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ABSTRACT

Although the Intellectual Development (ID) index was constructed using standard psychometric procedures, the derivation of the other two indexes, Socio Intellectual Status (SIS) and Differential Intellectual Development (DID), by criterion scaling should have applications in diverse areas of scale or index construction. The ID is basically comparable to an intelligence quotient index. The SIS is somewhat analagous to a Socio-Economic Status (SES) index, while the DID reflects intellectual achievement independent of the SIS family background contribution to the ID Index. The use of the three indexes in studying findings from the Cycle II children's survey (aged 6-11 years) of 1963-65 helps to clarify some persistent issues related to intellectual achievement. The first-order analyses revealed statistically significant relationships between the ID Index and (1) number of pregnancies previous to the birth of the examined child; (2) twin versus nontwin birth status; and (3) attendance vs. nonattendance at nursery school and/or kindergarten. However, these relationships were mostly attributed to family background factors reflected in the Socio-Intellectual index. Although the numerical index values derived in this report are specific and limited to the data of the Health Examination Survey Cycle II (children) and Cycle III (youths), the data base should have widespread applicability to behavioral scientists. Statistical data are appended, as well as brief notes on criterion scaling, multiple linear regression, and skewness and kurtosis tests. (Author/CP)

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The Construction and Utility of Three Indexes of Intellectual Achievement:

An Intellectual-Development (ID) Index
A Socio-Intellectual-Status (SIS) Index
A Differential-Intellectual-Development (DID) Index

U.S. Children and Youths, 6-17 Years

A methodological report on the construction and utility of three indexes of intellectual achievement. The concept of partitioning a measure of intellectual development into measurable components and the method of criterion scaling are seen as providing a structure for use by behavioral scientists in general as well as in the particular case of the search for contributing and impeding conditions associated with intellectual development.

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Harold J. Dupuy, Ph.D.

CONTENTS

LIST OF TEXT TABLES

SYMBOLS

Data not available	---
Category not applicable	...
Quantity zero	-
Quantity more than 0 but less than 0.05	0.0
Figure does not meet standards of reliability or precision	*

THE CONSTRUCTION AND UTILITY OF THREE INDEXES OF INTELLECTUAL ACHIEVEMENT

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SUMMARY

This report describes the construction of three indexes of intellectual achievement for use in analyses of the National Center for Health Statistics' Health Examination Survey findings for U.S. children (aged 6-11 years) and youths (aged 12-17 years).

Method

The index of Intellectual Development (ID) was developed through the application of standard psychometric procedures. However, the derivation of the other two new indexes, Socio-Intellectual Status (SIS) and Differential-Intellectual Development (DID), should be of major methodological significance to behavioral scientists who are concerned with advancing measurement capability into a heretofore intractable area. The elaboration and successful application of the method of criterion scaling as described in this report should encourage applications in many diverse areas of scale or index construction.

A note of caution is in order. The numerical index values derived in this report are specific and limited to the data of the Health Examination Survey Cycles II (children) and Cycle III (youths). However, the anticipated use of these data bases both within the National Center for Health Statistics (NCHS) and outside NCHS is the justification for presenting the obtained values and their incorporation, as individual examination components, into each examinee's data tape record for these two national examinations. Copies of these tapes can be purchased from NCHS.

Utility

The index of Intellectual Development (ID) can be used as a surrogate measure comparable to the Full Scale IQ (intelligence quotient) of the Wechsler Intelligence Scale for Children (WISC), 1949. The Socio-Intellectual-Status (SIS) index can be used as a single control, moderator, or covariate index for determining the contribution of the SIS family background factor in analytical studies of other examination findings.

The utility of the Differential-Intellectual-Development (DID) index is seen in terms of its potential for studying and identifying other examination findings that bear on intellectual development when the confounding intrusiveness of SIS is removed. The DID index provides an indicator of intellectual achievement that is independent of the concomitant relationship of the index of Intellectual Development and the family background factors used to construct the Socio-Intellectual-Status index.

Substantive Findings

The use of the three indexes in studying some examination findings from the Cycle II children's survey (aged 6-11 years) of 1963-65 helps to clarify some persistent issues related to intellectual achievement.

The first-order analyses revealed statistically significant relationships between the index of intellectual development and (1) number of pregnancies previous to the birth of the examined child, (2) twin versus nontwin birth status, and (3) attendance versus nonattendance at nursery school and/or kindergarten. However, these relationships were mostly accounted for by the family background factors reflected in the Socio-Intellectual-Status index. No important amount of variance was found in the residual component of the index of Intellectual Development as measured by the Differential-Intellectual-Development index. Thus the first-order relationships with the index of Intellectual Development were accounted for by the differential prevalence of these conditions among children coming from family backgrounds with different SIS index values.

INDEX DEVELOPMENT

Introduction

This report presents the methods of constructing three indexes of intellectual achievement derived from data collected by the NCHS' national Health Examination Surveys of U.S. children (6-7 years of age) and youths (12-17 years of age). The children's survey was conducted from 1963-65; the youths' from 1966-70. These surveys have been described in previous NCHS publications.[1]

The applications of these indexes in the analyses of some data from the Cycle II children's examination survey are also presented. While these findings may be of substantive interest to some readers, they are not exhaustive of the issues they reflect.

The three indexes of interest in this report bear on the measurement of intellectual achievement of our Nation's children and youths. These are labeled descriptively as indexes of:

Intellectual Development (ID)

Socio-Intellectual Status (SIS)

Differential-Intellectual Development (DID)

The index of Intellectual Development (ID) is basically comparable to an Intelligence Quotient (IQ) index. The Socio-Intellectual-Status (SIS) index is somewhat analogous to a Socio-Economic-Status (SES) index. However, the components of SIS were rigorously calibrated to reflect the contribution of certain family background factors to intellectual development which existed independently of the child's or youth's own control. The Differential-Intellectual-Development (DID) index is taken as reflecting intellectual achievement of the child or youth independent of the SIS family background contribution to the index of Intellectual Development.

The concept of a SIS-type index emerged from the perception of the confounding or intrusive relationship of certain family background characteristics in studying the associations among health-related variables within groups of individuals (in contrast to intra-individual associations). This seems to be especially relevant to studying the associations of certain somatic insults with intellectual development. For example, if a strong (negative) relationship were found between scarlet fever and intellectual development, the next question would be, Is this association accountable by a (possible) joint relationship of these two conditions with a common SIS-type family background? Also important in the conceptualization of SIS was the possibility of identifying a parsimonious set of family background factors which could be ordered along some dimension (scaled) so that none of the many other family background factors, which are or may be associated with intellectual development at the single variable level, would show an association when the scaled dimension is taken into account. The given investigator could then "control" on this one dimension rather than having to consider the many other singular variables. Thus SIS could serve as a moderator or covariate dimension in the study of associations among any health variables that also may covary along this family background dimension. As an example, if one wanted to study the association of the number of decayed teeth with diseased tonsils, the investigator might want to "partial out" the common variance of these two conditions with SIS.

The conceptualization of DID was a rational extension of a more general concept to a specific application. The general concept is that the variance in common between two (or more)

variables can be extracted and the residual variance in the variable of interest can be rescaled as an index for use in measuring its singular dimensionality. For example, raw score performances on a general vocabulary test are highly correlated with age from about age 2 to age 15. The age factor can be "taken out" and the vocabulary score achievement can be rescaled to be independent of age.

Criterion Scaling of Predictor Variables

The concept of criterion scaling is rather simple and its application straightforward. In this context it refers to the scaling of, or assigning weights or numerical values to, *response options* within an item or to the original values along a measured dimension (e.g., inches of height), in terms of certain numerical values of the criterion of interest. At least two conditions must be met. Within a given data set, at least one data element must be considered the criterion and at least one or more of the other data elements must have more than a zero correlation with the criterion. A criterion, in this context, is a variable that discriminates the sample of observations along some dimension, or into categories, of interest. The criterion can be viewed as the dependent variable and the other variables as independent, predictor, or discrimination variables. The Technical Notes section provides a more complete description of the method of criterion scaling and compares the results of criterion scaling with multiple linear regression.

The Index of Intellectual Development (ID)

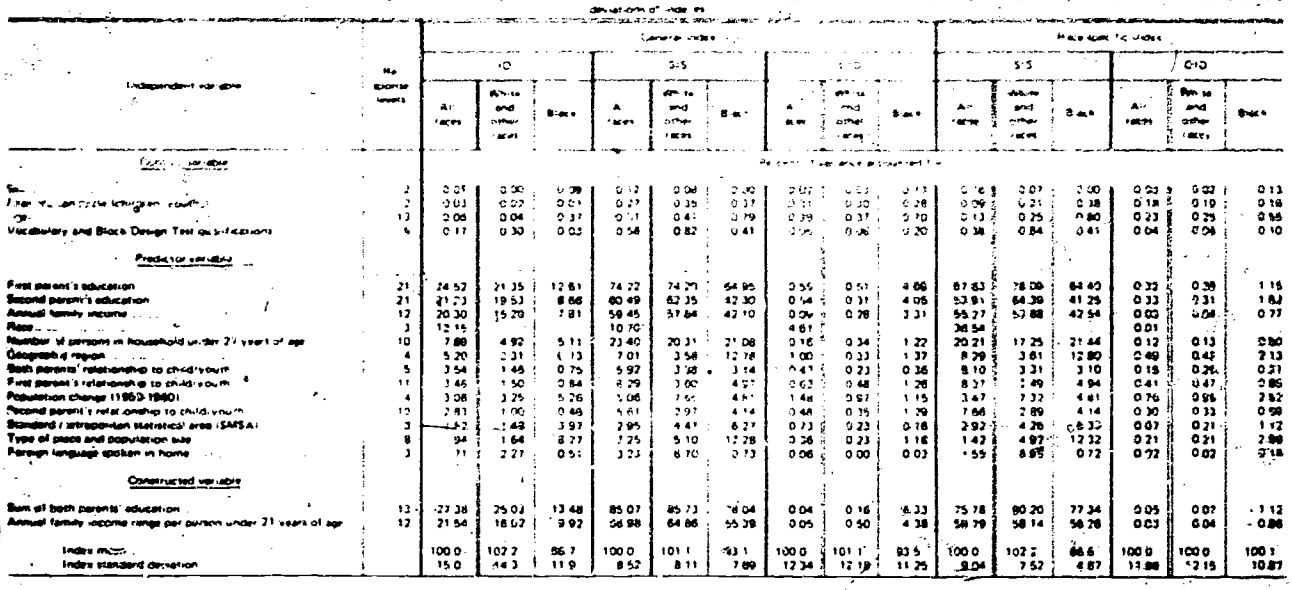
The index of Intellectual Development (ID) was constructed from the Vocabulary and Block Design subtests of the Wechsler Intelligence Scale for Children (WISC). These two subtests were given to both the children and youths. The total examined sample for 6-17 years of age was 13,887. A number of NCHS reports describe these two tests, the basis for selection, and procedures for examination and scoring.[1]

Independent research studies have found that the sum of the scaled scores for these two subtests correlates about .85 to .88 with total WISC IQ scores.[2] The raw scores on these subtests were transformed and normalized on the population estimates by 4-month age groups and within sex. The transformation was to T scores which are set to a mean and median of 50.0 and a standard deviation of 10.0 with the raw score population estimates of observations distributed according to the area under the normal curve. The T scores for the two subtests are thus sex-age independent. That is, the variance attributable to sex and age was removed. The two T scores were then summed. This provided a mean of 100.0. The population estimates were then redistributed to have a standard deviation of 15.0. These two properties are similar to the WISC Total Scale IQ score. The obtained range of ID scores was 46-152 which was very similar to the obtainable range of 46-154 for the WISC Total Scale IQ. The sample skew value of −.08 and kurtosis value of −.14 indicate a very close distribution fit to the normal curve.

