either the individual or group versions of the test. Five year old children as a group were unable to perform adequately, particularly on the group versions of the test. However, some individual five year olds obtained scores equal to those of eight year old children. Discrimination ability increased with age without respect for either race or socio-economic status, on both the individual and group tests.

The data supports the general conclusion that the individual auditory Wepman Test is a useable tool with selected five year old children and that both the individual and the group versions of the auditory test can be used with children six years of age and older. Parenthetically, it should be noted that in this study the individual condition always produced better discrimination scores than did the group version.

AUDITORY DISCRIMINATION AND SOCIO-ECONOMIC STATUS

The literature has established that auditory discrimination differences exist between children with high socio-economic status and children with low socio-economic status. The data obtained during this investigation is in substantial agreement with the older literature. This study provides new information regarding the relationship of discrimination ability and status. Prior studies have not controlled possible effects of race. This study controlled race and status in that both high and low status Caucasian children appeared in the sample. It was found that privileged Caucasian children obtained higher discrimination scores than did underprivileged Caucasian children at age five. This difference decreased with age and disappeared at age seven (Table Two). This trend was evident in data collected using both individual auditory discrimination test and the group auditory discrimination test. The data also supports the contention that privileged children obtained better discrimination scores at an earlier age than do underprivileged Caucasian children. This finding tends to support the generally held opinion that discrimination is influenced by sociological and educational factors.

AUDITORY DISCRIMINATION AND RACE

The literature strongly suggests that there is a relationship between auditory discrimination and status. In most instances, high and low socio-economic status has been operationally defined, at least in part, along ethnic grounds. This fact makes it difficult to ascertain whether the differences found between children at high socio-economic status and those of low economic status may be attributed solely to socio-economic status or if they may, in part, be attributed to some

racial characteristic. The design of this study makes it possible to compare the auditory discrimination ability of Caucasian underprivileged children and Negro underprivileged children living within the same school system. This portion of the data was analyzed using an analysis of variance technique. The obtained F ratio approached significance at the .05% level of confidence. A study of the mean discrimination score for these two groups of children revealed that the Caucasian underprivileged children consistently obtained better auditory discrimination scores than did Negro underprivileged children (Table Four and Table Nine). It was also noted that the Caucasian underprivileged children, as a group, were able to be tested at an earlier age than their Negro counterparts (Table Five).

These findings do not warrant the conclusion that Caucasian underprivileged children have better auditory discrimination than Negro underprivileged children. However, inspection of Tables Four and Nine clearly indicates that Caucasian children, on the average, always obtained better discrimination scores than did the Negro underprivileged children. It seems possible that the limited sample sizes may have obscured a statistically significant difference between the two races. It is felt that the social, educational, and racial implications of this trend towards better auditory discrimination is worthy of a large scale investigation. The evidence provided by this study cannot be generalized to support either a theory of genetic superiority or a theory of environmental superiority. It does, however, clearly suggest that if genetic factors are similar for both races then there is some subtle sub-environmental influence operating in Negro families, or sub-environments, which do result in sub-normal auditory discrimination at least until eight years of age. If these theorized sub-environmental influences could first be isolated and then removed, the potential benefits to our society would be substantial.

CONCLUSIONS

SUMMARY

The major thesis of this study was that the use of group auditory discrimination tests may permit the prediction of poor reading achievement and that poor reading achievement might then be eliminated or reduced by the early use of auditory training and/or special reading-teaching techniques. Specifically, this study was designed to investigate:

1. The relationship of the Wepman Auditory Discrimination Test and a group modification of the same test.

2. The relationship of auditory discrimination scores as measured by these tests and reading achievement.

3. The relationship of auditory discrimination to age, race, and socio-economic status.

To facilitate the investigation, a series of null hypotheses were formed and an experimental model was designed to test them.

The experimental design comprised:

1. Obtaining discrimination scores using the Wepman Auditory Discrimination Test and a modified group version for privileged Caucasian children, underprivileged Caucasian children, and underprivileged children at ages four, five, six, seven, and eight.

2. Obtaining scores on the subtests of the Stanford Reading Achievement Test for the same children.

3. Subjecting the obtained data to statistical analysis using analysis of variance and correlation coefficient techniques.

CONCLUSIONS

Based upon analysis of the data, and within the limitations imposed by the experimental design and methodology, the following conclusions seem justified:

1. Neither the individual Wepman Auditory Discrimination Test or the group version used in this study can be used with children four years of age or younger.

