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ABSTRACT

Major tenets summarizing Jensen's two-level theory of mental abilities were examined in a static-group comparison, correlational study. Caucasian siblings in grades one through four from low- and middle-socioeconomic (SES) populations were administered five Level I (associative learning ability) tasks and Raven's Progressive Matrices. Consistent with Jensen's theory, SES groups differed most on Level II (conceptual or problem solving ability) measures. However, predictions derived from Jensen's explanation of the phenomenon were not fulfilled. The functional dependence of II on I and the stronger relation of I and II in the middle-SES population were not supported. The pattern and strength of relationships among Level tasks were not suggestive of a relatively homogeneous class of performances or ability. (Author/RC)

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SOCIOECONOMIC STATUS AND LEVELS OF ABILITY

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Abstract

Major tenets summarizing Jensen's two-level theory of mental abilities were examined in a static-group comparison, correlational study. Caucasian siblings in grades one through four from low- ($N = 49$) and middle- ($N = 44$) socioeconomic (SES) populations were administered five Level I tasks and Raven's Progressive Matrices. Consistent with Jensen's theory, SES groups differed most on Level II measures. However, predictions derived from Jensen's explanation of the phenomenon were not fulfilled. The functional dependence of II on I and the stronger relation of I and II in the middle-SES population were not supported. The pattern and strength of relationships among Level I tasks were not suggestive of a relatively homogeneous class of performances or ability.

Socioeconomic Status and Levels of Ability

Jensen (1969, 1974) has posited that two broad classes of ability, associative learning ability, Level I, and conceptual or problem-solving ability, Level II, underlie performance on aptitude and learning measures. Performance on rote or associative tasks such as digit span or free recall performance is reflective of Level I ability while nonverbal "culture fair," intelligence tests are said to be the best Level II measures. Jensen's theory describes and explains the differential distribution of these abilities across socioeconomic groups.

Examination of the major facets of the two-level theory has resulted in a substantial but frequently equivocal body of research literature (Harris, 1973). Hypotheses originated by Jensen or suggested by him as appropriate derivatives of his theory were retested in the current study with selected modifications in subject and task selection. These hypotheses are: (a) Socioeconomic (SES) groups differ markedly in mean Level II performance but little if at all in Level I. (b) Within broad limits, Level II is functionally dependent upon Level I. (c) Correlations between Level I and II measures are of greater magnitude in middle-SES populations than in low-SES groups. These hypotheses were re-examined in a static-group comparison, correlational study.

Method

Subjects

Caucasian sibling pairs in grades one through four were randomly selected from schools representing low- (N = 49) and middle-socioeconomic (N = 44) strata. (Sibling pairs were selected for reasons pertinent to aspects of the overall study not reported on in this paper.) The number and mean ages of subjects are presented in Table 1. Schools were

Table 1

Subjects

	Grade			
	1	2	3	4
N for School L	14	12	11	12
Mean Age	7.2	8.4	8.9	10.1
N for School M	10	11	11	12
Mean Age	7.2	8.0	9.0	9.9

designated as representing low-(L) and middle-(M) SES populations on the basis of a socioeconomic scale employed by the school district (with rankings of 54.5 and 7 of 68 schools, respectively) and demographic information from census tract data.

Instruments

Paired associates (PA). Nine picture-pairs were presented visually while their names were presented orally on tape. Three study-test trials were given at a 4-second rate.

Serial learning (SL). Nine pictures of common objects were presented sequentially in book form. Following one study trial at a 4-second rate, three test trials were given at a 5-second rate.

Free recall (FR). Fifteen common, concrete objects were presented at a 4-second rate on the first trial and a 2-second rate on the second and third trials. Following each trial, a 60-second response interval occurred during which the subject was asked to name all the objects she or he could recall.

Digit span (DS). Series of digits ranging in length from two to nine (with three series of each length) were presented to subjects at a 1-second rate.

Shadowed recognition memory (SR). Subjects were shown a series of pictures and were asked to orally label each as an animal or person--a nonrelevant dimension for the given memory task. A visual display of many animal pictures was then presented, and the subject was asked to point to the specific animals which he had just seen. Following practice in the oral shadowing procedure at slower rates, subjects were gradually exposed to faster presentations until proficiency was achieved at a 2-second rate. Test series began with two pictures, one of which was an animal and progressed through a nine-picture series including five animals. Subjects were given eight discrete test trials. A response was credited each time the subject correctly identified on the recognition card an animal which he had just been shown.

Progressive matrices (RPM). Two of the three scales comprising Raven's Progressive Matrices were aministered in their book form. The Coloured Matrices were given to all subjects and sets from the Standard scale were given, if necessary, until the subject missed three or more items of the last six from a set.

