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RACE OF REHABILITATION CLIENTS AND PSYCHOMETRIC TEST SCORES IN THE PREDICTION OF VOCATIONAL POTENTIAL

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RACE OF REHABILITATION CLIENTS AND PSYCHOMETRIC TEST SCORES IN THE PREDICTION OF VOCATIONAL POTENTIAL

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As members of the Final Examination Committee, we certify that we have read the dissertation prepared by Lloyd Kenton Wilson

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Final approval and acceptance of this dissertation is contingent upon the candidate's submission of the final copy of the dissertation to the Graduate College.

I hereby certify that I have read this dissertation prepared under my direction and recommend that it be accepted as fulfilling the dissertation requirement.

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6-5-84 — Date

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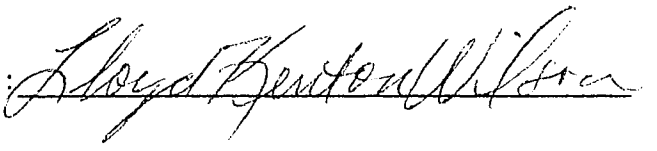
SIGNED: 

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ABSTRACT

This study investigated differences among racial groups and between sex groups on psychometric test performances, demographic data, and vocational potential ratings of an adult rehabilitation client sample. Also, the psychometric and demographic variables were included in discriminant function equations to predict the vocational potential ratings of the white, Hispanic, and black groups and of the total sample.

The sample in this study was composed of 99 adult rehabilitation clients who completed comprehensive vocational evaluations between January, 1980, and July, 1983. Each case included complete psychometric and demographic data. Also, a vocational potential rating based on this data, other aptitude and ability testing, work sample performances, behavior observations, and other information obtained by the vocational evaluator was reported for each case.

Analysis of variance procedures found no significant differences between the male group and the female group of the total sample on the psychometric and demographic variables, or on the cumulative vocational potential rating. Significant differences were found among the racial groups on mean performances of reading comprehension and arithmetic

computation, and on years of education attained. Tukey HSD procedures specified that these differences exist between the white group and the Hispanic group on reading comprehension, between the white group and the black group on arithmetic computation, and between the white and black groups and the Hispanic group on years of education attained. Also, no significant differences were demonstrated among the racial groups on general mental ability, age, or cumulative vocational potential ratings.

Discriminant function analysis procedures applied the psychometric and demographic variables to the prediction of vocational potential ratings of the racial groups and of the total sample. Observation of the resulting prediction equations indicated that some external bias may exist in the use of these equations for predicting vocational potential in white, Hispanic, and black groups. Also, no single predictor variable was the primarily selected variable in all of the discriminant function equations of vocational potential ratings in the total sample. Overall, the predictive power of the discriminant function equations was not sufficient to recommend their use in clinical practice.

INTRODUCTION

The present study investigated group differences in ratings of white, Hispanic, and black adult rehabilitation clients on indices of general mental ability, academic achievement, scholastic attainment, and vocational potential. The usefulness of psychometric test scores and demographic data as predictors of the vocational potential of rehabilitation clients was examined. The current investigation also provided an opportunity to observe the influence of race and sex factors on the performance of psychometric instruments not initially constructed for or standardized on an adult rehabilitation client population.

Rationale for the Study

In rehabilitation settings, as in education and industry, effective assessment methods are necessary for the identification of persons in need of special services (Goldman, 1961; Wright, 1980). The accuracy of rehabilitation treatment decisions relies upon the clinical skill of the rehabilitation psychologist or vocational evaluator in developing treatment recommendations (Bolton, 1968). The amount and quality of the information about the individual are primary factors in the accuracy of the recommendation and the effectiveness of the treatment (Koch, 1967; Wright,

1980). Psychometric test scores, demographic data, and observations of work-related performances are the primary sources of information employed in vocational evaluation.

Measures of intelligence and scholastic skills provide the examiner with estimates of the rehabilitation client's aptitude for training and employment at varying levels of complexity. All jobs require the ability to reason in novel problem-solving situations to some degree (Jensen, 1981). Measures of general mental ability are employed in vocational evaluation to provide an estimate of the disabled person's reasoning ability. Scores on general mental ability tests have been hypothesized by Jensen (1981) as being the best single predictors of educational and occupational success. However, rehabilitation literature (Gillman, 1957; Kalman, 1963; Neff, 1966; Wright, 1980) has suggested that intelligence test scores may not be significant predictors of vocational outcomes in rehabilitation populations.

Reading and mathematical abilities are also important factors in the determination of vocational potential (Parker and Hansen, 1976). Measures of primary reading comprehension and arithmetic skills illustrate the rehabilitation client's functional intellectual abilities and past learning. Achievement test scores correlate highly with measures of mental ability (Anastasi, 1968).

Individual demographic information provides the rehabilitation psychologist or vocational evaluator with important clinical indicators on which to base treatment recommendations. Also, the validity of vocational potential ratings is significantly increased by the addition of work-related behavior observations and work sample performances (Koch, 1967). Further, the combination of psychometric, demographic, and observational variables has been demonstrated to effectively discriminate between successful and unsuccessful rehabilitants.

The usefulness of psychometric and demographic variables in the prediction of educational and vocational outcomes has been debated in professional, legal, and social forums (Svanum and Bringle, 1982). The central issue of these debates has been the culture-fairness of these varables as used in selection and placement decisions. Studies of psychometric tests as predictors of educational or occupational outcomes have demonstrated no significant differences between white groups and black groups in terms of the predictive ability or usefulness of the tests (Schmidt, Berner, and Hunter, 1973; Cleary, 1968; Levin, 1965; Minton and Schneider, 1980). However, none of this research has addressed racial group differences in rehabilitation populations. General mental ability and

scholastic achievement test scores provide important comparisions of the client's performance with that of specific norm groups (Wright, 1980). However, the characteristics of the norm groups rarely match the characteristics of disabled persons, particularly in educational attainment and socioeconomic status.

In rehabilitation, prediction is a central activity of psychological and vocational evaluation services (Bolton, 1972). The primary purpose of psychological and vocational assessment is to provide accurate information on the abilities and limitations of disabled persons, leading to the prediction of vocational and other life potentials (Knight, 1983). One goal of evaluation in rehabilitation is to avoid inappropriate exclusion of individuals from treatment programs. Rather, the assessment information obtained through a psychological or vocational evaluation is used by the client and the rehabilitation team to make decisions about the placement of the client into appropriate treatment programs. Some such programs include individual or group psychotherapy, work adjustment, vocational skills training, sheltered or competitive employment, independent living training, and vocational activities.

The vocational evaluator analyzes relationships among the psychometric test scores, work sample

performances, behavior observations, and demographic data. This analysis of the client's current levels of intellectual, academic, sensory-perceptual, and physical functioning is combined with the evaluator's knowledge of the available services and of any special needs of the client. Clinical judgements of vocational potential are based on objective and subjective data, and result in placement recommendations (Knight, 1983). However, problems of standardization bring into question the predictive usefulness of psychometric test data as applied in the vocational evaluation of disabled persons.

Research Questions

The current investigation was concerned with psychometric and demographic variables which are employed in rehabilitation decision-making. Racial group performances on measures of general mental ability, academic achievement, scholastic attainment, and vocational potential were obtained and analyzed to answer the following research questions.