In summary then, the high correlations found between the sum of the Vocabulary and Block Designs subtests with Total Scale WISC IQ, and the equivalence in means, standard deviations, ranges, and distributions provide sufficient support for accepting the ID index as a comparable measure of WISC Total Scale IQ and as suitable for making aggregate comparisons of intellectual development.

The Index of Socio-Intellectual Status (SIS)

The next step was to select a set of variables out of the total number of variables obtained for each child and youth that would reflect family characteristics and demographic factors that a priori would seem to be independent of any personal contribution of the children or youths. Also excluded were any variables that would be of substantive interest in their own right in later analyses. Excluded under these two considerations were such variables as age of father and age of mother at birth of examined person, number of previous pregnancies of the mother, birth weight, attendance at kindergarten, any childhood diseases, school questionnaire items, etc. The final selection included 4 "control" variables and 13 "predictor" variables that seemed to meet all specifications. Each of these 17 variables was then subjected to an analysis of variance computation with the ID index as the dependent variable for criterion scaling. The per-



cent of variance accounted for and the correlation ratio of each of these 17 variables with the ID index were also obtained. Table A presents the list of 17 variables and the percent of variance accounted for in the ID index for the total sample, and the two race categories of black and white and other races. The detailed tables (1-3) present the mean ID values for each response level for the 17 variables plus other detailed statistics.

A number of analytical methods were then tried in a search for a procedure that could be used to combine the variables in a way that would account for the most variance in the ID index and that would also seem to be most meaningful in terms of the purpose to be achieved. A multiple regression of the 13 criterion-scaled predictor variables with the ID index was not performed. Instead a suggestion[a] was made to give first consideration to variables that would seem to reflect a "functional" factor among parents. A variable was considered as functional if a given parent could have exercised some degree of control or influence in the development of that parent's own life style or status attainment. Four of the first five predictor variables shown in table A accounted for the most criterion variance and also seemed to be the most relevant under this functional direction. The fourth most important variable, race, was not considered as functional in the sense just used. Percent variance accounted for in the ID index is shown in table B.

Again in order to simplify the more direct meaningfulness of these four functional variables, they were combined into two "constructed" variables: (1) sum of both parents' education (X_1) and (2) annual family income per person under 21 years of age in the household (X_2). The combined response levels were then subjected to analyses of variance with the ID index. The response levels were then grouped on the basis of approximately equal mean ID values with a progressive increase in mean ID for group division. The grouped response levels were then criterion scaled for response weights. A scrutiny of tables C and D should help to

Table B. Percent variance accounted for by four independent predictor variables

Variable	Percent variance accounted for
First parent's education	24.52
Second parent's education	21.23
Family income	20.30
Number in household under 21 years of age	7.69

[a]By Lincoln I. Oliver, Chief, Psychological Statistics Branch, DHES, NCHS.

Table C. Unweighted sample size, mean Intellectual-Development (ID) scores, standard deviations, and constructed variables, by sum of both parents' education in years, with percent variance accounted for and correlation ratios

Sum of both parents' education	*n*	Mean ID	SD	Constructed variable X_1			
				Value	n_x	Mean ID	SD
Total	13,887	100.0	15.0	...	...	...	...
None	52	82.4	10.3				
1 year	8	90.5	11.4				
2 years	37	79.1	11.2				
3 years	42	81.9	11.6	080.7	402	80.7	11.1
4 years	83	78.1	10.9				
5 years	51	81.1	14.0				
6 years	129	80.9	9.4				
7 years	53	89.6	11.2				
8 years	151	85.7	12.3				
9 years	111	87.5	12.8	085.7	640	85.7	12.8
10 years	217	83.9	13.2				
11 years	108	85.3	12.6				
12 years	228	89.3	12.9				
13 years	165	87.3	11.3	088.5	793	88.5	12.7
14 years	400	88.5	13.0				
15 years	223	91.9	12.8	092.9	1,135	92.9	13.6
16 years	913	93.2	13.8				
17 years	389	93.6	11.6	094.1	1,136	94.1	12.4
18 years	747	94.4	12.6				
19 years	514	96.5	12.9	098.0	1,596	98.0	13.2
20 years	1,082	98.7	13.2				
21 years	647	100.9	12.9	100.4	1,628	100.4	12.9
22 years	981	100.2	12.8				
23 years	638	102.0	12.7	103.7	3,410	103.7	12.6
24 years	2,772	104.0	12.6				
25 years	414	107.1	12.1	106.5	912	106.5	12.2
26 years	498	106.0	12.2				
27 years	218	109.4	13.6	108.6	821	108.6	13.1
28 years	603	108.3	12.9				
29 years	353	111.5	12.0	111.4	598	111.4	12.3
30 years	245	111.3	12.7				
31 years	155	112.1	11.7	112.1	477	112.1	12.5
32 years	322	112.1	12.8				
33 years	211	116.6	13.8	114.5	338	114.5	14.3
34 years and more	127	111.0	14.3				
Percent variance accounted for	...	27.74	....	...	...	27.38	...
Correlation ratio	...	.53	...	...	...	.52	...

NOTE: *n* = sample size; SD = standard deviation.

Table D. Unweighted sample size, mean Intellectual-Development (ID) scores, standard deviations, and constructed variablas, by annual family income per person under 21 years of age in household, with percent variance accounted for and correlation ratios

Annual family income per person under 21 years of age in the household	n	Mean ID	SD	Constructed variable (X_2)				
				Value	n	Mean ID	SD	
Total	13,887	100.0	15.0	...	...	...	...	
$0-$124	148	83.6	12.4	083.6	148	83.6	12.4	
$125-$374	706	85.0	12.7	085.0	706	85.0	12.7	
$375-$624	859	88.4	12.5	088.4	859	88.4	12.5	
$625-$874	1,054	92.2	14.0	092.2	1,054	92.2	14.0	
$875-$1,124	588	94.1	13.1	094.2	588	94.1	13.2	[1]
$1,125-$1,374	915	97.3	13.8	097.3	915	97.3	13.8	
$1,375-$1,624	1,027	99.4	13.3	099.9	1,572	100.0	13.9	[2]
$1,625-$1,874	545	101.0	14.2					
$1,875-$2,124	789	101.9	13.1					
$2,125-$2,374	817	102.2	12.5	102.2	1,876	102.2	13.2	[3]
$2,375-$2,624	270	102.9	14.7					
$2,625-$2,874	808	105.2	12.5					
$2,875-$3,124	581	102.7	12.7					
$3,125-$3,374	461	106.1	12.8	104.3	1,937	104.3	12.9	
$3,375-$3,624	87	97.9	13.8					
$3,875-$4,124	66	109.0	14.5					
$4,125-$4,374	1,249	106.5	12.8					
$4,375-$4,624	100	100.3	14.3	106.2	1,828	106.2	13.3	
$4,875-$5,124	186	110.1	12.0					
$5,875-$6,124	227	102.8	14.7					
$6,125-$6,374	504	108.0	12.4					
$6,625-$6,874	281	113.5	13.5					
$8,325-$8,574	259	106.4	12.3					
$9,875-$10,124	262	110.6	12.9	109.2	1,597	109.2	12.9	
$12,375-$12,624	190	107.4	12.5					
$19,875-$20,124	101	109.8	12.5					
"Don't know income" and number of persons under 21 years of age								
1 person	51	99.3	11.9					
2 persons	118	100.4	13.8	099.9	362	99.9	(1)	[2]
3 persons	121	98.9	16.3					
4 persons	72	101.3	14.9					
5 persons	67	93.9	14.7					
6 persons	47	90.8	12.8					
7 persons	26	91.8	13.0					
8 persons	17	88.6	16.8	091.1	178	91.1	14.3	
9 persons	8	85.1	12.4					
10 persons or more	13	84.2	13.9					
Blank or refused on income and number of persons under 21 years of age								
1 person	56	105.8	12.8					
2 persons	57	103.7	15.5					
3 persons	49	98.9	14.1	102.2	196	102.6	(1)	[3]
4 persons	34	101.0	15.0					
5 persons	19	98.6	8.9					
6 persons	26	93.6	16.7					
7 persons	13	95.7	16.7					
8 persons	9	90.6	7.4	094.2	71	94.6	(1)	[1]
9 persons	...	...	...					
10 persons or more	4	86.2	6.2					
Percent variance accounted for	...	22.53	...	...	...	...	21.54	
Correlation ratio	...	.47	...	...	...	...	.46	

[1] Standard deviation not computed.

NOTES: n = sample size; SD = standard deviation. [ ] = grouped together in final variable construction.

clarify these procedures. The resultant outcome for each of these two constructed variables was to reduce response levels in (1) from 35 to 13 with only a slight decrease in percent variance accounted for from 27.74 percent to 27.38 percent and in (2) from 45 to 12 with about a 1-percent decrease in accounted for variance from 22.53 percent to 21.54 percent. Table A presents the percent variance accounted for by the two constructed variables.

A linear multiple regression equation of the two criterion-scaled constructed variables with the ID index was then computed. The values of the equation were:

$$Y' \text{ (ID)} = .7382\ (X_1) + .5598\ (X_2) - 29.80 = \text{SIS}$$

The "predicted" values of the ID index (Y') were then taken as SIS index values. The product-moment correlation between SIS and ID was .5676 and the correlation ratio was .5690. Since these two values are so close, a linear relationship between the two variables is indicated. The mean value for SIS was 100.0 which is the same as the mean for the ID index; the median was 102.0. The standard deviation of SIS was 8.52 compared to 15.0 for ID which reflects the remaining unaccounted for variance in ID. The range of SIS index values was 76.6-115.9 and the distribution of observations was clearly skewed toward the lower values of SIS. However, the skew value of −.53 is not so great as to preclude the use of the SIS index as a dependent variable in an analysis of variance design. A description of the skewness and kurtosis tests used is presented in the Technical Notes.

The Index of Differential-Intellectual Development (DID)

The construction of the Differential-Intellectual-Development (DID) index was straightforward. The DID index score was obtained by simply subtracting the SIS index score from the ID index score for each individual and adding a constant of 100.0: DID = ID − SIS + 100.0. Thus if an ID score was 120 and SIS was 110, the DID index value would be 10 + 100.0 or equal to 110.0 which indicates a differential intellectual development of 10 ID index scores higher than expected based on the SIS index value. The constant of 100.0 was added to give the DID index the same mean as the ID and SIS indexes; it also eliminates negative values and permits a readily perceived comparison of DID performance compared to ID and SIS. Thus a DID score, for example, of 100.0 indicates that the person's ID score was the expected value based on the person's SIS score.

The product-moment correlation between DID and ID was .8225 and the correlation ratio was .8215. The closeness of these two coefficients indicates an almost perfect linear relationship between DID and ID. The mean and median for DID was 100.0 and the standard deviation was 12.34. The product-moment correlation between DID and SIS was −.0015, which indicates a near zero relationship. An analyses of variance test was computed using SIS as the independent variable and DID as the dependent variable. SIS accounted for only 0.19 percent of the variance in DID; the correlation ratio was .04. Inspection of the mean DID values for each value of SIS in table E, also reveals only slight random variations of mean DID values across the whole SIS range of values.