Procedure

Two female examiners administered all instruments following training and pilot testing phases. All data were collected during a 23-day period beginning in the eighth month of the school year. Subjects were individually administered three of the six measures on consecutive days. Task order was randomized.

On all tasks the examiner and subject sat facing one another at a table or desk. Instructions were presented by audio-tape recordings. The examiner manually presented visual stimulus materials at rates controlled by "clicks" on the audio tape. All tasks included warm-up trials.

Results

It should be noted that a sibling sample was employed in this study and that the usual assumption of independent observations from the population was not met. Generalizations to nonsibling samples seem tenuous at best. Also, analyses which are reported are based upon all available data including six subjects with missing data and five subjects whose siblings were not tested.

Descriptive data are presented in Table 2. The total number of correct responses (across three trials for PA, SL, and FR) are reported for

Table 2

Mean Number of Correct Responses for Each Task According to Socioeconomic Group and Grade of Subject

Task		Grade 1 Low SES	Grade 1 Mid SES	Grade 2 Low SES	Grade 2 Mid SES	Grade 3 Low SES	Grade 3 Mid SES	Grade 4 Low SES	Grade 4 Mid SES
SL	M	12.07	12.20	13.73	13.45	15.30	14.18	14.00	16.75
	SD	5.58	3.43	3.64	3.27	2.75	3.28	5.53	3.72
PA	M	14.07	15.80	15.73	13.36	17.70	16.36	14.18	18.58
	SD	2.92	3.46	4.76	3.85	4.81	4.53	4.85	2.57
FR	M	19.85	23.60	23.40	25.27	26.20	25.27	26.75	28.33
	SD	4.93	3.75	2.80	3.10	4.32	4.52	4.18	4.03
SR	M	15.00	15.60	14.80	16.00	17.45	17.55	16.75	18.25
	SD	3.16	1.65	2.20	2.37	2.42	1.97	2.49	1.86
DS	M	10.69	11.10	10.27	10.73	11.45	11.45	12.09	12.17
	SD	2.72	1.60	1.79	2.37	2.21	2.50	2.12	3.33
RPM	M	18.00	22.70	23.00	25.91	23.73	27.18	27.30	34.91
	SD	5.32	6.80	4.67	11.70	5.76	8.68	6.79	10.47

Note. n = 93.

each measure. Internal consistency estimates of task reliability are presented in Table 3.

Table 3

Reliability Coefficients for Tasks

Task	Socioeconomic Group	
	Low	Middle
Serial Learning	.80	.66
Paired Associates	.79	.73
Free Recall	.65	.49
Shadowed Recognition	.76	.34
Digit Span	.75	.80
Progressive Matrices	.81	.82
	N=43	N=44

Note. Internal consistency estimates of reliability.

A separate, least squares analysis of variance (Overall & Spiegal, 1969) was undertaken for each of the six measures.

Relevant to the first hypothesis, the main effect for socioeconomic status (schools) was significant at the .01 level for RPM ($F = 7.64$, $df = 1, 82$) and was not significant at the .05 level for any of the Level I tasks. This finding appears consistent with Jensen's observation regarding greater socioeconomic differences on Level II measures. A significant grades effect ($p < .01$) occurred for RPM ($F = 7.50$, $df = 3, 82$), FR ($F = 8.56$, $df = 3, 82$), and SR ($F = 6.33$, $df = 3, 82$). The effect for grades was not significant at the .05 level for DS, SL, or PA.

Only for the PA task was the Schools x Grades interaction significant at the .05 level ($F = 3.29$, $df = 3, 82$).

The second hypothesis was tested through examination of the variability about the regression lines of Level I measures on the RPM. Planned analyses were deemed appropriate only for the regression of SL on RPM and DS on RPM for the low-SES sample (for the other eight regression lines, the hypothesis of zero linear regression was not rejected).

For these two, standard errors of estimate were calculated by computing the standard deviation of residuals in all overlapping intervals of three adjacent, predicted scores along the regression line. Consequently, intervals occupied unequal portions of the regression line, a condition which would generally tend to amplify differences between intervals with respect to the variance of residuals. This procedure also increases the alpha error or the probability of rejecting the hypothesis of no differences in variance when differences do not, in fact, exist.

Nonetheless, the assumption of homoscedasticity, as tested by Cochran's test (Kirk, 1968) for homogeneity of variance, was not rejected at the .05 level in either case, contrary to predictions derived from Jensen's theory. Results of tests for homogeneity of variance are presented in Table 4.