1. Are there significant differences attributable to race or sex on psychometric, demographic, or behavioral rating variables obtained from a vocational rehabilitation sample?
2. Is there a single variable or group of variables which can effectively predict vocational potential?

3. Are there demonstrable differences among racial groups on the incidence or order of inclusion of the predictor variables into the vocational potential prediction equation?

LITERATURE REVIEW

The effectiveness of assessment in vocational rehabilitation depends primarily on the proficiency of the vocational evaluator or psychologist (Goldman, 1961). Five factors were suggested by Goldman (1961) which result in the improvement the clinical interpretive skills of evaluators. First, training in test instruments, methods, and measurement theory, including the knowledge of test validity and reliability. The second factor that Goldman suggested is the knowledge of the client's special characteristics which may require special procedures in testing or test interpretation. Third, skill in making clinical judgements and diagnostic or prognostic hypotheses, and flexibility in modifying hypotheses to fit new data or conditions. The fourth factor of improved clinical interpretive skill is familiarity with the range of services available to the client, including vocational training and employment possibilities, professional services, and community resources. Lastly, the effective evaluator self-monitors for personal biases which might color his or her assessment performance and interpretation.

An early study of the utility of vocational evaluation found the placement and employability predictions of

evaluators to be valid (Neff, 1960). Later studies confirmed the appropriateness of vocational evaluation recommendations in the subsequent rehabilitation of disabled persons (Phelps, 1965; Campbell and O'Toole, 1970). Koch (1967) showed that the confidence in vocational predictions for disabled persons was significantly increased when the training and experience of evaluators was accounted for in prediction equations. Further, the predictive validity of vocational recommendations on the vocational outcome of disabled persons has been found to range from 0.70 to 0.85 (Miller, 1958; Rosenberg and Usdane, 1963; Hallenbeck and Campbell, 1975).

The accuracy of vocational decision-making is increased significantly when the prediction has been based on an empirical, objective rating of demographic and occupational variables rather than subjective clinical data (Bolton, 1968). The greater utility of statistical over clinical prediction in rehabilitation was established by this research finding. Later research identified discriminant analysis as a strong statistical procedure in predicting rehabilitation outcomes (Melton, 1971; Lowery, 1973; Parks, 1973). In one study, the clinical prediction of rehabilitation outcomes was found to be better than chance, but not a significant predictor of the actual rate of successful rehabilitation (Koch, 1967). The addition of

biographical and psychological data to prior clinical data did not significantly enhance the prediction in Koch's (1967) study. However, the further addition of vocational evaluation results to the prediction equation did result in significantly better prediction than clinical prediction alone. Also, as previously noted, if the training and experience of the evaluator were accounted for in the prediction equation, the confidence of the prediction further increased.

Measurement of Mental Ability

The intellectual assessment of vocational rehabilitation clients is performed by rehabilitation psychologists or clinical psychologists knowledgable of a broad range of disability populations (Miller, 1976). In some cases, intellectual screening may be done by a vocational evaluator, under the supervision of a psychologist. One screening measure used in the vocational evaluation of rehabilitation clients is the Standard Progressive Matrices (Raven, 1960).

The Standard Progressive Matrics (SPM) was developed to assess levels of Spearman's g (1923), or general mental ability. General mental ability, g, is superordinate to all mental activities, according to Spearman (1923) and Jensen (1981). Jensen has proposed that all educational and

occupational activities can be directly correlated in the level of difficulty to the amount of g required for successful academic or work performance. Differences on any complex mental activity between racial groups are primarily the result of differences in individual and group innate general mental ability, according to Jensen. Research on general mental ability has demonstrated significant and non-significant differences between the white and non-white populations indigenous to the United States (Jensen, 1973a, 1974b; Jensen and Inouye, 1980). Also, significant differences in general mental ability have been specifically demonstrated between black rehabilitation clients and white rehabilitation clients (Vincent & Cox, 1974).

Evidence from Jensen's research (Jensen, 1973a, 1974a, 1974b; Jensen and Inouye, 1980) has supported his hypothesis that consistent racial mental ability differences exist from childhood through adulthood. This hypothesis was supported in Jensen's research with children and in one validation study of SPM as a measure of general mental ability in adult rehabilitation client groups (Vincent & Cox, 1974). However, the significant white-black general mental ability differences found by Vincent and Cox (1974) were suggested by the authors to be the result of the different educational experiences of the white and black groups included in the sample. The suggestion that

educational experiences affect mental ability is contrary to Jensen's (1969) hypothesis that general mental ability is largely inherited and not alterable by environmental influences.

White, black, and Latin adult rehabilitation clients participating in a comprehensive evaluation program provided by the Texas Rehabilitation Commission's Houston Diagnostic Unit comprised the sample for the Vincent and Cox (1974) study. That investigation demonstrated that blacks performed significantly poorer than whites on the SPM. There was no significant difference between the performance of the Latin group and either the performance of the white group or black group. The black group mean SPM IQ score was 91.98, the white group mean SPM IQ score was 106.01, and the Latin group mean SPM was reported as "not significantly different from the total sample" (Vincent & Cox, 1974, p. 301) mean of 100.83. Vincent and Cox concluded that the SPM was a valid measure of mental ability for general vocational rehabilitation populations and for the general United States population where accuracy of measurement is not required above SPM IQ 120.

Supportive evidence of qualitative educational differences between the white and black groups in the study may be derived from the demographics of the sample. The age range of the participants in the Vincent and Cox (1974)

study was not reported, but averaged 28.7 years of age at the time of evaluation (estimated to be 1973). This mean age indicates the average year of birth for the participants was 1944, and the mean period of public education for the sample was approximately from 1950-1951 to 1961-1962. Reasonable assumptions from the presented data are that black education in the 1950's was significantly different from white education (U.S. Congressional Budget Office, 1977) and that the sample of the Vincent and Cox study experienced the prevailing educational conditions.

Before 1950, black males in the United States completed an average of less than seven years of formal education while white males in the United States completed approximately 10.5 years of formal education (U.S. Congressional Budget Office, 1977). The difference of 3.5 + years between the educational attainments of blacks and of whites before 1950 was reduced to a difference of 2.6 years by 1960 (whites = 10.8 years, blacks = 8.2 years). That is a reduction in the differences of average white-black educational attainment in the United States of less than one year in a decade. In the 20 years that followed 1960, the difference in average white-black educational attainment was reduced to 0.4 years (whites = 12.5 years, blacks = 12.1 years) (Grant & Eiden, 1982).

Significant legislative and socioeconomic gains for minorities in the United States (U.S. Congressional Budget Office, 1977) have accompanied the increasing similarity of white-black educational attainment. National legislation focusing on civil rights and equal education has increased occupational and economic opportunities for minority groups. The increased educational, vocational, and economic opportunities for minorities have been reflected in the increased expectations of minority parents toward the scholastic performances of their children (Grover, 1981). In addition, minority parents have demonstrated increased expectations for the future vocational attainments of their children.