The range of the DID index values was 47-143; the skew and kurtosis values of −.03 and .14 respectively indicate an almost normal distribution of observations on DID.

Race-Specific SIS and DID Indexes

The SIS and DID index values were entered in the data tape file of each child and youth and analyses of variance were then run for all control, predictor, and constructed variables. The amount of variance accounted for in the DID index was 4.61 percent by race, 1.48 percent by population change, and 1.00 percent by geographic region. None of the remaining variables accounted for as much as 1 percent of the variance in DID (table A). Several procedures were used in trying to take out the race variance in DID without using race. These included adjustment of criterion weights by geographic region and population change jointly and the recalibration of the two constructed variables by optimal criterion scaling within race. None of these worked. The final procedure used was to compute race-specific (white and other races and black) multiple regression equations for race-

Table E. Unweighted sample size, mean Socio-Intellectual-Status scores, means and standard deviations of Intellectual-Development scores and Differential-Intellectual-Development scores, by each value of the Socio-Intellectual-Status index, with percent variance accounted for and correlation ratios

SIS	n	Mean SIS	Mean ID	ID SD	Mean DID	DID SD
Total	13,887	100.0	100.0	15.0	100.0	12.34
077	121	77.2	77.6	11.3	100.4	11.3
079	82	79.3	[illegible]	9.2	98.9	9.2
080	30	80.3	81.1	12.0	100.8	12.0
081	243	81.1	82.2	11.0	101.1	11.0
082	38	82.4	83.6	12.8	101.2	12.8
083	264	83.0	82.7	11.5	99.8	11.5
084	47	84.3	87.4	10.9	103.1	10.9
085	177	85.0	86.1	11.6	101.1	11.6
086	214	86.2	85.3	12.1	99.0	12.1
087	222	87.1	86.3	10.8	99.2	10.8
088	263	88.2	89.2	11.9	101.0	11.9
089	183	89.2	88.6	11.6	99.4	11.6
090	306	90.2	89.5	12.0	99.3	12.0
091	413	91.3	91.4	12.9	100.1	13.0
092	219	92.1	91.6	12.3	99.5	12.3
093	195	93.1	93.3	12.7	100.2	12.8
094	452	94.1	93.8	13.2	99.7	13.2
095	321	94.9	95.2	13.5	100.3	13.5
096	467	95.9	95.4	12.4	99.5	12.4
097	523	97.0	97.3	12.9	100.3	12.9
098	708	98.3	98.1	12.8	99.8	12.8
099	338	99.1	99.6	12.2	100.5	12.2
100	572	100.0	99.8	13.0	99.8	13.0
101	819	101.2	101.5	12.1	100.3	12.1
102	206	102.0	101.0	13.3	99.0	13.3
103	868	102.8	103.1	12.0	100.4	12.0
104	990	103.9	103.3	12.3	99.4	12.3
105	934	105.1	105.4	11.9	100.3	11.9
106	797	106.2	106.7	12.3	100.5	12.3
107	186	107.2	106.7	12.2	99.5	12.2
108	699	108.0	107.6	11.8	99.6	11.7
109	198	108.8	109.2	13.5	100.3	13.5
110	521	109.9	109.3	12.2	99.4	12.2
111	342	111.0	110.8	12.6	99.6	12.7
112	296	112.1	112.9	12.5	100.8	12.5
113	44	113.1	112.7	15.9	99.6	15.9
114	445	113.9	114.3	11.8	100.4	11.8
116	144	115.9	116.1	13.9	100.2	13.9
Percent variance accounted for	...	99.94	32.38	...	0.19	...
Correlation ratio	...	.9997	.5690	...	.0361	...

NOTE: n = sample size; SD = standard deviation.

specific SIS indexes. The resultant equations were:

$$\text{SIS (white and other races)} = .7488\ (X_1) + .4293\ (X_2) - 16.53$$

$$\text{SIS (black)} = .4625\ (X_1) + .3613\ (X_2) + 8.62$$

The obtained summary statistics for race-specific SIS indexes are shown in table F.

These mean SIS values were now comparable to the mean ID values within race whereas the

Table F. Obtained means, standard deviations, range of scores, and Socio-Intellectual-Status and Intellectual-Development correlations for race-specific Socio-Intellectual-Status indexes

Race	Mean	SD	Range	SIS-ID correlation
All races	100.0	9.04	76-116	.6011
White and other races	102.0	7.52	80-116	.5258
Black race	86.6	4.87	76-101	.4034

original SIS values were not (table A). SIS was still skewed for all races, for white and other races, but not for blacks.

The DID index values were obtained from the race-specific SIS indexes as before. The mean race-specific DID value equal to about 100.0 for both race g while the original DID means were quite nt for the two race groups (table A). Analyses of variance were run for the race-specific SIS and DID indexes with all 19 variables. It is apparent in table A that differences in mean Intellectual Development (ID) among the predictor and constructed variables were due to SIS influences. Less than 1 percent of the variance in the race-specific DID index was accounted for by any of the 19 variables for all races and white and other races. Among blacks, about half of the predictor and constructed variables accounted for over 1 percent of the variance in DID. Inspection of the mean DID values by response levels for blacks (see detailed tables) did not reveal strong consistent trends sufficient to justify carrying the race-specific SIS index construction any further.

The race-specific DID index for all races had a mean of 100.0, standard deviation of 11.98, and a range of 44-142, and was still almost normally distributed.

Examined Sample Compared to Population Estimates

Since the ex sample (n = 13,887) was used in the devel of the SIS and DID indexes, a compari the results from the examined sample was made with the sample weighted population estimates. No important differences emerged between the sample and the population estimates within all races, white and other races, and blacks for means, standard deviations, skewness, and kurtosis (table G). However, the statistical values shown in this report should not be taken as population estimates; they are sample values only.

Intercorrelations of the Indexes

The product-moment intercorrelations among the indexes are shown in table H. The race-specific SIS and DID index coefficients with ID in the total sample was .601 and .798, respectively. SIS and DID correlated −.003. Analyses of variance were run with ID as the de-

Table G. Examined sample and population estimates summary statistics, by race and intellectual indexes

Race and index	Examined sample				Sample weighted population estimates			
	Mean	SD	Skew	Kurtosis	Mean	SD	Skew	Kurtosis
All races (n)	(13,887)				(46,476,063)			
ID	100.0	14.99	−.08	−.14	100.0	15.00	−.09	−.15
SIS (general)	100.0	8.52	−.53	−.27	100.0	8.67	−.54	−.31
DID (general)	100.0	12.34	−.03	.14	100.0	12.30	−.02	.16
SIS (race-specific)	100.0	9.04	−.51	−.57	100.0	9.11	−.52	−.58
DID (race-specific)	100.0	11.98	−.04	.20	99.9	11.95	−.03	.20
White and other races (n)	(11,901)				(40,180,771)			
ID	102.2	14.29	−.13	.07	102.1	14.31	−.14	.05
SIS (general)	101.1	8.11	−.68	.14	101.1	8.29	−.69	.09
DID (general)	101.1	12.18	−.06	.18	101.0	12.13	−.05	.18
SIS (race-specific)	102.2	7.52	−.65	.12	102.2	7.68	−.67	.07
DID (race-specific)	100.0	12.15	−.06	.18	99.9	12.10	−.05	.18
Black (n)	(1,986)				(6,295,292)			
ID	86.7	11.82	.17	.00	86.5	11.98	.18	.01
SIS (general)	93.1	7.69	.13	−.50	93.1	7.78	.14	−.52
DID (general)	93.5	11.25	.06	.37	93.4	11.29	.06	.40
SIS (race-specific)	86.6	4.87	.13	−.50	86.6	4.93	.14	−.52
DID (race-specific)	100.1	10.87	.12	.23	100.0	10.92	.13	.25

Table H. Matrix of product-moment intercorrelations of the indexes, by race

Race and index	ID	SIS_G	DID_G	SIS_{RS}	DID_{RS}
All races (n = 13,887)					
ID	1.000				
SIS (general)	.568	1.000			
DID (general)	.822	−.002	1.000		
SIS (race-specific)	.601	.944	.078	1.000	
DID (race-specific)	.798	−.003	.970	−.003	1.000
White and other races (n = 11,901)					
ID	1.000				
SIS (general)	.524	1.000			
DID (general)	.824	−.051	1.000		
SIS (race-specific)	.526	.998	−.048	1.000	
DID (race-specific)	850	−.001	.998	−.001	1.000
Black (n = 1,986)					
ID	1.000				
SIS (general)	.403	1.000			
DID (general)	.780	−.258	1.000		
SIS (race-specific)	.403	1.000	−.258	1.000	
DID (race-specific)	.912	−.008	.968	−.007	1.000

NOTE: G = general, RS = race-specific.

pendent variable with race-specific SIS and DID indexes. SIS accounted for 36.26 percent and DID accounted for 63.79 percent of the variance in ID for a total of 100.05 percent. Since these SIS and DID indexes were essentially independent indexes (r = −.003), this indicates that the total variance in ID was separated into two nonoverlapping independent components.

As a check on the stability of these index values across diverse groups, the results from the analyses of variance with the four control variables were inspected (table A and detailed table 1). No significant variance occurred across these subgroups for any of the indexes. A further check on the limits of possible shrinkage of the strength of relationship of SIS and ID was made. Analyses of variance were made of the full-range variable sum of parental education, None-34 years and more, with ID for Cycles II and III separately. The percent of variance accounted for in ID was 28.04 and 27.96 and the correlation ratios were .530 and .529 respectively for the two cycles. These checks support the position that the strength of relationships reported for the combined sample would have been very close had one cycle been used to develop the indexes and then cross-validated on the other cycle.

Since the correlation between ID and race-specific SIS was .60 and since other studies[3] indicate a correlation of IQ of about .55 between siblings reared together, the position is taken that the SIS index is measuring a generalized sociological family background factor relating to intellectual achievement. However, DID cannot be taken, at least at this time, as independent of other intrafamily characteristics, orientations, and interactions.

Future research investigations into family contributors to children's intellectual achievement should include direct measures of parental intellectual achievement as well as intellectual achievement orientations and supports within the family.

SUBSTANTIVE FINDINGS

Application of the ID and Race-Specific SIS and DID Indexes to Substantive Examination Findings from Cycle II, Children 6-11 Years of Age

About 500 data elements were available on an extended data tape for the 7,119 children 6-11 years of age examined in Cycle II.

Sixteen data elements or variables were

selected to "test out" the indexes. The following nine variables were selected for which product-moment correlations were computed with the three indexes.

The two constructed variables
1. Sum of parental education
2. Annual family income per household person under age 21

The two Wechsler Intelligence Scale for Children (WISC) subtests used in constructing ID
3. T-scored Vocabulary subtest
4. T-scored Block Design subtest

Two tests from the Wide Range Achievement Test (WRAT)
5. T-scored Reading Test
6. T-scored Arithmetic Test

The Harris-Goodenough Draw-A-Person Test (DAP)
7. T-scored DAP Test

An educational achievement composite score of the two WRAT tests (mean 100.0, standard deviation 15.0—the same as ID)
8. Education achievement

A total measured performance index made of the two WISC, two WRAT, the DAP Test scores (mean 100.0, standard deviation 15.0)
9. Total performance

The correlation coefficients are shown in table J.

The intercorrelations among the three indexes were almost identical to those found on the combined Cycles II and III sample. Neither one of the two constructed variables that were used for deriving the SIS index correlated with DID. The WISC Vocabulary subtest contributed more to SIS than Block Design contributed, and the reverse occurred for DID. The WRAT tests had slightly higher correlations with SIS than with DID; the reverse was true for the Draw-A-Person (DAP) Test.

