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ABSTRACT

This paper summarizes data comparing the correlation patterns of psychometric, social, and demographic variables with intelligence quotient (IQ) and learning potential (LP) scores derived from the Kohs Block Designs and Raven Progressive Matrices procedures. The sample consists of educable mentally retarded special class and institutionalized students ranging from 7 to 15 years of age. These studies attempted to determine demographic and psychometric factors that account for significant portions of variance in scores on the Kohs and Raven problems before and after training, and to compare these factors with those related to scores on the Stanford-Binet IQ Test. With all variables partialled out, verbal and nonverbal IQs and demographic factors reflective of higher socioeconomic status predicted pretraining scores. Race, social class variables, and verbal IQ did not relate to post-training scores. (Author/LAA)

IQ AND LEARNING POTENTIAL MEASUREMENTS OF GENERAL INTELLIGENCE: A COMPARISON OF RELATIONSHIPS

Abstract

Demographic and psychometric factors related to pre- and posttraining LP scores were determined by multiple regression analyses. With all variables partialled out, pretraining scores were predicted by verbal and nonverbal IQs and demographic factors reflective of higher SES. Race, social class variables, and verbal IQ were not related to posttraining scores.

IQ AND LEARNING POTENTIAL MEASUREMENTS OF GENERAL INTELLIGENCE: A COMPARISON OF RELATIONSHIPS

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Learning potential assessment represents a response to the growing dissatisfaction with the validity of traditional IQ scores for poor, non-middle-class, and frequently, non-white populations. IQ tests (group and individual) primarily assess the extent to which a child has spontaneously acquired knowledge and school-related proficiencies from his natural environment. The IQ test is based on the assumption that children have equal opportunities of access to school-preparatory experiences, and, thus, that differences in acquisition of knowledge, information, and skills reflect differences in (inborn) intellectual abilities. Unfortunately, poor and/or non-white children often lack access to appropriate school-preparatory experiences in early childhood, and perform poorly on IQ tests administered during the school years, indicating a low probability for success in academic school programs. If the IQ scores were viewed merely as predictors of scholastic success, these children's inferior IQs should indicate the need for altered school programs to forestall a predicted failure. Rather, the low IQ scores are usually interpreted to indicate lower (inborn) intelligence, and result in the misclassification of substantial proportions of non-middle-class children. It is

underestimating their potential capabilities since their prior experiences have not prepared them for working with and solving the types of problems presented.

IQ testing is a particularly discriminatory practice when used as the primary criterion for classifying low income and/or non-white children as mentally retarded and segregating them into special classes, or into any other low educational track that may restrict the child's future educational opportunities. These children are grossly over-represented as educable retarded. More than 85% of all children in these classes are poor and/or non-white; the middle class children invariably have organic brain complications or severe emotional disturbance or both. Clearly a new approach to the testing of mental ability is required which would minimize the cultural biases of the tests, and offer insights into the potential abilities which could be incorporated into educational programs for these children.

The Research Institute for Educational Problems has been studying learning potential assessment as an alternative procedure for estimating general ability to reason. The learning potential (LP) assessment approach is based on a conceptualization of intelligence which stresses trainability, or the ability to profit from learning experiences. It assumes that the prior and continuing experiences of poor and/or non-white children do not allow them to spontaneously acquire school-relevant skills in their natural environment. The learning potential paradigm provides subjects with training experiences

directly relevant to the reasoning task presented, so they can apply, in microcosm, their problem-solving ability and show whether they can improve their performance on the task. The improved performance indicates problem-solving capability not evident when the equalizing experiences of training are provided as part of the test administration.

Learning potential assessment replaces the traditional product-oriented test with a three-stage procedure which includes a pretest, one or more training sessions, and a posttest. Investigations of learning potential have usually employed the Kohs Block Designs or the Raven Progressive Matrices as pretest and posttest.

This paper summarizes data comparing the patterns of correlations of psychometric, social, and demographic variables with IQ and LP scores derived from the Kohs and Raven procedures, respectively, with large samples of educable mentally retarded (EMR) special class and institutionalized students. The purpose of these studies was to determine demographic and psychometric factors that accounted for significant portions of variance in scores on the Kohs and Raven problems before and after training, and to compare these factors with those related to scores on the Stanford-Binet IQ Test. The results of these two investigations will be presented separately.