Increases in level of educational attainment and quality of education, social and economic gains, and changes in parental education and parental attitudes are environmental influences which Jensen (1981) has contended do not affect general mental ability. Level I and Level II abilities are the primary constructs in Jensen's theory of intelligence. Level I ability includes the process of stimulus perception, recognition, and simple association formulation. Education and experience are important in the development of Level I ability. Learned facts, concrete associations, and rote memorization skills are manifestations of Level I ability. White, Asian, Mexican-American, and black children have been demonstrated not to be

appreciably different on Level I ability measures (Jensen, 1973a, 1974b; Jensen and Inouye, 1980).

In contrast, white and Asian children were shown to differ from Mexican-American and black children on Level II ability (Jensen, 1973a, 1974a; Jensen and Inouye, 1980). Level II ability is the complex mental process of elaborating on the stimulus input and transforming the input into abstractions of reality (Jensen, 1981). Level II ability, like Spearman's (1927) g, refers to superordinate mental ability, a property of the brain, and is manifested in all mental activities. Tests of complex problem solving or abstract reasoning, with both nonverbal abstract content and high loadings on g, are representative of Level II ability. Racial group differences on Level II ability are considered by Jensen (Jensen, 1973a, 1974b; Jensen and Inouye, 1980) as evidence of differential genetic endowments of general mental ability and not the effects of different environmental conditions.

In contrast to the hereditarian intelligence theory of Jensen (1969), the quantity and quality of education have been hypothesized as primary factors that determine general mental ability differences between social classes (Davis 1951). When socioeconomic status was held constant, the differences between ethnic groups on measures of intelligence were statistically insignificant (Eells, Davis,

Havighurst, Herrick, and Tyler 1951).

In separate studies, Klineberg (1935) and Lee (1951) found that blacks who migrated from southern states to northern states increased in IQ score performances as a function of the length of residence in the northern states. Both studies found significant differences between white and black mean IQ scores within each of the northern and southern states. However, the blacks migrating to northern states obtained IQ scores significantly higher than blacks remaining in southern states. Also, the northern black mean IQ scores were in some instances higher than the white mean IQ scores in some southern states. The inference that the authors draw from this evidence is that the increase in social, economic, and educational opportunities for the blacks who migrated to northern states resulted in significantly different enviornmental conditions of northern blacks from southern blacks. Klineberg concluded that the better environmental conditions of northern blacks over southern blacks accounted for the nonsignificant differences in general mental ability between southern whites and northern blacks. Davis (1951) inferred from the Klineberg and Lee studies that the influence of schooling and other cultural demands on problem solving ability were the primary factors relating to increases in general mental ability.

Children with the highest risk of educational subnormality were observed to be members of low socioeconomic status (SES) families in which the mother performed poorly on intelligence tests (IQ = 80 or less) (Garber and Heber, 1977). A long-term intensive intervention was provided to both high risk children and their mothers, in terms of language based stimulation. After six years of intervention and a two year post-intervention period, the experimental group (stimulated) children had advanced intellectually over the control group (unstimulated) children by a mean of 30 IQ points (experimental group mean IQ = 110, control group mean IQ = 80). Garber and Heber (1977) concluded from the available data that early and intensive educational intervention can affect general mental ability. This evidence further supports the hypothesis that environment plays a key role in the development of intellectual ability (Davis, 1951).

Another explanation of racial group differences in general mental ability can be found in the research of Olson (1977). That knowledge is specific to the activity and context in which the unit of learning is obtained was hypothesized in this study. Further, only if all persons or groups under study had been equally exposed to the learning of a skill could the persons or groups be expected to perform the skill at a common level. Group differences on

a test of academic achievement were demonstrated to correlate with group differences on a test of general mental ability to the degree that each test measured common context specific skills. Olson concluded that the use of achievement test scores as the criterion for predictions from a general mental ability score is improper. Further, the prediction of academic achievement from a general mental ability test score implies nothing about native mental ability necessary for academic success, but only indicates the common attributes of the achievement and intelligence tests.

Differences on culture-free or culture-fair test performances can be accounted for by the unfamiliarity of persons from differing cultures with certain mental operations or the application of certain mental operations to certain materials (Grover, 1981). Thus, a minority group person may not have learned the necessary operations or operations-materials applications for successful performance on a reasoning task such as the SPM. The resulting differences of individual or group performances are in large part manifestations of the presence or lack of cultural training rather than of native general mental ability.

The relationship of general mental ability test performance to learning of context specific skills was demonstrated in studies by Huttenlocher (1968) and Basso,

DeRenzi, Faglioni, Scotti, and Spinnler (1973). Huttenlocher found that covert verbalizations were invoked by people during the performance of nonverbal reasoning tasks. This finding contradicts Jensen's (1982) and Spearman's (1923) hypothesis that general mental ability is not related to language functionality, but is superordinate to all mental abilities and a diffusely represented property of the brain. Basso et al., in a neurophysiological study, found that covert encoding of perceptual data from the SPM into verbal symbols aided mental operations used in the performance of nonverbal tasks. The Basso et al. research suggests further that there is a region in the brain overlapping and integrated with the language area which is critical to the performance of several intellectual operations.

Neurophysiological findings indicate significant cerebral blood flow in the left hemisphere, and in the left frontal and left posterior language areas in particular, during performances of the SPM (Risberg and Ingvar, 1973; Risberg, Maximilian, and Prohovnik, 1977). The conclusion of these studies is the inner speech, as described by Luria (1966) and Sokolov (1972), occurred during complex nonverbal problem solving. This covert verbalization or language based reasoning supports Olson's (1977) hypothesis of context specific knowledge.

Luria (1979) observed significant differences between the problem solving approaches of persons possessing no formal education and the problem solving approaches of persons who had completed two or three years of education in early adulthood. The unschooled persons relied on concrete classification and simple or practical association in problem solving situations, suggestive of Level I mental ability (Jensen, 1973a). The schooled persons, on the other hand, were able to employ abstractions in problem solving, the primary descriptor of Level II mental ability, as a function of the amount of education each person possessed. Luria concluded from these observations that basic changes in the organization of thinking occur as social or personal environmental circumstances change. Luria's conclusion supports Davis (1951), Klineberg (1935), Lee (1951), and Garber and Heber (1977) in demonstrating the effect of environmental change on general mental ability.

If language is important in both verbal reasoning and nonverbal reasoning, as suggested by the studies cited above, the effect of poor language skills on general mental ability performances should be demonstrable. It has been observed that low SES individuals possessing low IQ scores tended to use restricted and concrete modes of language Bernstein (1960, 1961a, 1961b), Schultz and Aurbach (1971), and Schutz and Keisler (1972). Further the relationship of

restricted language and concrete thinking on low SES children to the restricted language use of their mothers has been demonstrated by Hess and Shipman (1965) and Brophy (1970). The implication of these studies is that the limited and simplistic verbalization and the concrete problem solving modeled by low SES mothers prevented their children from learning language and problem solving strategies representative of Level II abilities.

A disproportionate number of low SES families in the United States before 1950 were black or Hispanic (U.S. Congressional Budget Office, 1977). While the proportion of low SES blacks and Hispanics continues to be greater than the proportion of low SES whites, the actual number of low SES minority families has decreased markedly. The comparatively higher SES of minority families and the increases in educational and vocational attainments of minority groups are examples of environmental changes which may affect the psychometric test performances of minority individuals (Feldman, 1973). In terms of Maslow's (1954) hierarchical theory of self-actualization, as the material needs of people are relatively more satisfied, they will seek higher-order outcomes from educational and occupational opportunities. Thus, as the basic life requirements are achieved by minorities, their cognitive strategies become more abstract to fulfill higher-order life needs (Feldman,

1973).