The correlations of SIS with the WRAT and the DAP Test are reasonable expectations. The DID correlations with these three tests indicate that it has a meaningful measurement property and is not just a random residual component of

Table J. Correlation coefficients, means, and standard deviations for intellectual indexes and selected variables

Index and variable[1]	ID	Race-specific		Mean	SD
		SIS	DID		
Index	Correlation coefficient				
ID	1.000	.603	.793	100.2	14.91
SIS	.603	1.000	−.009	99.7	9.09
DID	.793	−.009	1.000	100.5	11.90
Constructed variable					
Sum of parental education	.523	.880	−.016	100.1	7.0
Annual family income per household person under age 21	.486	.790	.006		
WISC					
T-scored Vocabulary subtest	.859	.581	.633	50.3	9.82
T-scored Block Design subtest	.857	.454	.727	50.2	9.76
WRAT					
T-scored Reading test	.633	.505	.408	50.2	9.81
T-scored Arithmetic test	.612	.463	.413	50.2	9.77
Draw-A-Person Test	.481	.263	.402	50.4	9.86
Educational achievement composite	.679	.530	.447	100.1	14.94
Total performance composite	.895	.589	.671	100.2	14.88

[1]Sample size = 7,119.

the ID index after SIS variance was taken out.

The next seven variables were selected because of interest in their substantive properties. Analyses of variance were used to try to explicate their relationships with intellectual achievement and as further tests of application of the SIS and DID indexes. The dependent variables were the ID and race-specific SIS and DID indexes. The substantive variables are as follows:

1. Number of pregnancies previous to the birth of the examined child as reported at the time of examination.
2. Parental reporting of attendance at nursery school or kindergarten of the examined child.
3. Parental reporting of a talking problem of the examined child.
4. Twin status as determined from parental interview and birth certificates.
5. Judged intellectual level by school personnel as given on the school questionnaire.
6. Need for special school resources as indicated by school personnel on the school questionnaire.
7. Diagnostic impressions of neurological, muscular, or joint conditions by the examining physician. Interest in this variable was centered on the relationships of the neurological conditions and intellectual achievement indexes.

In the following description of findings, if at least 1 percent of variance is accounted for in any of the three indexes, then this will be considered as statistically significant or of practical importance.

A guide in the interpretation of the relative contribution of SIS versus DID in reflecting their respective parts of the Intellectual Development (ID) index is that the percent of variance accounted for in the SIS index must be almost two times as great as in the DID index to show equal accounting. A more precise indicator is to multiply each percent of variance by .364 for SIS and .629 for DID. This indicates *how much of the ID index variance* was accounted for in the SIS and DID indexes. The sum of these computed variances will not necessarily equal the ID variance due to SIS and DID interactions with a given condition.

While a substantial relationship is shown between number of previous pregnancies (or approximate birth order) and the index of Intellectual Development, the variance was almost completely accounted for by SIS (table K). These findings thus indicate that birth order per se has little to do with the intellectual achievement of the child when the Socio-Intellectual-Status index of the family is taken into consideration. That is, children further down in birth order also come from families with lower SIS.

Attendance at nursery school or kindergarten was associated with the index of Intellectual Development and SIS but had little relationship with the index of Differential-Intellectual Development (table L). Thus attendance did not contribute to the Differential-Intellectual-Development index.

While reported talking problems were related to the index of Intellectual Development, a part of this relationship was due to more talking problems among lower SIS families (table M). However, "hard to understand" does seem to have a negative relationship on the index of

Table K. Sample size and mean index scores of intellectual achievement, by number of pregnancies previous to birth of examined child, with percent variance accounted for and correlation ratios

Number of pregnancies previous to birth of examined child	*n*	Mean index scores		
		ID	Race-specific	
			SIS	DID
No pregnancy	1,700	102.2	101.9	100.3
One pregnancy	1,620	101.9	101.8	100.2
Two pregnancies	1,323	101.5	100.9	100.6
Three pregnancies	864	100.4	99.2	101.1
Four pregnancies	539	97.3	97.1	100.3
Five pregnancies	352	95.3	94.8	100.5
Six pregnancies	218	93.3	92.4	100.9
Seven pregnancies	131	90.1	91.6	98.6
Eight pregnancies	78	92.1	90.3	101.8
Nine pregnancies or more	114	88.8	88.3	100.5
Blank item	180	100.9	98.8	102.1
Percent variance accounted for	...	4.44	12.11	0.18
Correlation ratio	...	.21	.35	.04

NOTE: *n* = sample size.

Table L. Sample size and mean index scores of intellectual achievement, by attendance at nursery school or kindergarten, with percent variance accounted for and correlation ratios

Attended nursery school or kindergarten	*n*	Mean index scores		
		ID	Race-specific	
			SIS	DID
Yes	4,932	102.7	101.7	101.0
No	2,159	94.6	95.2	99.4
Blank item	16	93.5	98.5	95.0
Don't know	12	90.7	93.5	97.2
Percent variance accounted for	...	6.37	11.06	0.43
Correlation ratio	...	.25	.33	.07

NDTE: *n* = sample size.

Table M. Sample size and mean index scores of intellectual achievement, by nature of talking problem, with percent variance accounted for and correlation ratios

Nature of talking problem	*n*	Mean index scores		
		ID	Race-specific	
			SIS	DID
No talking problem reported	6,563	100.7	99.9	100.8
Lisping	81	101.8	100.6	101.1
Some other talking problem	137	97.8	99.6	98.2
More than one listed problem	5	92.0	101.4	90.6
Stammering or stuttering	144	91.7	93.2	98.5
Hard to understand	189	91.1	97.5	93.6
Percent variance accounted for	...	1.32	1.25	1.12
Correlation ratio	...	.14	.11	.11

NOTE: *n* = sample size.

Table N. Sample size and mean index scores of intellectual achievement, by twin status, with percent variance accounted for and correlation ratios

Twin status	*n*	Mean index scores		
		ID	Race-specific	
			SIS	DID
Not a twin	6,965	100.2	99.7	100.5
Twin, identical	43	99.9	100.7	99.2
Twin, not identical	95	96.3	97.8	98.5
Twin, unknown if identical	18	84.9	92.8	92.2
Percent variance accounted for	...	0.36	0.21	0.12
Correlation ratio	...	.06	.05	.04

NOTE: *n* = sample size.

Table O. Sample size and mean index scores of intellectual achievement, by school-judged intellectual level, with percent variance accounted for and correlation ratios

School-judged intellectual level	*n*	Mean index scores		
		ID	Race-specific	
			SIS	DID
Clearly above average (top 25 percent)	1,594	110.9	104.4	106.5
About average (mid-50 percent)	3,646	100.4	99.9	100.5
No school questionnaire	322	95.4	97.1	98.3
No basis for judging	299	93.7	95.9	97.8
Clearly below average (bottom 25 percent)	1,258	89.0	95.0	94.1
Percent variance accounted for	...	22.79	11.97	11.24
Correlation ratio	...	.48	.35	.34

NOTE: *n* = sample size.

Differential-Intellectual Development. Thus this type of talking problem does seem to reflect impeded intellectual achievement.

Twin status had only a very weak association with the index of Intellectual Development (table N). These data indicate that twin versus nontwin birth is not importantly related to individual intellectual achievement particularly when the family factor of SIS is removed.

Two evaluations were obtained from school personnel that were highly associated with the index of Intellectual Development, and especially so for the question specifically requesting an evaluation of intellectual level (tables O and P). Besides the three special resources shown in table P (gifted, slow learner, retarded), six other resources were provided in the questionnaire checklist (hard of hearing, "sight" saving, speech therapy, orthopedically handicapped, emotionally disturbed, and "other"). If any of these were recommended but not also recommended for the three shown here, they were coded in the "other resource recommended" category. It is evident that this group, as a group, was very close to average on all three intellectual achievement indexes. The finding of interest here is

Table P. Sample size and mean index scores of intellectual achievement, by recommendations for special school resources, with percent variance accounted for and correlation ratios

Recommendation for special school resources	n	Mean index scores		
		ID	Race-specific	
			SIS	DID
For gifted	307	114.9	105.0	109.9
None recommended	4,767	102.2	100.8	101.5
Other resources recommended	751	98.0	98.7	99.4
No school questionnaire	322	95.4	97.1	98.3
For slow learner	889	89.5	94.6	94.9
For mentally retarded	83	77.3	92.7	84.6
Percent variance accounted for	...	15.41	7.54	8.30
Correlation ratio	...	.39	.27	.29

NOTE: n = sample size.

that the strong association of DID with school evaluation indicates that these judgments reflected differential teacher assessments of students' intellectual achievement beyond what would be expected based on family background.

The examining physicians did detect some medical conditions that also had strong relationships with the index of Intellectual Development (table Q). Interestingly these noted conditions occurred almost independently of SIS family background. Thus these data seem to clearly indicate that the 61 children with listed conditions 1-8 (in table Q) suffered direct personal impairment in intellectual achievement attendant to these conditions.

These findings indicate that the three indexes, ID, SIS, and DID, can provide differential information on the association of intellectual achievement with other health-related variables.

Table Q. Sample size and mean index scores of intellectual achievement, by diagnostic impressions of neurological, muscular, or joint conditions by the examining physician, with percent variance accounted for and correlation ratios

Diagnostic impressions of neurological, muscular, or joint conditions by the examining physician	n	Mean index scores		
		ID	Race-specific	
			SIS	DID
1. Mongolism or other developmental	8	65.8	99.2	66.6
2. Mental retardation unknown etiology	11	70.7	99.4	71.3
3. Eye and muscular-skeleton	1	88.0	102.5	85.5
4. Cerebral palsy and brain damage	16	88.7	101.2	87.5
5. Minimal cerebral dysfunction	9	83.1	83.8	89.3
6. Cerebral problem	7	90.7	100.1	90.6
7. Epilepsy	3	102.3	107.1	95.2
8. Other neurological	6	97.2	101.2	96.0
9. Other muscular, skeleton, joint condition	3	86.0	87.2	98.8
10. Traumatic neurological residual	8	98.6	99.7	98.9
11. Muscular-skeleton-joint	81	99.5	99.9	99.5
12. Eye muscular imbalance or eye condition	34	97.3	96.8	100.5
13. Ear condition including deafness	2	99.0	98.1	100.9
None of the above noted	6,930	100.4	99.8	100.6
Percent variance accounted for	...	1.63	0.22	2.36
Correlation ratio	...	.13	.05	.15

NOTE: n = sample size.