2. Neither discrimination test can be used routinely with five year old children.

3. The group version of the Wepman Auditory Discrimination Test produces test scores that are not interchangeable with the individual Wepman Auditory Discrimination Test.

4. The individual Wepman Auditory Discrimination Test produced better discrimination scores than does its group version.

5. Neither version of the Wepman Auditory Discrimination Test predicts poor reading achievement reliably enough to use either test as a device for selecting children for special reading therapy.

6. Auditory discrimination ability increases with age up to age eight.

7. Privileged Caucasian children have better auditory discrimination than do underprivileged Caucasian children.

8. Underprivileged Caucasian children have better auditory discrimination than do underprivileged Negro children.

9. The Wepman Auditory Discrimination Test norms were not paralleled by the data collected by this investigation.

FUTURE RESEARCH

The data obtained in this investigation did not support the major hypothesis, i.e., that it is possible to use the Wepman Auditory Discrimination Test to predict poor reading achievement and that identifying children with auditory discrimination problems could lead to a reduction in poor reading achievement via appropriate auditory training procedures and/or special reading-teaching techniques. It is felt that the original premise is a sound one. For this reason, it is suggested that other types of auditory discrimination tests be used in an attempt to predict poor reading achievement.

The finding that underprivileged Caucasian children tended to exhibit better auditory discrimination than do underprivileged Negro children is a new finding. This new information has many socio-economic and educational ramifications. It seems highly desirable to design studies capable of determining if there is, in fact, a racial difference relative to auditory discrimination.

The discrimination scores obtained during this investigation for both the individual and group versions of the Wepman Auditory Discrimination Test were at variance with the norm published for the test. The children in this investigation tended to yield many more Y and X error scores than the norms indicated they should. Other recent investigators have also found this phenomenon. An implication of this finding is that the Wepman Auditory Discrimination Test norms should be investigated.

APPENDIX A

TABLE 1A

Summary of an Analysis of Variance for Privileged Caucasian Versus Underprivileged Caucasian Children, Age Six, Individual Data

Source of Variation	SSD	dF	MS	F
Within Groups	.79916665+03	22	.36325756+02	2.8676*
Among Groups	.10416668+03	1	.10416668+03	
Total	.90333328+03	23		

*Not significant at the .05 level of confidence.

TABLE 2A

Summary of an Analysis of Variance for Privileged Caucasian Versus Underprivileged Caucasian Children, Age Seven, Individual Data

Source of Variation	SSD	dF	MS	F
Within Groups	.13391666+03	22	.60871210+01	1.1568*
Among Groups	.70416687+01	1	.70416687+01	
Total	.14095832+03	23		

*Not significant at the .05 level of confidence.

TABLE 3A

Summary of an Analysis of Variance for Privileged Caucasian Versus Underprivileged Caucasian Children, Age Eight, Individual Data

Source of Variation	SSD	dF	MS	F
Within Groups	.19258332+03	22	.87537873+01	.0428*
Among Groups	.37500000-00	1	.37500000-00	
Total	.19295832+03	23		

*Not significant at the .05 level of confidence.

APPENDIX B

TABLE 1B

Summary of an Analysis of Variance for Privileged Caucasian Versus Under-privileged Caucasian Children, Age Six, Group Data

Source of Variation	SSD	dF	MS	F
Within Groups	.47058333+03	22	.21390150+02	2.9628*
Among Groups	.63375000+02	1	.63375000+02	
Total	.53395829+03	23	.63	

*Not significant at the .05 level of confidence.

TABLE 2B

Summary of an Analysis of Variance for Privileged Caucasian Versus Under-privileged Caucasian Children, Age Seven, Group Data

Source of Variation	SSD	dF	MS	F
Within Groups	.41633332+03	22	.18924242+02	1.4884*
Among Groups	.28166668+02	1	.28166668+02	
Total	.44450000+03	23		

*Not significant at the .05 level of confidence.

TABLE 3B

Summary of an Analysis of Variance for Privileged Caucasian Versus Under-privileged Caucasian Children, Age Eight, Group Data

Source of Variation	SSD	dF	MS	F
Within Groups	.46291665+03	22	.21041666+02	.0495*
Among Groups	.10416682+01	1	.10416682+01	
Total	.46385830+03	23		

*Not significant at the .05 level of confidence.