If the source of racial mental ability differences is genetic rather than environmental (Jensen, 1973b, 1980b), the genetic factors which determine the development of complex mental ability may account for as much as 80% of the variance in racial group mean IQ score performances (Jensen, 1973c). However, the hereditarian intelligence theorists (Spearman, 1923; Jensen, 1973c) fail to note that human beings are genotypic only at the moment of conception (Garcia, 1981). Thereafter, the human is phenotypic, the genetic program interacting with the totality of environmental factors, which may result in significant modifications of the genetic program. From intra-uterine conditions and later mother-child interactions to educational experiences and socioeconomic circumstances, the individual is supplied with opportunities for many kinds of physical and mental growth. The previously cited research of Olson (1977), Huttenlocher (1968), and Luria (1979) demonstrated how different environmental conditions can affect mental growth. The significant environmental differences between white, Hispanic, and black groups may account for differences in the racial mental ability performances observed.

The non-white participants in the Vincent and Cox (1974) investigation were conceivably raised in homes where

the parents averaged less than seven years of education (Grant and Eiden, 1973). The income of the participants' families probably averaged at or near the poverty line, and the parents were often restricted from employment opportunities which could have raised their socioeconomic status (Garcia, 1981). These prevailing conditions in many of the participants' environments may have fostered parent-child interactions in which language and conceptual thinking were restricted (Bernstein, 1960, 1961a, 1961b; Schultz and Aurbach, 1971; Hess and Shipman, 1965; Brophy, 1970), resulting in significant differences on mental ability tests.

The neurophysiological research of Risberg and Ingvar (1973) and others (Basso, DeRenzi, Faglioni, Scotti, and Spinnler, 1973; Risberg, Maximilian, and Prohonvnik, 1977) has indicated that language areas in the brain are employed during the production of complex abstract mental activity. These research findings show that even the nonverbal items of the SPM require active language manipulations in the problem solving process. Therefore, the significantly different racial group mental abilities of white, Hispanic, and black rehabilitation clients, as measured on the SPM (Vincent and Cox, 1974), are conceivably attributable to the restricted language and problem solving abilities learned by the minority clients. Further, the minority participants in the Vincent and Cox study were

themselves the object of de jure and de facto educational and social segregation (Haney, 1981). The combined effects of the participants' home, educational, and vocational environments may have resulted in negative motivational factors on the development of complex abstract mental ability and on scholastic attainment (U.S. Congressional Budget Office, 1977).

Interestingly, an investigation of race and SES with mental ability demonstrated that blacks in high-SES and middle-SES groups did not differ significantly from whites (Jensen, 1974a). However, low-SES blacks scored significantly lower on mental ability than whites, high-SES blacks, and middle-SES blacks. The evidence from this Jensen (1974a) study can reasonably be interpreted as support for the environmental position that genes or race are not the most significant determinants of mental ability differences between whites and other groups.

The SPM has been demonstrated to be culture-reduced and a valid measure of intelligence for comparing white, Mexican-American, and black children (Jensen, 1974b). The item analysis of the SPM shows that no significant internal culture bias is attributable to this test. However, Jensen does not question the predictive validity of the SPM for racial groups, and he challenges other researchers to prove that external culture bias exists for the SPM.

Reviews (Burke, 1958; Raven, Court, and Raven, 1977) of investigations into the reliability of the SPM have found acceptable reliability coefficients (.7 to .9 +) in adult populations in widely varying geographic and cultural samples. The research reviews noted moderate to high correlations (.6 to .9 +) of the SPM to other mental ability tests. Also, significant though less impressive correlations (.3 to .6) of the SPM to scholastic achievement, vocational ability level, and occupational status have been demonstrated. However, the cross-cultural studies reviewed indicated possible problems with the use of the SPM as a scholastic or vocational predictor in minority populations.

Achievement Measures

Aptitude and achievement tests possess more practical utility in predicting the vocational potential of rehabilitation clients than nearly any other type of psychometric instrument (Parker and Hansen, 1976). Aptitude tests measure an individual's propensity to master a particular skill. Achievement tests, on the other hand, demonstrate previous learning. Correlational research has shown the close relationship of aptitude, achievement, and intelligence test performances (Anastasi, 1968). These results suggest a common underlying construct. Jensen

(1981) perceived the relationship of aptitude, achievement, and intelligence test performances as the manifestation of general mental ability. Conversely, the behaviorists (Klineberg, 1935; Davis, 1951; Eells, 1961; Grover, 1981; and others) describe this relationship in terms of the similarity of test content and required skills and as measurements of experiential opportunity.

Achievement tests are often catagorized with intelligence tests as a single cognitive factor useful in predicting academic or vocational success (Ghiselli, 1966; Jensen, 1981). Among the most frequently used of the achievement tests in vocational evaluation programs are the Gates-MacGinitie Reading Test and the Wide Range Achievement Test (Botterbusch, 1974). These measures of academic ability provide pre-counseling diagnostic information and data to aid the process of counseling, in addition to decision-making data (Goldman, 1961).

The Gates-MacGinitie Reading Test, Survey D, (GMRT) is a measure of reading speed and accuracy, vocabulary, and comprehension intended for use at grade levels 4 through 6. The norms provided with the 1972 revision of the GMRT (Gates and MacGinitie, 1972a) give grade level scores ranging from 2.2 to 12.5. Reviews of this test show that it possesses adequate reliability (.78 to .89, alternate form reliability). Reviews have suggested that the best use for

this test is as a screening instrument rather than as a comprehensive diagnostic tool (VanRockel, 1972). In accord with this view, the authors (Gates and MacGinitie, 1972b) suggest that the Comprehension subtest score is the most useful index of reading ability. The GMRT, as a measure of demonstrated ability, is useful in vocational evaluation because the reading comprehension skill measured relates directly to the demands of work (Campbell, Todd, and O'Rourke, 1971). Other important dimensions of this test are ease of administration and brevity.

The Wide Range Achievement Test (Guidance Associates, 1965, 1978) measures basic skills in reading, spelling, and arithmetic. The normative data provides grade level scores for individuals ranging between 5 and 45 years of age. The manual also indicates concurrent validities with other achievement tests (.81 to .93) and with IQ scores (.74 to .84). However, these correlations have been criticized in test reviews (Buros, 1972) for standardization inconsistencies. Also, the brevity of the subtests suggests that this test be used only for screening purposes.

In addition to the wide use of the Gates-MacGinitie Reading Test and the Wide Range Achievement Test (WRAT) reported by Botterbusch (1974), these test have been incorporated into standardized vocational assessment batteries (Hester, 1975; SAVE Enterprizes, 1977). The reading

comprehension and arithmetic scores are employed, along with intelligence test scores, in calculating abilities to perform a wide variety of jobs. Typically, the examinee's scores are compared to an industrial norm and to worker traits in the Dictionary of Occupational Titles (U.S. Department of Labor, 1977). Thus, the direct comparison of the reading and computational skills of a disabled person with functioning workers is possible and a useful classification of the individual's vocational traits is obtained.