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LIST OF DETAILED TABLES

2. Unweighted sample size and mean index scores of the intellectual achievement indexes for children and youths aged 6-17 years, by race and independent predictor variables, with standard deviations of total, percent variance accounted for, and correlation ratios

[Unweighted examined sample = 13,887 children and youths, aged 6-17 years]

Independent predictor variable	All races	White and other races	Black	Mean index score													
				General index									Race-specific index				
				ID			SIS			DID			SIS			DID		
				All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black
Total, 12-17 years	13,887	11,901	1,986	100.0	102.2	86.7	100.0	101.1	93.1	100.0	101.1	93.5	100.0	102.2	86.6	100.0	100.0	100.1
Standard deviation	..	..	..	15.0	14.3	11.9	8.52	8.11	7.68	12.34	12.18	11.25	9.04	7.52	4.87	11.98	12.15	10.87
t parent's education (completed years)																		
[illegible]	164	125	39	81.9	83.1	78.2	81.4	81.5	81.1	100.5	101.6	97.1	82.5	83.6	79.0	99.4	99.5	99.2
[illegible] year	75	51	24	81.0	82.3	78.2	82.0	81.7	82.7	99.0	100.7	95.5	82.8	84.1	80.0	98.2	98.3	98.2
[illegible] years	165	115	50	83.8	84.9	81.2	83.2	83.2	83.1	100.6	101.7	98.1	83.8	85.3	80.5	100.0	99.6	100.6
[illegible] years	257	170	87	83.7	85.1	80.8	83.5	83.6	83.1	100.2	101.5	97.7	83.9	85.8	80.3	99.8	99.4	100.5
[illegible] years	254	154	100	84.9	87.1	81.6	86.0	86.0	86.0	98.9	101.0	95.6	85.7	88.0	82.1	99.2	99.1	99.5
[illegible] years	297	182	115	88.2	90.2	85.1	87.9	88.2	87.4	100.3	102.0	97.7	87.3	90.1	83.0	100.9	100.1	102.1
[illegible] years	382	256	126	90.6	93.8	84.3	89.9	90.5	88.8	100.7	103.3	95.4	89.4	92.1	83.9	101.3	101.7	100.4
[illegible] years	586	413	173	90.9	93.6	84.6	91.9	92.5	90.4	99.0	101.1	94.2	91.3	94.0	84.9	99.8	99.8	99.7
[illegible] years	1,632	1,437	195	96.6	98.2	84.9	95.3	95.8	92.1	101.3	102.5	92.8	95.7	97.1	86.0	100.9	101.2	99.1
[illegible] years	984	804	180	96.4	98.9	85.6	96.6	97.6	92.0	99.9	101.3	93.5	96.5	98.8	85.9	100.0	100.0	99.7
[illegible] years	1,117	914	203	98.1	100.5	87.3	98.6	99.4	95.3	99.5	101.1	92.0	98.3	100.5	87.9	99.9	100.0	99.5
[illegible] years	782	640	142	99.3	100.9	90.7	100.8	101.5	97.6	98.2	99.4	93.1	100.2	102.6	89.4	98.8	98.3	101.3
[illegible] years	4,107	3,748	359	103.6	104.7	92.2	103.2	103.5	100.2	100.3	101.1	92.0	103.3	104.5	91.1	100.2	100.1	101.1
[illegible] years	374	343	31	106.5	107.5	94.8	106.8	107.1	102.9	99.7	100.4	91.9	106.8	107.9	92.8	99.8	99.6	102.6
[illegible] years	524	505	19	107.4	108.1	91.2	107.5	107.5	105.5	100.0	100.5	85.7	107.8	108.3	94.4	99.6	99.7	99.7
[illegible] years	206	197	9	109.4	110.0	96.9	109.3	109.4	107.3	100.2	100.7	89.6	109.4	110.1	95.6	100.0	99.9	101.1
[illegible] years	980	956	25	110.2	110.7	93.7	110.1	110.2	108.6	100.1	100.5	85.1	110.5	110.9	96.4	99.7	99.8	97.7
[illegible] years and above	723	705	18	112.3	112.7	98.2	112.4	112.4	110.9	99.9	100.2	87.3	112.7	113.0	97.8	99.8	99.8	100.1
[illegible] (Cycle III)	3	3	.	101.7	101.7	...	96.4	96.4	...	105.3	105.3	...	97.2	97.2	...	104.5	104.5	...
[illegible] (Cycle II)	86	56	30	88.1	91.1	82.4	90.5	90.7	90.2	97.6	100.4	92.2	89.9	92.6	84.7	98.2	98.5	97.7
[illegible] (Cycle III)	189	128	61	90.7	93.7	84.5	95.1	95.9	93.3	96.6	97.7	91.2	93.7	97.1	86.7	97.0	96.6	97.7
[illegible] variance accounted for	...	...	...	24.52	21.35	12.61	74.22	74.20	64.95	0.55	0.51	4.69	67.63	78.09	64.40	0.32	0.39	1.11
[illegible] ratio	...	...	...	.50	.46	.36	.86	.86	.81	.07	.07	.22	.82	.88	.80	.06	.06	.33
Second parent's education (completed years)																		
[illegible]	69	61	8	81.9	82.3	78.9	81.6	81.5	82.0	100.4	100.8	96.9	83.1	83.6	80.1	98.8	98.8	98.2
[illegible] year	37	23	14	83.9	82.3	86.6	82.2	81.9	82.6	101.7	100.3	104.0	82.5	84.1	80.0	101.4	98.2	104.1
[illegible] years	89	67	22	81.3	84.6	71.1	83.0	83.5	81.6	98.3	101.1	89.6	84.0	85.3	79.3	97.3	99.1	91.1
[illegible] years	144	124	20	85.2	86.1	79.4	84.0	84.1	83.3	101.2	102.0	96.1	85.4	86.2	80.4	99.5	99.9	97.6
[illegible] years	171	133	38	85.6	86.7	81.8	85.1	85.4	84.3	100.5	101.3	97.4	86.1	87.5	81.1	99.5	99.2	100.3
[illegible] years	193	150	43	86.6	87.4	83.8	86.3	86.4	85.8	100.3	101.0	98.2	86.9	88.4	81.9	99.6	99.5	101.1
[illegible] years	319	259	60	88.7	90.4	81.9	88.4	88.9	86.5	100.3	101.5	94.9	89.2	90.7	82.4	99.5	99.7	99.1
[illegible] years	362	283	79	90.8	92.8	82.5	91.2	92.2	87.7	99.4	100.6	94.8	91.4	93.7	83.1	99.2	99.2	99.6
[illegible] years	1,053	898	155	94.5	96.2	84.9	93.9	94.5	90.7	100.6	101.7	94.2	94.1	95.9	85.0	100.2	100.3	99.5
[illegible] years	794	643	151	94.9	97.4	84.4	96.2	97.2	92.1	98.8	100.3	92.3	96.0	98.4	85.9	98.9	99.0	98.5
[illegible] years	1,108	950	158	97.4	99.2	86.6	98.5	99.1	94.7	98.9	100.1	91.9	98.4	100.2	87.6	99.0	99.0	99.0
[illegible] years	853	677	176	99.2	101.7	89.7	100.8	101.7	97.0	98.5	100.0	92.8	100.0	102.8	89.1	99.2	98.9	100.3
[illegible] years	4,857	4,559	298	104.6	105.5	90.7	103.9	104.2	99.5	100.7	101.3	91.2	104.2	105.1	90.6	100.4	100.4	100.1
[illegible] years	403	375	28	107.6	109.1	87.9	107.0	107.7	98.1	100.6	101.4	89.8	107.2	108.5	89.8	100.4	100.5	99.8
[illegible] years	481	451	30	108.9	109.8	95.5	108.9	109.1	105.0	100.1	100.7	89.9	108.9	109.8	94.5	100.1	100.0	101.0
[illegible] years	222	213	9	109.5	110.1	95.0	109.3	109.4	107.1	100.2	100.7	87.9	109.7	110.3	95.5	99.8	99.8	99.8
[illegible] years	586	566	20	112.5	113.1	94.8	111.7	111.9	105.2	100.8	101.2	89.5	111.9	112.5	94.2	100.6	100.6	100.1
[illegible] and above	182	173	9	113.1	113.9	97.7	113.7	113.8	111.4	99.4	100.0	86.3	113.5	114.3	98.1	99.6	99.6	99.5
[illegible] parent (Cycle III)	1,015	682	333	94.6	98.6	86.4	96.2	97.9	92.6	98.4	100.7	93.8	95.0	99.2	86.3	99.6	99.4	100.2
[illegible] parent (Cycle II)	827	526	301	94.5	99.1	86.3	94.1	96.2	90.4	100.4	102.9	96.0	93.1	97.9	84.9	101.3	101.2	101.1
[illegible]	122	88	34	94.6	97.9	86.0	93.8	95.1	90.3	100.8	102.8	95.7	93.1	96.3	86.1	101.5	101.6	101.0
[illegible] variance accounted for	...	...	...	21.23	19.53	8.66	60.49	62.35	42.30	0.54	0.31	4.06	53.91	64.39	41.25	0.33	0.31	1.05
[illegible] ratio	...	...	...	.46	.44	.29	.78	.79	.65	.07	.06	.20	.73	.80	.64	.06	.06	.32

Table 1. Unweighted sample size and mean index scores of the intellectual achievement indexes for children and youths aged 6-17 years, by race and independent control variable, with standard deviations of total, percent variance accounted for, and correlation ratios

[Unweighted examined sample = 13,887 children and youths, aged 6-17 years]