Factors Related to Improved Performance after Training on the Kohs LP Measure

The sample for this study consisted of 627 EMRs from

nine cities and towns in Massachusetts. Seventy-five percent (N = 471) were students in segregated special classes in public schools. Most of the remainder (N = 134) were residents of state institutions for the retarded; 22 were participants in a community workshop. The subjects ranged in age from eight to forty years, with a mean of 14.55 years (SD = 2.75) at the time of initial testing. Fifty-nine percent were males, 38% were white, and 79% had fathers who were manual laborers or menial service workers. Stanford-Binet IQ scores were obtained for 535 subjects; those scores ranged from 65 to 98, with a mean of 68.81 and standard deviation of 10.26.

Data on the following variables were collected from school or institutional records: place and date of birth, father's occupation, race, family size and degree of intactness, number of diseases, age at entry into special class, and WISC and Stanford-Binet IQs. Raven Progressive Matrices were group administered in the usual one session format by project staff. The Kohs learning potential measure was administered individually to each subject. The sixteen block designs were administered three times: prior to, and one day, and again one month following training. (See Budoff (1969) for details of administration.)

Stepwise multiple regression analyses were performed against four main dependent variables: Stanford-Binet IQ, pretraining score (K1), immediate posttraining score (K2) corrected by pretraining score, and delayed posttraining

score (K3) corrected by the two prior Kohs scores. Major background predictors were evaluated both for their simple relationships to these four dependent variables and for their unique contributions to the variance of the dependent variables. Simple relationships between predictors and criteria were described by zero-order correlation coefficients. In order to test the unique contributions of predictors, the set of independent variables in question (e.g., all of the age-related variables) were forced into the regression equation after all of the other variables had been entered. From the remaining partials, one can infer each variable's unique contribution in predicting the dependent variable.

Sets of independent variables in the equations included chronological age, race (Black and Caucasian), social class, sex, birthplace, family size (number of children) and intactness, number of diseases, and scores on various psychometric measures. Turner's classification (1964) was used as the measure of social class.

Partial correlation coefficients indicated that the Stanford-Binet score was significantly related to non-institutionalization, family intactness, and WISC Verbal IQ, whereas partial r's showed that pretraining Kohs (K1) scores were not significantly related to any of these factors.

With all variables held constant, factors related to immediate effects of training on the Kohs were male sex; family size; birthplace outside Northeast U.S., or in foreign

country; and high scores on the Stanford-Binet, Raven Progressive Matrices, and WISC Performance IQ tests. The only factors significantly related to delayed posttest scores obtained one month following training on the Kohs (R3 with all variables partialled out), were WISC Performance IQ and scores on the Raven Progressive Matrices. WISC Verbal IQ was not found to be uniquely related to any of the three Kohs scores. In several equations where race and social class were used as independent variables, these two factors were not found to be significantly related to Kohs posttraining scores.

Factors Related to Improved Performance on the Raven [illegible]

The sample for this study consisted of 403 EMR children who attended segregated special classes in Massachusetts public schools, including 130 children who had participated in the study previously described. They ranged in age from about seven to fifteen, with a mean age of 11 years (SD = 2). Sixty-two percent were male and 70% were Black. Three fourths of the subjects were from working class families. The mean Stanford-Binet IQ score was 70.95, with a standard deviation of 7.77. Raven Progressive Matrices (Sets A_1, A_B, B (1956) and Sets C, D, E (1958)) were group-administered by project staff before and after subjects received training. Training was done individually in two sessions. (See Budoff (1972) for details of administration.) The mean time interval between pre- and posttest was 30 days (SD = 29).