Demographic Variables

Sex, age, disability, education, work experience, and other individual variables have been studied in the search for predictors of academic, vocational, and rehabilitation success. Thurstone (1919) demonstrated that a single aptitude test was not a significant predictor of vocational success. But, when age, education, and behavior ratings were added, the prediction of job performances was possible nearly twice as often as with the single variable alone. Thomsen (1938) and Kappel (1962) also found that the prediction of vocational success could be done efficiently with multiple demographic variables.

However, the usefulness of demographic variables has not been validated in rehabilitation populations. Gillman (1957) was not able to distinguish successful from

unsuccessful rehabilitants using the variables of age, sex, disability, intelligence, and work history. In corroboration, no significant relationships were found between the same variables and the successful vocational adjustment of disabled persons by Meadow and Kalman (1963).

These conflicting research findings suggest that demographic variables cannot as yet be discounted as non-significant in the prediction of vocational potential in rehabilitation populations.

Summary

There is a serious question of the validity of using intelligence and achievement test scores in rehabilitation decision-making. The issue is whether or not the individuals who compose the rehabilitation client population have been adquately represented in the standardization samples of each test. In particular, the SPM has not been normed on even a general population sample in the United States. Also, the SPM norms are quite old. However, Vincent and Cox (1974) supported these norms as adequate in screening the intellectual abilities of disabled persons. The GMRT was standardized on fourth through sixth grade students, and no content, concurrent, or predictive validity studies of this test have included an adult rehabilitation sample. The WRAT has norms for child, adolescent and adult groups,

though the manual does not describe the ethnic or disability characteristics of the samples. In view of these possible deficiencies, Lesh (1968) suggested that such tests not be employed in the evaluation of disabled persons.

Bird (1974) notes that in the vocational evaluation setting there are also many sources of variance which may affect test performance. In a discussion of error variance in psychometric testing, Lyman (1978) cites the examinee, the examiner, test content, timing factors, and situational factors as potential sources of systematic error.

While agreeing with the limitations of standardized test use in rehabilitation populations, as noted by Lesh (1968) and Bird (1974), Krautz (1973) points out the purpose of psychometric testing is to support the behavioral observations obtained in the vocational evaluation. Careful test selection, fair administration, and objective interpretation may overcome the limitations of using a test in a nonstandard manner. Botterbusch (1978) indicates that the usefulness of a psychometric test in rehabilitation depends upon the examiner's interpretive skill and upon the decisions to be made on the basis of the test, demographic data, and other behavioral performances. Primarily, the psychometric test scores or demographic data should not be used to exclude a disabled person from participating in an activity, but should be prescriptive in assessing existing

skills and methods of overcoming obstacles to meeting the individual's objective.

THE PROBLEM

The primary goal of vocational assessment is the prediction of future job performance. There have been many attempts to discriminate successful from unsuccessful job candidates, with varying results (Goldsmith, 1922; Bills, 1923; Wonderlic and Associates, 1956; Jensen, 1981). The focus in this research has been on identifying a single test which could accurately predict vocational potential. However, from the very beginnings of vocational assessment research it has been shown that multiple predictors possess significantly greater validity than single predictors of job success (Thurstone, 1919; Thomsen, 1938; Borow, 1964; Standard Oil Company of New Jersey, 1961; Krautz, 1973). Intelligence test scores have been proposed as the best single predictors of vocational potential (Jensen, 1981), but research has not supported this proposition (Gillman, 1957; Krautz, 1973). Only when intelligence test scores were combined with other psychometric test scores and demographic data was it found that vocational potential ratings achieved sufficient validity. In fact, Equal Employment Opportunity guidelines (U.S. Department of Labor, 1978) prohibit the use of a single determinant of employability because of the invalidity of such a procedure and because of the possible unfair discrimination which may result from

such a practice. This constraint is also voiced in Public Law 94-142 standards for educational placement and in the Rehabilitation Act of 1973 (Public Law 93-112, Sections 503 and 504).

Assessment in rehabilitation has developed from the long history of vocational aptitude and employment testing, and from the parallel history of psychological assessment (Wright, 1980). The emphasis on the comprehensive individualized assessment of disabled persons has been a key element in the effectiveness of the rehabilitation movement (Hardy and Cull, 1969). The value of thorough testing, Hardy and Cull (1969) point out, is that the disabled individual is evaluated for potential to benefit from the complete range of rehabilitative services which may result in maximal vocational and life adjustment.

The current investigation was confined to measurement of racial group performances on general mental ability, academic achievement, scholastic attainment, and vocational potential ratings, and the ability of the psychometric and demographic variables to predict vocational potential. In particular, the possibility of group differences in general mental ability was of interest.

The findings of significant differences between white group and black group SPM IQ scores in a rehabilitation client sample (Vincent and Cox, 1974) supported the hypothesis that racial differences in complex mental ability

exist in adults (Jensen, 1969). The mean SPM IQ score of the white rehabilitation client group in the Vincent and Cox (1974) study was found to be significantly higher (15 SPM IQ points) than the mean SPM IQ score of the black rehabilitation client group. The Latin rehabilitation client group mean SPM IQ score in that study was not significantly different from either the white group mean or the black group mean. The findings of Vincent and Cox were consistent with demonstrations of mental ability differences among white, Mexican-American, Asian, and black children (Jensen, 1973a, 1974a, 1974b; Jensen and Inouye, 1980).

Alternatives to the hereditarian views of intelligence proposed by Jensen (1969) have been cited in the Literature Review in a previous section of this study. The environmentalist view (Davis, 1951; Eells, et al, 1951; Klineberg, 1935; Lee, 1951; Huttenlocher, 1968; Basso, et al, 1973; Garber and Heber, 1977; Olson, 1977; Grover, 1981) presented in that review notes that economic and social disadvantage results in different patterns of learning of cognitive strategies assessed on intelligence tests. Further, this body of research has demonstrated that ethnic or cultural differences can be reduced through changes in environmental conditions.

Attempts to identify predictors of rehabilitation outcomes have traditionally been based on one or two critical variables (Ben-Yishay, Gerstman, and Diller, 1972).

A practical criticism of such research is that a single parameter prediction is of little value. Single psychometric, demographic, or behavioral measures cannot account for a significant portion of the variance in the prediction of successful rehabilitation outcomes. Further, the complex relationship of environmental variables in the individual case may have subtle effects on test performance (Rosenthal, Pearson, Medenica, Manaster and Smith, 1965).

As previously stated, prediction of rehabilitation outcomes for disabled individuals is the primary goal of psychological and vocational evaluation. An important part of psychological and vocational evaluations performed on rehabilitation clients is the assessment of general mental ability and academic achievement. Information obtained from mental ability and achievement testing is commonly employed in the development of treatment recommendations. However, the predictive validity of these measures for use with disabled persons is questionable (Neff, 1966; Gillman, 1957; Lesh, 1968; Krautz, 1973). The appropriateness of rehabilitation treatment recommendations relies on the validity of the information about the client on which the decision is based. Psychometric tests used for the purpose of predicting rehabilitation outcomes cannot be culture biased (Atkins and Wright, 1980).