APPENDIX C

TABLE 1C

Summary of a Two Way Analysis of Variance for Privileged Caucasian and Underprivileged Caucasian Children With Status and Age Held Constant, Individual Data

Source of Variation	SSD	dF	MS	F
Status	60.5000	1	60.5000	3.5472*
Age	115.8611	2	57.9306	3.3966*
Interaction	108.5833	2	54.2917	3.1832*
Residual Error	1125.6662	66	17.0555	
Total	1410.6107	71		

*Significant at or beyond the .05 level of confidence.

TABLE 2C

Summary of a Two Way Analysis of Variance for Privileged Caucasian and Underprivileged Caucasian Children With Status and Age Held Constant, Individual Data

Source of Variation	SSD	dF	MS	F
Status	196.6805	1	196.6806	9.8185*
Age	130.5278	2	65.2639	3.2581*
Interaction	171.3611	2	85.6806	4.2773*
Residual Error	1322.0830	66	20.0316	
Total	1820.6524	71		

*Significant at or beyond the .05 level of confidence.

APPENDIX D

TABLE 1D

Summary of an Analysis of Variance for Underprivileged Caucasian Versus Underprivileged Negro Children, Age Six, Individual Data

Source of Varia Variation	SSD	dF	MS	F
Within Groups	.66916665+03	22	.30416666+02	.79123*
Among Groups	.24066666+03	1	.24066666+03	
Total	.90983329+03	23		

*Not significant at the .05 level of confidence.

TABLE 2D

Summary of an Analysis of Variance for Underprivileged Caucasian Versus Underprivileged Negro Children, Age Seven, Individual Data

Source of Variation	SSD	dF	MS	F
Within Groups	.64583330+03	22	.29356059+02	3.3703*
Among Groups	.96000000+02	1	.96000000+02	
Total	.74183320+03	23		

*Not significant at the .05 level of confidence.

TABLE 3D

Summary of an Analysis of Variance for
Underprivileged Caucasian Versus
Underprivileged Negro Children,
Age Eight, Individual Data

Source of Variation	SSD	dF	MS	F
Within Groups	.15391666+03	22	.69962120+01	.2918*
Among Groups	.20416644+01	1	.20416644+01	
Total	.74183320+03	23		

*Not significant at the .05 level of confidence.

APPENDIX E

TABLE 1E

Summary of an Analysis of Variance for Underprivileged Caucasian Versus Underprivileged Negro Children, Age Six, Group Data

Source of Variation	SSD	dF	MS	F
Within Groups	.56991667+03	22	.25905302+02	.8509*
Among Groups	.22041662+02	1	.22041662+02	
Total	.59195831+03	23		

*Not significant at the .05 level of confidence.

TABLE 2E

Summary of an Analysis of Variance for Underprivileged Caucasian Versus Underprivileged Negro Children, Age Seven, Group Data

Source of Variation	SSD	dF	MS	F
Within Groups	.87233330+03	22	.39651513+02	1.2147*
Among Groups	.48166663+03	1	.48166663+02	
Total	.92050000+03	23		

*Not significant at the .05 level of confidence.

TABLE 3E

Summary of an Analysis of Variance for
Underprivileged Caucasian Versus
Underprivileged Negro Children,
Age Eight, Group Data

Source of Variation	SSD	dF	MS	F
Within Groups	.57091665+03	22	.25950757+02	3.8551*
Among Groups	.10004165+03	1	.10004165+03	
Total	.67095827+03	23		

*Not significant at the .05 level of confidence.

APPENDIX F

TABLE 1F

Summary of a Two Way Analysis of Variance for Underprivileged Caucasian and Underprivileged Negro Children With Race and Age Held Constant, Individual Data

Source of Varia Variation	SSD	dF	MS	F
Race	284.0139	1	284.0139	13.4316*
Age	350.5277	2	175.2639	8.2886*
Interaction	446.1944	2	223.0972	10.5507*
Residual Error	1395.5826	66	21.1452	
Total	2476.3187	71		

*Significant at or beyond the .05 level of confidence.

TABLE 2F

Summary of a Two Way Analysis of Variance for Underprivileged Caucasian and Underprivileged Negro Children With Race and Age Held Constant, Individual Data

Source of Variation	SSD	dF	MS	MS	F
Race	177.3472	1		177.3472	5.8454*
Age	109.7778	2		54.8889	1.8091*
Interaction	348.1111	2		174.0555	5.7369*
Residual Error	2002.4163	66		30.3396	
Total	2637.6523	71			

*Significant at or beyond the .05 level of confidence.

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