Table 4

C Tests of the Homogeneity of Variance of the Standard Error of Estimate

Task	df: k	df: n-1	$\sum_{j=1}^{k} \hat{\sigma}_j^2$	$\hat{\sigma}_j^2$ largest	C
Serial Learning	14	2	34,988.5	9,273.7	.27
Digit Span	14	2	20,138.5	4,900.0	.24

*$p < .05$.

Tasks Intercorrelations

Correlation matrices computed from scores transformed to standard scores at each grade level are presented in Table 5. In effect, these Pearson product-moment correlation coefficients reflect the intercorrelations of the six measures with the variance due to grade levels partialled out. One-tailed *t* tests of differences in correlation magnitude between the two SES groups for each Level I-RPM correlation were carried out. The middle-SES correlation was not significantly larger for any of the comparisons. In fact, post hoc analysis indicated that three of the five coefficients (RPM-SL, RPM-FR, RPM-DS) were significantly greater for the low-SES group ($p < .05$).

These findings run contrary to the general prediction that Level I and II abilities are more closely associated within the middle-SES population.

Table 5

Standard Score Intercorrelations Among Tasks

Task	1	2	3	4	5	6
Serial Learning (1)		.56**	.25	.22	.12	.09
Paired Associates (2)	.40*		.10	.06	-.29	.01
Free Recall (3)	.34*	.21		.21	.28	-.23
Shadowed Recognition (4)	.08	.16	.36*		.24	.09
Digit Span (5)	.37*	.19	.16	.04		-.18
Progressive Matrices (6)	.54**	.22	.25	.24	.47**	

Note. Correlations above the diagonal are for the total middle-SES group; those below are for the total low-SES group.
*$p < .05$.
**$p < .01$.

Jensen has suggested (1974) that the regression coefficient (i.e., slope) of Level I on Level II is a more appropriate index of their relationship than the magnitude of the correlation between them. Though of questionable appropriateness in this case due to the poor fit of the linear model, for all five measures, regression coefficients for Level I on Level II were greater in the low-SES sample than in the middle-SES sample. The median beta weight across the five regression equations was .38 for the low-SES group and .01 for the middle-SES group.

Discussion

Previous research has generally suggested that mean differences between socioeconomic groups on Level II tasks are larger than are those on Level I tasks. Findings from the current study involving conventional measures and one "new" Level I task were clearly in agreement with the bulk of the earlier research with respect to this point. In short, within a sample of Caucasian siblings, a triple interaction of SES, Level I performance, and Level II performance was suggested--an interaction of the general form described by Jensen.

Contrary to predictions derived from Jensen's model, correlations between Level I and Level II measures were not of greater magnitude for the middle-SES group than for the low-SES sample. Furthermore, there was no indication of heteroscadacity in the regression line of Level I on Level II. Clearly, the scatter diagrams did not take the forms described by Jensen. Even within "very broad limits," a hierarchical relationship between Level I and Level II was not suggested.

With respect to Age x SES interactions, some researchers have reported smaller SES differences among older subjects than among younger children on tasks presumably amenable to Level II processing (Rowher & Lynch, 1968; Rohwer, Ammon, Suzuki, & Levin, 1971). The interaction effect noted in the current study, however, is generally consistent with a trend toward increasing SES differences as subjects' chronological ages increase. These results appear more in keeping with predictions derived from Jensen's theory than have findings from some previous studies of PA performance in young children.

No compelling explanation for the dissimilarity between current findings and these earlier studies is apparent. Comparisons among these earlier investigations and between them and the present study indicate differences along several dimensions including most notably, the racial composition of the samples. Also, it should be noted that the youngest subjects in the current study were at the upper limit of the age range in which SES differences have been most frequently found. Possibly, had younger subjects been included, significant SES differences in PA might well have occurred. Nonetheless, Rohwer's (1971) suggestion that SES equivalence is more apparent for PA than DS tasks, or for the theoretically less pure Level I measure, was not supported by the present study.

The relative homogeneity of the Level I construct was also of interest in the current study. While some task specific variance is to be expected, various Level I measures should share a moderate amount of common variance if all such tasks are reflective of the phenotypic expression of a common genotype.

Ten pair-wise correlations of Level I tasks were computed for each SES group. Of the twenty correlation coefficients, only one-fourth are significant greater than zero at the .05 level. Even if one ignores the tasks which were least reliable (internal consistency estimates of less than .65), fewer than 40 percent of the remaining correlations are significant.

Serial learning shared more common variance with other Level I tasks than did PA, FR, DS, or SR. However, the total pattern of relationships among tasks was not suggestive of any relatively unitary class of performances or ability.

In sum, the current study supports the basic observation on which Jensen's theory was apparently founded but fails to fulfill predictions derived from his explanation of the phenomenon.

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