The possibility that external culture bias exists in psychometric tests and demographic data employed in

rehabilitation decision-making was examined in the present study. Analysis of variance procedures were performed on collected vocational evaluation cases to identify race of sex differences on measures of general mental ability, academic achievement, scholastic attainment, biographical characteristics, and vocational potential. Discriminant function analyses were performed on the total sample and on the separate racial groups to distinguish which psychometric and demographic variables predict vocational potential ratings obtained from comprehensive vocational evaluation recommendations.

Research Hypotheses

To address the objectives of the study as stated in the Introduction, the following hypotheses were posed by the investigator.

Null Hypothesis #1

The mean SPM IQ scores of the white, Hispanic, and black groups are not significantly different ($p < .05$).

Null Hypothesis #2

There are no significant differences ($p < .05$) among the mean GMRT grade level scores of the white, Hispanic, and black groups.

Null Hypothesis #3

The mean WRAT grade level scores of the white,

Hispanic, and black groups are not significantly different ($p < .05$).

Null Hypothesis #4

The mean vocational potential ratings (cumulative Data, People, Things occupational code) of the white, Hispanic, and black groups are not significantly different ($p < .05$).

Null Hypothesis #5

There are no significant differences ($p < .05$) among the mean ages of the white, Hispanic, and black groups.

Null Hypothesis #6

There are no significant differences ($p < .05$) among the mean years of education attained of the white, Hispanic, and black groups.

Null Hypothesis #7

The mean SPM IQ, GMRT, WRAT scores, the mean cumulative vocational potential rating, the mean age, and the mean years of educational attainment of males and females in the total sample are not significantly different ($p < .05$).

Null Hypothesis #8

In the discriminant function equation which predicts the vocational potential rating of the total sample, the SPM

IQ score is not the initially selected predictor variable in the stepwise inclusion method.

Null Hypothesis #9

The order of inclusion of the predictor varables into the discriminant function euqation does not vary for the white, Hispanic, and black groups.

Null Hypothesis #10

The discriminant function equation performed on the total sample will not correctly classify the individuals into the actual Data, People, and Things categories to which they belong in 70 percent of the cases.

Assumptions

In the present study the following assumptions apply.

1. The adult rehabilitation client sample employed in the current investigation was representative of a larger adult rehabilitation client population participating in accredited rehabilitation facilities (CARF, 1983). The subsamples obtained from three different geographic locations present similar genetic and environmental factors. This similarity allowed for the combination of the individual cases of the three subsamples into a single sample and into common racial groups for data analysis.

2. The individual cases composing the sample were evaluated under standard conditions and procedures by professional rehabilitation psychologists and vocational evaluators. The data used in this study were collected from test protocols, professional reports, and other information sources contained within confidential master casefiles. This information was accurate.

3. The measures utilized in this investigation represented important information used in the development of treatment recommendations for disabled clients.

4. The mean scores of each racial group on the psychometric tests were accurate representations of the ability or achievement of each group.

Limitations

Several limitations inherent in the study are noted below.

1. A major limitation of this study was that the measurements of general mental ability, reading comprehension skill, arithmetic computation skill, and years of education do not span the entire range of cognitive abilities which people possess. Therefore, generalizations about the comprehensive mental ability of individuals or groups were limited to discussions of the variables measured.

2. No attempt was made in the present study to identify any single variable or defined set of variables as the

principal determinant of mental ability. The vast array of environmental influences, the complex interaction of these influences with each other and with individual genetic programs, and the lack of knowledge of how to measure the effects of these factors makes the identification of critical environmental variables questionable (Eells, 1948). No generalizations can be made about the effect of singular or combined environmental variables on mental ability, and no discussion of this interaction was presented.

3. As stated in Assumption 1., the sample in this study represented a rehabilitation population specific to vocational evaluation settings. No generalization based on the results of this study can be made to populations possessing characteristics dissimilar to those of the sample.

Definition of Terms

Disability

Any physical, mental, or emotional condition which limits the functioning of a person, and is or threatens to be a handicap to the individual's life goals (Wright, 1980).

Physical Disability

Any medically diagnosed condition exclusive of emotional or intellectual dysfunctionality.

Emotional Disability

Any psychiatric or psychological diagnosis of an affective etiology exclusive of neurological impairment or intellectual dysfunctionality.

Mental Disability

Any psychiatric or psychological diagnosis of neurological or developmental etiology including emotional disabilities which impair cognitive functioning.

Placement

The process of matching the characteristics of a rehabilitation client with the most appropriate treatment alternative available.

Psychometric

Measurements of mental ability and achievement.

Dictionary of Occupational Titles (DOT)

A comprehensive catalog of occupational numerical codes, titles, and descriptions of job duties published periodically by the U.S. Department of Labor (1977). The nine-digit occupational code represents catalog numbers of the common vocational group, worker traits involved in the specified job, and the number of similar job titles requiring the same skills. The worker traits are numerically coded for skill levels in working with Data, People, and Things (DPT). See Appendix A for a further explanation of

the DPT codes. There are approximately 20,000 job titles and occupational codes listed in the DOT.

Vocational Potential Rating

Numerical codes based on the Data, People, and Things codes of job titles listed in the vocational evaluation reports of the adult rehabilitation clients included in the current sample. These ratings were determined through the comprehensive vocational evaluation process of psychometric testing, work sampling, behavior observation, and demographic data review. Based on this data, specific vocational training or job placement recommendations were developed, resulting in DOT occupational codes.

SPM

Standard Progressive Matrices test.

GMRT

Gates-MacGinitie Reading Test

WRAT

Wide Range Achievement Test.

METHODOLOGY

This section of the study describes the population under study, the demographic data to be collected, the test instruments and scoring procedures, the measurement of vocational potential, and the procedures of data collection and analysis.

The Sample

Adult vocational rehabilitation client cases composed the sample of the present investigation. The total sample size was 99 cases, with 33 cases in each of the white, Hispanic, and black groups. This sample was derived from a pool of 199 cases obtained from a review of approximately 1,000 master casefiles. Each case in the pool included complete demographic and test data for the variables under investigation. The purpose of equal group sizes was to avoid the possibility of confounding the statistical analyses. In this study, the case pool was composed of 120 white rehabilitation clients, 33 Hispanic rehabilitation clients, and 36 black rehabilitation clients. To achieve maximum sample size, all of the 33 Hispanic cases were selected for inclusion in the study. Three of the 36 black cases were discarded by random drawing. Thirty-three white

cases were selected by random drawing from the 120 white cases in the pool.

The case pool and the resulting sample was obtained through the review of three and one half years of vocational evaluations of disabled adults produced in three rehabilitation facilities. The vocational evaluation units providing cases for inclusion in this study were located in San Francisco, California, Richmond, California, and Tucson, Arizona. Each facility is accredited by the Commission on Accreditation of Rehabilitation Facilities (CARF, 1983). In these rehabilitation facilities, the vocational evaluators and rehabilitation psychologists who assessed the rehabilitation clients represented in the sample were trained and experienced professionals of recognized ability.

Permission to review the casefiles and compile data for research purposes was obtained from the directors of the three rehabilitation facilities. The facilities include the Comprehensive Rehabilitation Workshop (San Francisco, California) and Westcom Industries (Richmond, California), both components of Rehabilitation Services of Northern California, and the Comprehensive Evaluation Project, Rehabilitation Department, The University of Arizona (Tucson, Arizona). These facilities were assured that access to individual case identification data was restricted to the principal investigator.