Insert Table 1 about here

Table 1

Partial Correlation Coefficients of Variables Predicting Stanford-Binet IQ, K1, K2, and K3

Variable Set	Variables Included	r_{SBIQ} zero order	r_{SBIQ} all variables partialled out	r_{K1} zero order	r_{K1} all variables partialled out	r_{K2} K1 partialled out	r_{K2} all variables partialled out	r_{K3} K1 and K2 partialled out	r_{K3} all variable partiall out
Age	Age at K1	-.402**	-.205**	.058	.248**	-.160**	.039	-.033	-.075
	Age first in special class	-.150**	-.091*	.014	.110*	-.170**	-.046	.019	-.031
	Years in special class	-.154**	-.010	-.029	-.003	.004	.031	-.061	-.011
Sex (1 = female, 2 = male)		.133**	-.027	.163**	.183**	.093*	.091*	.015	.050
Race (1 = white, 2 = black)		.086	.006	.026	.019	.045	not tested	-.055	not tested
Social class (1 = low, 9 = high)		-.009	.009	-.078	-.082*	.044	not tested	.058	not tested
Family size		-.024	-.030	.041	.033	.182**	.170**	-.025	-.002
Family intactness	Institutionalized (1 = yes, 2 = no)	.499**	.207**	.099*	-.009	.104*	-.074	.083	.075
	Father in home (1 = yes, 2 = no)	-.033	.072	-.001	033	-.078	-.028	-.073	-.071
	Mother in home (1 = yes, 2 = no)	-.057	-.007	-.020	.017	-.078	-.022	-.038	-.038

Table 1 (continued)

Variable Set	Variables Included	r_{SBIQ}		r_{K1}		r_{K2}		r_{K3}	
		zero order	all variables partialled out	zero order	all variables partialled out	K1 partialled out	all variables partialled out	K1 and K2 partialled out	all variables partialled out
	Intactness rating (1 = low, 9 = high)	.449**	.161**	.080*	.016	.129**	-.027	.116*	.076
Birthplace	Born in Northeast (1 = no, 2 = yes)	.236**	.003	.021	.003	.086*	-.084*	.007	.096
	Born in other U.S. (1 = no, 2 = yes)	.032	-.035	-.021	-.014	.000	-.023	-.081	-.040
	Foreign born (1 = no, 2 = yes)	.105*	.032	.024	.011	.169**	.148**	.070	-.093
Number of diseases		-.033	-.016	-.049	-.004	-.114*	-.053	.056	.005
Verbal IQ	Stanford-Binet IQ	---	---	.309**	.179**	.225**	.100*	.068	-.014
	WISC verbal IQ	.436**	.287**	.147**	-.076	.059	-.029	.059	-.010
Performance IQ	Raven score	.260**	.136**	.351**	.304**	.221**	.229**	.228**	.201**
	WISC performance IQ	.380**	.086*	.379**	.336**	.186**	.141**	.173**	.152**
N		535	535	627	627	627	627	409	409

*$p < .05$

**$p < .01$

The following factors were examined with respect to their unique contribution to pre- and posttraining scores on the Raven: social class, race, sex, age, number of diseases, family size, family intactness, birthplace, score on a group IQ test, WISC Verbal IQ, WISC Performance IQ, and length of time interval between pretest and posttest. Statistical methodology was parallel to that used in the study with the Kohs BP measure. Six multiple regression equations were performed with the following Raven scores as dependent measures: pretraining scores on Sets A, Ap, B; pretraining scores on Sets C, D, E; pretraining scores on the total test; and three posttraining scores for these sets corrected by the corresponding pretraining scores.

Results indicated that variables uniquely related to a high pretest score on the total Raven test were: male sex, age, few older siblings, father absent from the home, and a high Stanford-Binet and WISC Performance IQ. Greater than expected improvement following training appropriate to these problems on Sets A, Ap, B was uniquely related only to being male, having a high WISC Performance IQ, and long interval between test sessions. Comparison between factors uniquely related to performance before and after training indicated that effects due to age, number of older siblings, father's absence, and Stanford-Binet IQ, which were related to pretest performance, were not uniquely related to improved scores on the total Raven test after training.

Insert Table 2 about here

Table 2

Partial Correlation Coefficients of Variables Predicting AABB, CDE, and Total Raven Pretest and Posttest