Independent control variable	All races	White and other races	Black	Mean index score													
				General index									Race-specific index				
				ID			SIS			DID			SIS			DID	
				All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black
Total, 12-17 years	13,887	11,901	1,986	100.0	102.2	86.7	100.0	101.1	93.1	100.0	101.1	93.5	100.0	102.2	86.6	100.0	100.0	100.0
Standard deviation	. . .	. . .	. . .	15.0	14.3	11.9	8.52	8.11	7.69	12.34	12.18	11.25	9.04	7.52	4.87	11.98	12.16	10.1
Sex																		
Male	7,177	6,234	943	100.1	102.2	86.3	100.3	101.3	93.2	99.9	100.9	93.1	100.3	102.4	86.8	99.8	99.8	99.7
Female	6,710	5,667	1,043	99.8	102.2	87.0	99.7	100.9	93.1	100.2	101.3	93.9	99.6	102.0	86.6	100.2	100.2	100.3
Percent variance accounted for	. . .	. . .	. . .	0.01	0.00	0.09	0.12	0.08	0.00	0.02	0.03	0.13	0.16	0.07	0.00	0.03	0.02	0.09
Correlation ratio	. . .	. . .	. . .	0.01	0.00	0.03	.07	.03	.00	.01	.02	.04	.04	.03	.005	.02	.02	.03
Examination cycle (children and youths)																		
Cycle II, 6-11 years	7,119	6,132	987	100.2	102.4	86.4	99.5	100.6	92.7	100.7	101.7	94.1	99.7	101.9	86.3	100.5	100.5	100.5
Cycle III, 12-17 years	6,768	5,769	999	99.7	102.0	86.5	100.4	101.6	93.6	99.3	100.4	92.9	100.3	102.6	86.9	99.5	99.4	99.5
Percent variance accounted for	. . .	. . .	. . .	0.03	0.02	0.01	0.27	0.35	0.37	0.31	0.30	0.28	0.09	0.21	0.38	0.18	0.19	0.17
Correlation ratio	. . .	. . .	. . .	.02	.01	.01	.05	.06	.06	.06	.05	.05	.03	.05	.06	.04	.04	.04
Age at examination																		
6 years	1,111	955	156	100.3	102.4	87.5	99.6	100.8	92.6	100.7	101.8	94.9	99.8	102.0	86.3	100.5	100.3	101.0
7 years	1,241	1,069	172	100.1	102.4	86.1	99.5	100.6	92.9	100.6	101.8	93.2	99.7	101.9	86.4	100.4	100.5	99.9
8 years	1,231	1,039	192	99.8	102.1	87.2	99.6	100.7	93.6	100.2	101.4	93.6	99.8	102.0	86.9	100.2	100.1	100.5
9 years	1,184	1,026	158	100.6	102.3	86.7	99.4	100.5	92.4	101.3	102.3	94.3	99.6	101.7	86.1	101.0	101.1	100.7
10 years	1,160	1,018	142	100.3	102.2	87.0	99.6	100.6	92.7	100.7	101.8	94.3	99.9	101.8	86.3	100.4	100.3	100.7
11 years	1,120	962	158	100.1	102.4	86.5	99.4	100.8	91.8	100.8	101.8	94.7	99.6	101.8	85.8	100.6	100.6	100.6
12 years	1,262	1,064	198	99.6	101.9	87.0	100.3	101.5	93.9	99.3	100.5	93.1	100.1	102.5	87.1	99.5	99.4	99.8
13 years	1,208	1,037	171	100.0	102.2	86.5	100.3	101.5	93.0	99.7	100.7	93.5	100.3	102.5	86.6	99.7	99.7	99.8
14 years	1,204	1,015	189	99.5	102.0	86.4	100.5	101.7	93.9	99.0	100.2	92.5	100.3	102.7	87.1	99.3	99.3	99.3
15 years	1,116	959	157	99.8	101.9	87.2	100.3	101.4	93.7	99.5	100.5	93.5	100.2	102.3	87.0	99.6	99.5	99.8
16 years	1,092	942	150	99.9	102.0	86.5	100.7	101.8	93.2	99.3	100.2	93.3	100.5	102.8	86.7	99.4	99.3	99.6
17 years	900	772	128	99.7	102.2	84.8	100.7	101.8	93.7	99.0	100.3	91.1	100.4	102.7	87.0	99.2	99.5	98.6
18 years	58	43	15	97.2	99.5	90.7	100.6	102.2	96.0	95.6	97.3	94.8	99.2	103.0	88.4	98.0	98.8	96.8
Percent variance accounted for	. . .	. . .	. . .	0.06	0.04	0.37	0.31	0.41	0.79	0.39	0.37	0.70	0.13	0.28	0.86	0.23	0.26	0.21
Correlation ratio	. . .	. . .	. . .	.02	.02	.06	.06	.06	.09	.06	.06	.08	.04	.05	.09	.06	.06	.07
Vocabulary and Block Design Test qualifications																		
Tests—Cycle III	69	60	9	97.9	99.6	86.7	99.4	99.9	96.2	98.5	98.7	90.5	99.2	100.8	88.5	98.7	98.8	98.2
Vocabulary Test invalid	45	42	3	92.8	93.0	89.7	90.0	90.1	88.8	102.8	103.0	100.9	91.4	91.9	83.8	101.4	101.1	103.1
Block Design Test invalid	28	22	6	96.0	97.7	89.5	99.8	101.2	94.5	96.2	96.5	95.0	99.2	102.3	87.4	96.8	96.4	98.6
Both tests invalid	49	44	5	93.4	94.3	85.6	94.8	95.9	85.0	99.6	98.4	100.6	96.8	97.4	81.4	97.5	96.8	100.4
Both tests valid	13,696	11,733	1,963	100.0	102.3	86.7	100.0	101.2	93.2	100.0	101.1	93.5	100.0	102.3	86.6	100.0	100.0	100.0
Percent variance accounted for	. . .	. . .	. . .	0.17	0.30	0.03	0.58	0.82	0.41	0.05	0.06	0.20	0.38	0.84	0.41	0.04	0.06	0.02
Correlation ratio	. . .	. . .	. . .	.04	.05	.02	.08	.09	.06	.02	.02	.04	.06	.09	.06	.02	.02	.02

Annual family income																		
01 Under $500	104	69	35	85.6	88.0	80.8	84.3	83.6	85.3	101.2	104.2	95.5	85.2	87.1	81.6	100.3	100.9	99.2
02 $500-$999	288	162	126	86.8	89.9	82.7	86.1	86.7	85.3	100.6	103.2	97.3	86.2	89.7	81.6	100.6	100.2	101.0
03 $1,000-$1,999	709	437	272	86.9	89.8	82.2	87.3	87.1	87.7	99.5	102.7	94.5	87.2	89.7	83.1	99.7	100.1	99.1
04 $2,000-$2,999	939	628	311	89.7	92.1	84.9	90.3	90.6	89.6	99.5	101.5	95.3	90.0	92.9	84.4	99.7	99.3	100.6
05 $3,000-$3,999	1,084	745	339	92.5	95.2	86.8	93.1	93.7	92.8	99.4	101.9	94.0	92.4	95.1	86.4	100.1	100.0	100.5
06 $4,000-$4,999	1,142	927	215	96.4	99.5	87.7	97.0	97.4	95.1	99.5	101.1	92.6	96.8	98.9	87.8	99.7	99.6	99.9
07 $5,000-$6,999	2,737	2,422	315	100.2	101.7	88.4	100.1	100.5	98.7	100.1	101.1	91.7	100.2	101.7	88.9	100.0	100.0	99.5
08 $7,000-$9,999	3,008	2,830	176	104.1	104.7	93.6	103.6	103.8	101.3	100.4	100.9	92.2	103.8	104.6	91.8	100.2	100.1	101.8
09 $10,000-$14,999	2,090	2,029	61	106.9	107.4	91.8	106.9	107.0	105.0	100.0	100.4	86.8	107.1	107.5	94.1	99.8	99.9	97.6
10 $15,000 and over	981	966	15	110.6	110.8	95.0	110.5	110.6	105.0	100.1	100.3	90.1	110.6	110.8	94.1	100.0	100.0	100.9
11 Don't know	540	449	91	97.0	99.0	87.1	96.7	97.4	93.0	100.3	101.6	94.0	96.9	99.0	86.5	100.1	100.0	100.5
12 Blank or refused to answer	267	237	30	100.5	102.3	85.6	100.4	101.0	96.4	100.0	101.4	89.3	100.7	102.2	88.7	99.8	100.2	97.0
Percent variance accounted for				20.30	15.25	7.81	59.45	57.64	42.10	0.09	0.28	3.31	55.27	53.88	42.54	0.03	0.04	0.77
Correlation ratio				.45	.39	.28	.77	.76	.65	.03	.05	.18	.74	.73	.65	.02	.02	.09
Race																		
White	11,815			102.1			101.1			101.1			102.2			100.0		
Black	1,386			86.2			93.1			93.5			86.6			100.1		
Other	66			104.2			101.6			102.6			102.7			101.4		
Percent variance accounted for				13.15			10.70			4.61			36.54			0.01		
Correlation ratio				.36			.33			.21			.60			.01		
Number of persons in household under 21 years of age																		
One person	1,264	1,121	143	102.6	104.3	89.5	103.1	90.2	97.1	99.6	100.5	92.4	102.5	104.2	89.2	100.1	100.0	100.3
Two persons	2,836	2,611	225	103.2	104.5	88.7	103.7	103.8	97.4	99.6	100.3	91.3	103.6	104.8	89.4	99.6	99.7	99.4
Three persons	3,229	2,957	272	103.1	104.3	90.2	102.5	104.2	96.8	100.5	101.2	93.4	102.7	104.0	88.9	100.4	100.3	101.2
Four persons	2,558	2,199	359	100.2	102.2	87.9	100.3	103.1	94.2	99.9	100.9	93.7	100.4	102.5	87.3	99.8	99.7	100.6
Five persons	1,567	1,279	288	97.4	100.1	85.8	96.6	101.3	92.6	100.8	102.5	93.2	96.9	99.2	86.2	100.6	100.8	99.6
Six persons	1,007	766	241	93.6	96.1	85.4	93.9	97.6	90.6	99.7	101.2	94.8	94.0	96.8	85.0	99.6	99.3	100.4
Seven persons	699	517	182	93.1	96.6	85.0	93.0	94.9	90.7	100.1	102.6	94.3	92.9	96.3	85.0	100.2	100.4	100.0
Eight persons	371	261	110	89.9	93.4	84.4	91.1	94.1	89.1	98.8	101.4	92.5	91.3	94.3	84.0	98.6	99.0	97.6
Nine persons	181	117	64	91.0	96.1	81.6	91.6	92.0	87.0	99.5	102.0	94.8	91.5	96.3	82.7	99.5	99.8	99.1
Ten persons or more	295	173	102	88.2	92.3	81.3	88.1	94.1	84.6	100.1	102.1	96.7	88.4	92.7	81.2	99.8	99.7	100.1
Percent variance accounted for				7.69	4.92	5.11	23.40	20.31	21.08	0.16	0.34	1.22	20.21	17.25	21.44	0.12	0.13	0.80
Correlation ratio				.28	.22	.23	.48	.45	.46	.04	.06	.11	.45	.42	.46	.03	.04	.09
Geographic region																		
Northeast	3,423	3,011	412	102.3	104.0	89.9	101.7	102.6	95.2	100.6	101.4	94.7	101.7	103.6	87.9	100.6	100.4	102.0
Midwest	3,653	3,311	342	102.0	103.4	88.4	101.6	102.0	97.1	100.4	101.4	94.3	101.8	103.1	89.1	100.2	100.3	99.2
South	3,411	2,443	968	94.0	98.1	83.7	96.1	98.4	90.4	97.9	99.7	93.3	95.5	99.7	84.9	98.5	98.4	98.8
West	3,400	3,136	264	101.4	102.3	90.3	100.3	100.8	94.8	101.1	101.5	95.5	100.9	102.0	87.7	100.5	100.4	102.7
Percent variance accounted for				5.20	2.31	6.13	7.01	3.58	12.78	1.00	0.33	1.37	8.29	3.61	12.80	0.49	0.42	2.13
Correlation ratio				.23	.15	.25	.26	.19	.36	.10	.06	.12	.29	.19	.36	.07	.06	.15
Both parents' relationship to child/youth																		
Father and mother	11,148	10,029	1,119	101.3	102.9	87.0	100.6	101.7	94.1	100.4	101.2	92.9	101.2	102.8	87.2	100.1	100.1	99.8
Father without mother*	240	188	52	96.8	99.5	87.8	99.2	100.3	93.1	98.2	99.2	94.7	98.1	101.3	86.6	98.9	98.2	101.2
Mother without father	2,055	1,410	645	95.0	98.8	86.8	96.1	97.7	92.5	98.9	101.1	94.3	95.1	99.2	86.2	99.3	99.6	100.6
Both foster parents	85	65	20	94.6	97.3	85.8	99.8	102.5	90.9	94.8	94.8	94.9	99.2	103.5	85.2	95.4	93.8	100.5
All other	359*	209	150	90.0	95.0	83.2	93.0	95.7	89.2	97.1	99.3	94.0	91.6	96.9	84.1	98.4	98.0	99.0
Percent variance accounted for				3.54	3.46	0.75	5.82	3.38	3.14	0.47	0.23	0.36	8.10	3.31	3.10	0.16	0.25	0.21
Correlation ratio				.19	.12	.09	.24	.18	.18	.07	.05	.06	.28	.18	.18	.04	.05	.05
Focal parent's relationship to child/youth																		
Unknown	18	16	2	83.9	84.0	80.5	95.4	94.9	99.0	88.5	89.4	81.5	95.6	98.3	99.3	88.2	88.0	90.2
Father	11,388	10,217	1,171	101.2	102.8	87.0	100.9	101.7	94.0	100.3	101.2	93.0	101.1	102.7	87.2	100.1	100.1	99.9
Mother	1,519	988	531	94.8	99.1	86.9	95.4	97.2	92.1	99.5	102.0	94.8	94.3	98.7	85.9	100.6	100.4	101.1
Stepfather	536	420	116	95.8	98.0	86.6	97.9	98.9	94.4	97.8	99.1	92.2	97.4	100.2	87.4	98.1	97.9	98.1
Stepmother	4	4		94.5	94.5		96.9	96.9		97.8	97.8		97.8	97.8		98.7	96.7	
Grandfather	107	60	47	91.1	96.6	84.2	92.4	96.2	87.5	98.7	100.4	96.6	91.0	97.3	83.1	100.1	99.3	101.1

Table 2. Unweighted sample size and mean index scores of the intellectual achievement indexes for children and youths aged 6-17 years, by race and independent predictor variables, with standard deviations of total, percent variance accounted for, and correlation ratios—Con.