Criteria for individual case inclusion into the case pool are described below.

1. The client tested and described in the vocational evaluation and the results and recommendations of the vocational evaluation were reported between January, 1980, and July, 1983.
2. The client included in the case pool was between 18 and 35 years of age at the time of the vocational evaluation.
3. Each casefile contained complete data, including sex, ethnicity, age, disability type, and years of education.
4. Each casefile contained complete vocational and psychological test data, including SPM raw score; Gates-MacGinitie Reading Test, Survey D Reading Comprehension subtest score; Wide Range Achievement Test, Arithmetic Level II subtest score; and the Dictionary of Occupational Titles Worker Trait Group occupational code.

Demographic Data

The demographic data collected on each case from the master casefile originated as referral information received by the vocational evaluation unit from the client, referring counselor, other professionals involved in the case, and significant others. The ranges or categories of each demographic variable are listed below.

1. Sex: male or female.

2. Ethnicity: white, Hispanic, or black.

3. Age: 18 to 35 years of age at the time of the evaluation.

4. Disability Type: physical, mental, or emotional.

5. Years of Education Attained: zero to 17 years at the time of the evaluation.

Test Instruments

The following psychometrics were administered during the vocational evaluation and the test scores were collected for the present study from the test protocols of evaluation reports of the individual cases.

1. Raven's Standard Progressive Matrices (SPM) is a non-verbal untimed test considered by Spearman (1927) and Jensen (1973a) to be a measure general mental ability, g. Studies by Raven (1960) and Vernon (1942) demonstrated the g-loading of the SPM to range from 0.76 to 0.84. The SPM has been reported to possess high split-half reliability (0.89 to 0.96) as reported by Burke (1972). Foulds (1949) indicated that the SPM test-retest reliability varied with age in adults between 0.83 and 0.93. In three studies reviewed by Raven, Court, and Raven (1977), the concurrent validity of the SPM with the Wechsler Adult Intelligence Scale, Full Scale IQ ranges from 0.61 to 0.85, with a mean correlation of 0.74. Nine concurrent validity studies reviewed by Burke

(1958) demonstrated that the correlations of the SPM with other mental ability tests (Standford-Binet, WAIS, WISC, Terman-Merrill) range from 0.57 to 0.91, with a mean correlation of the nine studies of 0.76.

The SPM is described by Raven (1960) as a relation-perceiving and reasoning test appropriate for persons eight years of age and older. The SPM is composed of 60 abstract geometric patterns in which a portion of the pattern has been removed. Immediately below each pattern six to eight alternatives are presented which will complete the pattern meaningfully. The examinee is to choose a numbered alternative which best completes the pattern and record that choice on a separate record form. The instructions are simply and clearly written and are presented to the examinee orally. The examiner monitors the progress of the examinee, assuring that the client understands the task as instructed, and then allows the examinee to complete the SPM independently. In rehabilitation settings, the answer recording process may be altered for persons whose disabilities preclude written responding. The SPM manual provides percentile norms based on a British military and civilian sample (5857 persons) for adult age groups between 20 and 65 years.

2. The Gates-McGinitie Reading Test, Survey D, Hand-Scored Edition (GMRT), Reading Comprehension subtest measures the

reading and understanding of complete prose passages (Gates & McGinitie, 1978). The GMRT was normed on fourth through sixth grade students, and the manual provides grade level scores for the reading comprehension subtest ranging from grade level 2.2 to grade level 11.9. The manual also provides transformations of the grade level scores into percentile or standard scores. In rehabilitation settings, adult client performances are compared to the norms for students at grade level 6.9.

The GMRT reading comprehension subtest consists of 21 prose passages containing 52 blank spaces. Five alternative words are presented for each blank. The examinee chooses the word which best completes the meaning of the passage and records that answer on a separate record form. The instructions are presented in oral and written form and include a sample passage. The GMRT reading comprehension subtest is timed (25 minutes) and is independently completed by the examinee, following instruction.

3. The Wide Range Arithmetic Test, Arithmetic Level II (WRAT) subtest measures arithmetic computation skills in persons 12 years of age and older (Jastak & Jastak, 1965). The WRAT was normed on persons from nine to 65 years of age (5933 cases). The manual provides age-related grade level, percentile, and standard scores.

The WRAT arithmetic computation subtest consists of 46 written problems ranging from simple addition to complex algebraic calculation. The examinee is given 10 minutes to complete as many computations as possible. In addition, for persons unable to correctly complete five of the problems, there is a section of 10 oral problems consisting of counting, number recognition, and simple addition and subtraction.

Vocational Potential

The vocational potential rating for each case was derived from the Dictionary of Occupational Titles (DOT) job title or occupational group in which the client had been recommended for vocational training or job placement by the vocational evaluator. This recommendation is based on the vocational evaluator's analysis of all psychometric testing, work sample performances, behavior observations, other case data, and the availability of employment within occupational groups in the geographic area where the client lives. In the vocational evaluation report for each client and job title or occupational code is listed. This title or occupational code will be compared to the DOT listing and a Data, People, Things code will be determined. The Data, People, Things (DPT) code is a numerical ranking of the individual's skill levels in working with words and numbers, with people, and with materials and tools.

Appendix A defines each of the skill level descriptors of the DPT numerical code. As used in the data analysis, the three codes were combined (added) into a score for each case for the analysis of variance procedures. In the discriminant function analysis procedures, the three vocational potential rating variables (Data, People, and Things) were analyzed separately due to computer program limitations.

Data Collection

The demographic data, psychometric test scores, and vocational potential ratings on the individual cases were compiled through reviews of the vocational evaluation casefiles of the adult vocational rehabilitation clients. The assignment of cases to racial or sex groups was based on the ethnicity and sex of the clients as recorded in the vocational evaluation casefiles.

The data on the psychometric test performances was collected as raw scores or in the form recorded in the vocational evaluation report. The vocational potential rating data was collected as a job title or occupational code as recorded in the vocational evaluation report.

Data Transformation

The collected psychometric test data was transformed into consistent score formats to provide uniform data analysis.

The SPM score data was transformed into raw scores for the cases where the SPM raw score was not available in the casefile. Then, the SPM raw score was converted into an age-related SPM IQ score based on a procedure suggested by Shaw (1966). The derived SPM IQ score for each case was used in the analysis of variance and discriminant function analysis procedures employed in this study.

The GMRT reading comprehension subtest and the WRAT arithmetic computation Level II subtest scores were transformed into grade level scores to be used in the analysis procedures in this study.

The data collected on years of education attained and the age of the individuals in this sample were based on the whole number recordings in the casefiles.

Data Analysis

One way analysis of variance, post hoc significance tests, and discriminant function analysis statistical procedures were applied to the various groups of data to address the hypotheses. These statistical procedures were performed through the ONEWAY and DISCRIMINANT computer statistical programs of the Statistical Package for the Social Sciences (SPSS) (Hull and Nie, 1981).

The first seven hypotheses required the performance of one way analysis of variance procedures. Race (white,

Hispanic, and black) was the dependent variable and SPM IQ, GMRT, WRAT, vocational potential (additive data, people, and things code), age, and years of education were the independent variables on the first six hypothesis tests. The seventh hypothesis test employed the same independent variables in analysis of variance on sex (male, female). The resulting F-ratios were observed for significance at the 95% confidence level. If the predetermined probability of significance of the F-ratio was demonstrated, post hoc Tukey HSD method tests were performed to define the groups which were significantly different from each other.