Variable set	Variables included	r_{AABB1}		r_{AABB2}		r_{CDE1}		r_{CDE2}		r_{R1}		r_{R2}	
		Zero order	Partial r^a	Partial r^b	Partial r^a	Zero order	Partial r^a	Partial r^b	Partial r^a	Zero order	Partial r^a	Partial r^b	Partial r^a
Social Class (1 = low; 9 = high)		-.060	-.006	-.107*	-.106*	.044	.000	.066	.083	.029	-.003	.031	.051
Race (1 = white;2 = black)		.029	.027	.089	.055	-.116	-.081	.018	.000	-.113	-.087	.043	.040
Sex (1 = male; 2 = female)		-.239**	-.123*	-.156**	-.111*	-.220**	-.107	-.078	-.006	-.287**	-.153*	-.194**	-.126*
Age		.500**	.458**	.077	.087	.414**	.392**	.226**	.208**	.478**	.494**	.114	.101
Diseases		-.175**	-.021	-.131**	-.040	-.002	-.002	-.108	-.013	-.065	.004	-.085	.003
Family Size	Older Siblings	-.077	-.093	-.021	-.038	-.077	-.091	-.081	-.141*	-.109	-.143*	.084	-.119
	Younger Siblings	.183**	.125*	.078	.104*	.163**	.086	.078	.056	.183**	.101	-.058	.113
Family Disintegration	Father Absent (1=no;2=yes)	.127*	.109*	.000	.035	-.057	.108	.054	.049	.143*	.144*	.036	.072
	Mother Absent (1=no;2=yes)	.020	.016	.139**	.152**	.113	-.063	.027	.011	-.025	-.023	.126*	.120
	Disintegration Rating (1 = low; 9 = high)	.026	.040	.022	.039	-.041	.036	-.064	-.035	-.025	.062	-.038	.020

Table 2 (continued)

Variable set	Variables included	r_{AABB1}		r_{AABB2}		r_{CDE1}		r_{CDE2}		r_{R1}		r_{R2}	
		Zero order	Partial r^a	Partial r^b	Partial r^a	Zero order	Partial r^a	Partial r^b	Partial r^a	Zeor order	Partial r^a	Partial r^b	Partial r^a
Birthplace	Born in West or South U.S. (1 = no; 2 = yes)	-.036	-.067	.007	-.002	-.085	-.031	.000	.036	-.091	-.037	.018	.043
	Foreign Born (1=no; 2=yes)	.099*	-.005	.087	.097	.095	-.017	.030	.060	.108	-.004	.058	.099
Group IQ		.090	.010	-.003	-.003	.035	.054	.008	.035	.073	.121	-.079	-.066
Verbal IQ	Stanford-Binet IQ	.207**	.152**	.065	.016	.197**	.183**	.042	.056	.254**	.251**	.039	.022
	WISC Verbal IQ	.169**	.040	.087	.030	.017	-.089	.003	.000	.042	-.066	.059	.014
Performance IQ	WISC Performance IQ	.354**	.261**	.207**	.163**	.309**	.290**	.116	.113	.351**	.327**	.176**	.142*
Days from R1 to R2		---	---	.054	.072	---	---	.189**	.155*	---	---	.185**	.149*
N		403	403	403	403	266	266	259	259	266	266	259	259

[a]Partial r obtained with all other variables partialled out.

[b]Partial r obtained with only corresponding pretest score partialled out.

*p <.05

**p <.01

Regression analyses with posttraining scores on Sets C, D, E as the dependent variable indicated that older children and children with fewer older siblings improved the most on these more difficult items. For the total sample, social class and being white were not positively related to any pre- or post-test scores on the Raven test.

With all other variables held constant, WISC Performance IQ was found to predict significantly all pre- and posttest scores, with the exception of posttraining scores on Sets C, D, E. By comparison, WISC Verbal IQ was not significantly related to any pre- or posttest scores, when all other variables were partialled out.

Summary

The IQ test, which measures the child's spontaneously acquired skills which predict academic outcomes, misclassifies disproportionate numbers of poor and/or nonwhite populations as mentally retarded. Since prior experiences may vary, learning potential assessment, which uses a (multi-session) test-train-test paradigm, defines intelligence as ability to profit from suitable experience. Low IQ students (60 to 80) demonstrate marked heterogeneity of ability on a training-based assessment procedure which teaches principles relevant to the reasoning task (Kohs Block Designs or Raven Progressive Matrices). Data were presented comparing the pattern of correlations of psychometric, social, and demographic variables with IQ and LP scores, respectively. Variables commonly

associated with socioeconomic status were correlated with IQ and pretest administration of the LP measure. Following training, LP scores were related to performance IQ but unrelated to race, social class, or verbal IQs.

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Footnotes

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