[Unweighted examined sample = 13,887 children and youths, aged 6-17 years]

Independent predictor variable	All races	White and other races	Black	Mean index score													
				General index									Race-specific index				
				ID			SIS			DID			SIS			DID		
				All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black
First parent's relationship to child/youth—Con.																		
Grandmother	87	47	40	88.1	93.9	81.3	88.8	91.7	85.5	99.3	102.3	95.8	88.0	93.3	81.8	100.1	100.6	99.5
Other guardian (related)	119	71	48	90.5	95.0	83.8	95.7	97.8	92.6	94.8	97.2	91.2	93.8	98.9	86.3	96.6	98.1	97.5
Other guardian (unrelated or unknown)	12	9	3	95.6	100.9	79.7	97.6	97.0	99.5	98.0	103.9	89.2	96.2	98.0	90.7	99.4	102.9	89.0
Foster parent	94	66	28	93.7	97.4	85.0	99.1	102.5	91.2	94.6	94.9	93.9	98.1	103.5	85.4	95.6	93.9	99.6
Self	3	3	. .	101.7	101.7	. . .	96.4	96.4	. . .	105.3	105.3	. . .	97.2	97.2	. . .	104.5	104.5	. . .
Percent variance accounted for	. . .	. . .	. . .	3.46	1.50	0.84	6.29	3.60	4.97	0.63	0.48	1.26	8.27	3.49	4.94	0.41	0.47	0.65
Correlation ratio	. . .	. . .	. . .	.19	.12	.09	.25	.19	.22	.08	.07	.11	.29	.19	.22	.06	.07	.08
Population change (1950-1960																		
Population loss	3,428	3,253	175	98.4	99.4	79.2	97.3	97.8	88.5	101.1	101.6	90.8	98.4	99.2	83.8	99.9	100.2	95.6
Below-average gain	3,442	2,927	515	99.7	101.6	89.1	100.0	101.1	93.9	99.6	100.4	95.2	99.9	102.2	87.1	99.7	99.4	102.0
Average gain	3,662	2,727	935	97.7	101.7	85.9	99.8	102.2	92.8	97.8	99.4	93.1	98.9	103.2	86.4	98.7	98.5	99.5
Above-average gain	3,355	2,994	361	104.4	106.3	88.7	102.8	103.7	95.1	101.7	102.6	93.6	102.8	104.6	87.9	101.8	101.7	100.9
Percent variance accounted for	. . .	. . .	. . .	3.08	3.25	5.26	5.06	7.65	4.81	1.48	0.97	1.15	3.47	7.32	4.81	0.76	0.95	2.62
Correlation ratio	. . .	. . .	. . .	.18	.18	.23	.22	.28	.22	.12	.10	.11	.19	.27	.22	.09	.10	.16
Second parent's relationship to child/youth																		
Father	4	1	3	92.8	92.0	93.0	101.3	97.2	103.7	91.4	94.8	90.3	94.0	97.8	92.7	98.8	94.2	100.3
Mother	11,685	10,452	1,233	101.0	102.7	87.0	100.8	101.6	94.1	100.2	101.1	92.8	101.0	102.7	87.2	100.0	100.0	99.7
Stepmother	65	55	10	96.6	97.9	89.4	101.1	101.8	97.5	95.5	96.1	91.9	100.9	103.0	89.4	95.7	94.9	100.0
Grandmother	106	58	48	92.4	98.2	85.5	92.7	96.3	88.4	99.7	101.9	97.2	91.1	97.4	83.6	101.3	100.8	101.9
Other guardian (related)	85	54	31	89.1	93.4	81.5	96.1	98.2	92.5	93.0	95.2	89.0	94.4	99.2	86.2	94.8	94.2	96.3
Other guardian (unrelated or unknown)	15	8	7	94.0	99.0	88.3	98.8	97.8	100.0	95.2	101.2	88.2	95.2	98.8	91.0	98.8	100.2	97.3
Foster parent	85	65	20	94.6	97.3	85.8	99.8	102.5	90.9	94.8	94.8	94.9	99.2	103.5	86.2	95.4	93.8	100.5
Self	3	3	.	101.7	101.7	. . .	96.4	96.4	. . .	105.3	105.3	. . .	97.2	97.2	. . .	104.5	104.5	. . .
Blank (no second parent)	839	1,205	634	94.5	98.8	86.4	95.2	97.2	91.5	99.3	101.6	94.8	94.2	98.7	85.6	100.4	100.1	100.8
Percent variance accounted for	. . .	. . .	. . .	2.83	1.00	0.46	5.61	2.97	4.14	0.48	0.35	1.29	7.66	2.89	4	0.30	0.33	0.59
Correlation ratio	. . .	. . .	. . .	.17	.10	.07	.24	.17	.20	.07	.06	.11	.28	.17	.20	.05	.06	.08
Standard metropolitan statistical area (SMSA)																		
In SMSA, central city	4,182	3,069	1,113	97.7	101.1	88.3	99.1	101.0	94.4	98.5	100.1	93.9	98.2	102.1	87.4	99.5	99.0	100.9
In SMSA, not in central city	4,797	4,205	592	102.3	104.5	86.2	102.0	103.2	92.9	100.3	101.3	93.3	102.0	104.2	86.5	100.3	100.4	99.7
Not in SMSA	4,908	4,627	281	99.6	100.8	81.3	98.6	99.2	88.7	101.0	101.5	92.6	99.6	101.5	83.8	100.1	100.2	97.5
Percent variance accounted for	. . .	. . .	. . .	1.52	1.49	3.97	2.95	4.47	6.27	0.73	0.73	0.16	2.92	4.26	6.30	0.07	0.21	1.12
Correlation ratio	. . .	. . .	. . .	.12	.12	.20	.17	.21	.25	.09	.05	.04	.17	.21	.25	.03	.05	.11
Type of place and population size																		
Urban, in an urbanized area (3 million persons or more)	2,913	2,228	685	100.5	103.7	89.9	101.3	103.0	96.0	99.1	100.7	93.9	100.2	103.9	88.4	100.2	99.8	101.5
Urban, in an urbanized area (1 million-2.9 million persons)	1,809	1,554	255	103.0	105.3	89.5	102.4	103.6	95.1	100.6	101.7	94.5	102.2	104.5	87.8	100.9	100.7	101.7
Urban, in an urbanized area (250,000-999,999 persons)	1,590	1,294	296	100.4	103.8	86.5	101.0	102.9	92.9	99.4	100.8	93.7	100.6	103.8	86.4	99.8	99.8	100.1
Urban, in an urbanized area (less than 250,000 persons)	1,112	901	211	97.7	100.8	84.2	98.8	100.8	90.4	98.9	100.1	93.8	98.7	101.9	84.9	99.0	98.9	99.4

Urban not in urbanized area (25,000 persons or more)	634	617	17	99.2	99.4	92.4	99.6	99.7	93.7	99.7	99.7	98.8	100.5	100.9	86.9	98.7	98.5	105.5
Urban, not in urbanized area (10,000-24,999 persons)	397	369	28	99.3	100.8	79.9	99.5	100.0	93.1	99.8	100.8	86.8	100.2	101.3	86.6	99.1	99.5	93.4
Urban, not in urbanized area (2,500 9,999 persons)	817	730	87	100.3	102.3	83.4	99.5	100.7	89.2	100.8	101.6	94.2	100.0	101.9	84.1	100.3	100.5	99.3
Rural	4,615	4,208	407	99.0	100.6	81.7	98.3	99.1	89.7	100.7	101.5	92.1	99.0	100.4	84.4	100.0	100.2	97.3
Percent variance accounted for	. .	. .	. .	0.94	1.64	8.27	3.25	5.10	12.28	0.36	0.23	1.18	1.42	4.92	12.32	0.21	0.21	2.99
Correlation ratio	. .	. .	. .	.10	.13	.29	.18	.23	.35	.06	.05	.11	.12	.22	.35	.05	.05	.17
Foreign language spoken in home																		
Yes	1,663	1,614	49	96.8	97.0	91.7	96.0	96.0	97.0	100.8	101.0	94.7	97.1	97.4	89.0	99.7	99.6	102.7
No	11,632	9,814	1,858	100.5	103.2	86.6	100.6	102.0	93.1	99.9	101.1	93.5	100.5	103.1	86.6	100.0	100.1	100.0
Blank or don't know	552	473	79	97.9	100.1	85.3	98.2	99.2	91.9	99.8	100.9	93.3	98.4	100.5	85.8	99.5	99.5	99.4
Percent variance accounted for	. .	. .	. .	0.71	2.27	0.51	3.23	6.70	0.73	0.06	0.00	0.03	1.55	6.95	0.72	0.02	0.02	0.16
Correlation ratio	. .	. .	. .	.08	.15	.07	.18	.26	.09	.02	.01	.02	.12	.26	.08	.01	.01	.04

Table 3. Unweighted sample size and mean index scores of the intellectual achievement indexes for children and youths aged 6-17 years, by race and independent constructed variables, with standard deviations of total, percent variance accounted for, and correlation ratios

[Unweighted examined sample = 13,887 children and youths, aged 6-17 years]

Independent constructed variable	Unweighted sample size			Mean index score													
				General index									Race-specific index				
				ID			SIS			DID			SIS			DID	
	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black	All races	White and other races	Black
Total, 12-17 years	13,887	11,901	1,986	100.0	102.2	86.7	100.0	101.1	93.1	100.0	101.1	93.5	100.0	102.2	86.6	100.0	100.0	100.1
Standard deviation	...	...	...	15.0	14.3	11.9	8.52	8.11	7.69	12.34	12.18	11.25	9.04	7.52	4.87	11.98	12.15	10.87
Sum of both parents' education (X_1)																		
None-6 years	402	290	112	80.7	81.6	78.2	80.7	80.8	80.5	99.9	100.8	97.7	81.8	83.0	78.8	98.9	98.6	99.5
7-11 years	640	439	201	85.7	87.1	82.7	84.8	84.9	84.8	100.9	102.1	98.2	85.2	87.1	81.2	100.5	100.0	101.5
12-14 years	793	546	247	88.5	91.1	82.5	88.5	89.1	87.2	99.9	102.0	95.3	88.3	90.8	82.9	100.1	100.3	99.7
15-16 years	1,136	880	256	92.9	95.3	84.8	92.9	93.5	90.8	100.0	101.8	93.9	92.8	95.0	85.1	100.2	100.3	99.5
17-18 years	1,138	889	247	94.1	96.3	86.3	94.2	95.0	91.5	99.9	101.4	94.8	94.0	96.3	85.8	100.2	100.0	100.8
19-20 years	1,596	1,348	248	98.0	100.1	86.3	98.1	98.7	95.1	99.9	101.5	91.2	98.0	99.8	87.8	100.0	100.3	98.5
21-22 years	1,628	1,382	246	100.4	102.3	89.9	100.7	101.1	98.0	99.8	101.2	91.9	100.3	102.2	89.7	100.1	100.1	100.2
23-24 years	3,410	3,101	309	103.7	104.8	92.5	103.7	104.0	100.7	100.0	100.8	91.8	103.7	105.0	91.4	99.9	99.8	101.1
25-26 years	912	858	54	106.5	107.3	94.0	106.7	106.9	104.9	99.7	100.4	89.0	106.9	107.7	94.1	99.6	99.6	99.9
27-28 years	821	797	24	108.6	109.2	88.9	108.5	108.5	106.2	100.2	100.7	82.6	108.9	109.3	94.9	99.7	99.9	94.0
29-30 years	598	584	14	111.4	111.7	98.1	111.3	111.3	110.7	100.1	100.4	87.4	111.8	112.0	97.7	99.8	99.8	100.4
31-32 years	477	460	17	112.1	112.7	94.6	111.8	111.8	107.3	100.5	101.0	87.4	111.9	112.5	95.5	100.2	100.3	99.2
33-34 years	338	327	11	114.5	115.0	100.5	114.2	114.2	112.4	100.4	100.8	88.1	114.2	114.8	98.7	100.3	100.2	101.7
Percent variance accounted for	...	...	...	27.38	25.03	13.48	85.07	85.73	78.04	0.04	0.16	6.33	75.78	90.20	77.34	0.05	0.07	1.12
Correlation ratio	...	...	...	.52	.50	.37	.92	.93	.88	.02	.04	.25	.87	.95	.88	.02	.03	.11
Annual family income range per person under 21 years of age in household (X_2)																		
None-$124	148	82	66	83.6	87.1	79.3	83.7	83.0	84.5	99.9	104.0	94.8	84.0	86.3	81.1	99.8	100.8	98.2
$125-$374	706	388	318	85.0	87.8	81.6	85.2	84.9	85.5	99.8	102.9	96.0	85.2	88.0	81.7	99.8	99.8	99.8
$375-$624	859	560	299	88.4	90.3	84.8	88.0	87.5	89.1	100.3	102.8	95.8	88.0	90.1	84.1	100.4	100.2	100.7
Income unknown and 5 or more children	178	136	42	91.1	92.7	86.0	90.6	90.8	90.0	100.5	101.9	96.0	91.2	93.2	84.6	100.0	99.5	101.4
$625-$874	1,054	729	325	92.2	94.8	86.5	92.4	92.7	91.7	99.8	102.1	94.8	92.1	94.9	85.7	100.2	99.9	100.8
$875-$1,124 (includes blank or refused to answer and 5 or more children)	659	504	155	94.2	96.6	86.2	94.6	95.3	93.2	99.3	101.3	92.9	94.8	97.3	86.7	99.4	99.3	99.5
$1,125-$1,374	915	773	142	97.3	98.8	89.0	96.9	97.2	95.7	100.3	101.8	93.3	97.1	98.8	88.3	100.2	100.0	100.7
$1,375-$1,874 (includes income unknown and 1-4 children)	1,934	1,662	272	99.9	101.9	88.1	99.9	100.2	97.7	100.1	101.7	90.4	99.8	101.5	89.5	100.2	100.4	98.6
$1,875-$2,624 (includes blank or refused to answer and 1-4 children)	2,072	1,907	165	102.2	103.2	90.7	102.3	102.6	100.4	99.9	100.7	90.4	102.4	103.4	91.2	99.8	99.8	99.5
$2,625-$3,624	1,937	1,844	93	104.3	104.8	94.3	104.1	104.2	101.4	100.3	100.6	92.9	104.3	104.9	91.9	100.1	99.9	102.4
$3,625-$6,124	1,828	1,752	76	106.2	106.7	93.4	106.1	106.2	102.9	100.1	100.5	90.5	106.1	106.7	92.8	100.0	100.0	100.5
$6,125 and over	1,597	1,564	33	109.2	109.5	94.2	109.5	109.6	107.8	99.8	99.9	86.8	109.4	109.6	95.9	99.8	99.8	98.3
Percent variance accounted for	...	...	...	21.54	18.02	9.92	66.98	64.86	55.39	0.05	0.50	4.38	59.79	58.14	56.26	0.03	0.04	0.86
Correlation ratio	...	...	...	.46	.40	.32	.82	.81	.74	.02	.07	.21	.77	.76	.75	.02	.02	.09

APPENDIX

CONTENTS

LIST OF APPENDIX TABLES

APPENDIX
TECHNICAL NOTES

Criterion Scaling

The objective of criterion scaling is to determine a set of scale values for the *response options* of an independent or predictor variable which will maximally predict a given dependent or criterion variable. The optimum predictor value for a response option is the mean criterion score for the persons who responded to that response option.

If the data array is subjected to a one-way analysis of variance, the mean criterion value for each response option (including blanks on the predictor variable) can be obtained. A correlation ratio, or eta coefficient, and an F statistic can be computed to determine the degree of association and the statistical significance of the observed mean differences. Beaton[4] provides a fuller treatment of criterion scaling.

The following example is given to help clarify the concept and to demonstrate the procedure.

A teacher in a given subject area wants to identify and scale some variables which might contribute to an end-of-course comprehensive subject matter test. The following data elements are obtained for each student:

Predictor variables

1. A subject matter pretest score at the beginning of the course.
2. Average number of hours per week spent on studying the course material.
3. The number of times absent from class during the course.

Criterion variables

A. End-of-course test score on 70-item test.
B. Subdivision of the class into two groups: top 50 percent and bottom 50 percent of the class on the end-of-course test.

The variables are then ordered with mean or average criterion test scores and proportions scoring at top 50-percent level for each predictor response level (table I).

The scale value for each predictor element *response level* for criterion A is its mean criterion score, and for criterion B it is the proportion in the top 50 percent. The zero-order correlation coefficient of each data element with the criterion can then be calculated using the scale values to determine the strength of relationship or association. All three predictor elements can be put into a multiple-regression equation to determine their joint contributions and beta weights. The appropriate beta weight can be applied to each response scale value within each predictor element and a total predictor scale can be derived and correlated with the criterion. The teacher can now identify how much each predictor element contributed to accounting for the variance in the criterion scores, or in discriminating the category placement, their relative contributions, and their total combined contribution. The response level weights can be studied to see if "critical" points exist. Thus for "times absent from class" the response levels of 0, 1, 2, would seem to indicate that up through two absences were not important in terms of final-test-score performance. The students (cases) in these three levels

NOTE: A list of references follows the text.

Table I. Number of students and criterion values of predictor elements

Predictor element	Number of students	Criterion value	
		Mean	Proportions at top 50 percent
Pretest scores			
Total	100	54.6	.500
25 points and more	20	65.2	.750
20-24 points	20	60.0	.600
15-19 points	40	51.2	.450
0-14 points	20	30.1	.250
Study per week			
Total	100	54.6	.500
5 hours and more	2	50.0	.000
4 hours	10	54.0	.500
3 hours	50	66.6	.660
2 hours	25	48.1	.400
1 hour	8	26.3	.250
0 hours	5	15.1	.000
Absent from class			
Total	100	54.6	.500
4 times and more	15	20.0	.133
3 times	20	48.0	.300
2 times	30	65.1	.667
1 time	20	65.0	.650
0 times	15	63.1	.600

could be grouped and new weights obtained for 0-2 absences.

An investigator using criterion scaling should inspect the response weights to see if they make sense. If these weights are to be presented as applicable to new samples, they should be cross-validated on an independent sample to determine how stable they are.

Comparison of Multiple Linear Regression With the Criterion-Scaled Constructed-Variables Method in Predicting Intellectual Development

The five predictor variables used in constructing the two Socio-Intellectual-Status (SIS) indexes were entered into a multiple linear regression equation to predict the index of Intellectual Development (ID). The five variables with their ordinal values were:

Race: black = 1; white and other races = 2

First parents's education: none = 00; 17 years or more = 17

Second parent's education: none = 00; 17 years or more = 17

Number of persons in household under 21 years of age: 1 = 1 person; 10 persons or more = 10

Annual family income: coded as shown in detailed tables: 01-10.

Two equations were computed. The first excluded race and the second included race to see how much added variance race would account for (see table II).

Table II. Multiple correlation (R) and percent variance accounted for in the ID index by each method without and with race included

Method	ID relationship	
	Multiple correlation R	Percent variance accounted for
Without race:		
Multiple regression	.554	30.7
Criterion scaling	.568	32.2
Including race:		
Multiple regression	.583	34.0
Criterion scaling	.601	36.1

In the multiple regression equation computations, any child or youth with a blank or unknown on any variable was deleted from the computations. This resulted in the sample characteristics shown in table III.

Table III. Sample characteristics for the two scaling methods

Method	*n*	Intellectual Development	
		Mean	SD
Criterion scaling	13,887	100.0	15.0
Multiple regression	11,188	101.1	14.8

NOTE: *n* = sample size.

This comparison of methods indicates that the criterion scaling method allowed for the attribution of variable values for all cases and provided a somewhat greater accounting of variance in the index of Intellectual Development than did the multiple linear regression equation method.

Skewness and Kurtosis Tests

In a symmetrical distribution, mean, median, and mode coincide. It is thus natural to take the deviation mean to mode or mean to median as a measure of skewness. K. Pearson proposed the measure S_k = (mean-mode)/standard deviation which is subject to the inconvenience of determining the mode. A more common measure is (mean-median)/standard deviation. However, for ease in handling the sampling distribution as well as for computational convenience the sample moment U_k is defined as follows:

$$U_k = \frac{1}{n} \Sigma (X_i - U)^k$$

where U is the mean and $k > 1$. Denoting the standard deviation S, then $S^2 = U_2$.

It can be shown that for a wide class of frequency distributions, Pearson's S_k can be expressed exactly in terms of U_2, U_3, and U_4. U_3 itself is also a measure of skewness. Clearly, if the distribution is symmetrical, U_3 vanishes and the ratio U_3/S^3 will give some indication of the extent of departure from symmetry. Obviously, all symmetric distributions are not normal. As a measure of the peakedness or flatness of the distribution (kurtosis) ratio U_4/S^4 is used. For a normal distribution this ratio has a value of 3 and thus we can define our measures of skewness and kurtosis as:

$$b_1 = U_3/S^3 \text{ and } b_2 = U_4/S^4 - 3$$

For normal distributions b_1 and b_2 equal zero. A nonsymmetric distribution is negative or positive skewed depending on the sign of b_1. If $b_2 < 0$ the distribution is flat (platykurtic) and if $b_2 > 0$ the distribution is peaked (leptokurtic) in comparison with the normal.

This kurtosis test should be used only when the distribution is symmetric. For testing purposes the null hypothesis assumes that the population distribution is normal. Then the standard error squared for b_1 and b_2 is $6/n$ and $24/n$ respectively where n is the sample size. See Kendall[5] for further statistical detail.

For Cycle II and Cycle III combined, n was 13,889 and the standard error would be .02 for b_1 and .04 for b_2. For the index of Intellectual Development (ID) b_1 was -.08 which indicates that the distribution had a significant (but considering the sample size) slight negative skewness. For the Socio-Intellectual-Status index, b_1 was -.53 and the distribution was markedly negative skewed. Both b_2 values were significant and indicate a platykurtic distribution.

For the Differential-Intellectual-Development index, b_1 was -.03 which is not significantly different from zero. On the other hand, b_2 was .14 and thus the distribution is significantly leptokurtic (peaked). For all practical purposes, however, this distribution cannot be distinguished from a normal distribution.

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