Hypotheses eight, nine, and ten were examined through discriminant function analysis procedures. First, the total sample and each of the racial groups were analyzed to find the most effective equations of the SPM, GMRT, WRAT, years of education, age, and sex variables in predicting group levels of potential for working with data. Next, the same variables were analyzed for their ability to predict racial group and total sample potentials for working with people. Then, the same procedure was applied to predict the group and total sample potentials for working with things. For a further explanation of the Data, People, and Things codes, see Appendix A.

RESULTS

This chapter presents the findings of the study in terms of the data analyses performed to test each hypothesis proposed in this investigation.

Null Hypothesis #1

The first hypothesis stated that no significant differences ($p < .05$) exist among the white, Hispanic, and black groups on mean SPM IQ scores. Table 1 illustrates the group mean performances on the SPM, including means, standard deviations (SD), standard errors (SE), and mean ranges of scores at the 95% confidence interval.

TABLE 1

SPM IQ Score Means, Standard Deviations, Standard Errors, and Mean Ranges for White, Hispanic, and Black Groups

Group	Mean	SD	SE	Range (95% C.I.)
White	101.33	16.55	2.88	95.47 to 107.20
Hispanic	95.27	17.66	3.07	89.01 to 101.53
Black	94.21	13.89	2.42	89.29 to 99.14
Total Sample	96.94	16.25	1.63	93.70 to 100.18

Table 2 contains the results of the analysis of variance of SPM IQ by race. As can be seen in Table 2, the analysis of variance indicated nonsignificant differences on SPM IQ among the white, Hispanic, and black groups, F (2, 96) = 1.88, $p < .16$. This finding supports Null Hypothesis #1.

TABLE 2

Analysis of Variance

SPM IQ by Race

Source	df	Mean Squares	F	p
Between Groups	2	487.10	1.88	0.16
Within Groups	96	259.56		
Total	98			

Null Hypothesis #2

This hypothesis, stated in the null form, asserted that the mean GMRT grade level scores of the white, Hispanic, and black groups are not significantly different at the 0.05 confidence level. Table 3 contains the group mean performances on the GMRT, including the means, standard deviations, standard errors, and mean ranges of the grade level scores at the 95% confidence interval.

TABLE 3

GMRT Grade Level Score Means, Standard Deviations, Standard Errors, and Mean Ranges for White, Hispanic, and Black Groups

Group	Mean	SD	SE	Range (95% C.I.)
White	8.34	3.85	0.67	6.97 to 9.70
Hispanic	5.85	4.35	0.76	4.30 to 7.39
Black	6.41	3.40	0.59	5.20 to 7.62
Total Sample	6.86	3.99	0.40	6.07 to 7.66

Table 4 contains the GMRT by race one way analysis of variance results. This analysis of variance indicates that there exists a significant difference among the white, Hispanic, and black groups on GMRT, F (2, 96) = 3.73, $p <$ .03. This finding rejects Null Hypothesis #2, based on this data. The Tukey HSD method of analyzing the variance between group means was employed to determine the source of the significant interaction found in the analysis of variance. The Tukey HSD method indicated that the white group and the black group were not significantly different from each other on mean GMRT grade level scores. Also, the black group and the Hispanic group were not significantly different from each other on this screening measure of reading

comprehension skill. The white group and the Hispanic group were significantly different from each other on the GMRT, beyond the predetermined 0.05 level of significance.

TABLE 4

Analysis of Variance

GMRT by Race

Source	df	Mean Squares	F	p
Between Groups	2	56.30	3.729	0.03
Within Groups	96	15.10		
Total	98			

Null Hypothesis #3

The third hypothesis stated that the mean WRAT grade level scores of the white, Hispanic, and black groups are not significantly different ($p < .05$). The group means, standard deviations, standard errors, and mean ranges at the 95% confidence interval on the WRAT are presented in Table 5.

TABLE 5

WRAT Grade Level Score Means, Standard Deviations, Standard Errors, and Mean Ranges for White, Hispanic, and Black Groups

Group	Mean	SD	SE	Range (95% C.I.)
White	6.16	2.43	0.42	5.29 to 7.02
Hispanic	4.91	2.40	0.42	4.06 to 5.76
Black	4.38	1.65	0.29	3.80 to 4.97
Total Sample	5.15	2.29	0.23	4.69 to 5.61

The results of the one way analysis of variance of WRAT by race are presented in Table 6. This analysis of variance indicated that a significant difference exists among the white, Hispanic, and black groups on mean performances of the WRAT arithmetic computation subtest, F (2, 96) = 5.70, $p < .01$. Null Hypothesis #3 was rejected, based on this data. A Tukey HSD analysis of the source of the significant interaction found in the analysis of variance indicated that the white group and the Hispanic group are not significantly different from each other on the WRAT. Also, the Hispanic group and the black group are not significantly different from each other on mean arithmetic computation performance. The analysis of variance finding

of significant differences in mean WRAT grade level performances was portrayed by the Tukey HSD procedure as existing between the white group and the black group, beyond the 0.05 level of significance.

TABLE 6

Analysis of Variance

WRAT by Race

Source	df	Mean Squares	F	p
Between Groups	2	27.34	5.70	0.01
Within Groups	96	4.80		
Total	98			

Null Hypothesis #4

This hypothesis, stated in the null form, asserted that there are no significant differences ($p < .05$) among the white, Hispanic, and black groups on mean cumulative vocational potential ratings. The measure used in this hypothesis test was the additive combination of the individual Data, People, and Things numerical codes (See Appendix A for description of these codes). These Worker Trait Group codes were obtained from the Dictionary of Occupational Titles (U.S. Department of Labor, 1977) job codes corresponding to the job training or occupational placement

recommendations contained in the vocational evaluation reports. The means, standard deviations, standard errors, and mean ranges at the 95% confidence interval of the cumulative vocational potential ratings for the white, Hispanic, and black groups are listed in Table 7.

TABLE 7

Cumulative Vocational Potential Rating Means, Standard Deviations, Standard Errors, and Mean Ranges for White, Hispanic, and Black Groups

Group	Mean	SD	SE	Range (95% C.I.)
White	12.48	5.24	0.91	10.63 to 14.34
Hispanic	11.24	4.62	0.80	9.60 to 12.88
Black	11.00	3.63	0.63	9.71 to 12.28
Total Sample	11.58	4.55	0.46	10.67 to 12.48

Table 8 contains the results of the analysis of variance of cumulative vocational potential rating by race. This analysis of variance found no significant differences ($p < .05$) among the white, Hispanic, and black groups on cumulative vocational potential ratings, F (2, 96) = 1.01, $p < .37$. This finding supports Null Hypothesis #4.

TABLE 8

Analysis of Variance

Cumulative Vocational Potential Rating by Race

Source	df	Mean Squares	F	p
Between Groups	2	20.94	1.01	0.37
Within Groups	96	20.69		
Total	98			

Null Hypothesis #5

The fifth null hypothesis stated that the mean ages of the white, Hispanic, and black groups are not significantly different ($p < .05$). The age means, standard deviations, standard errors, and mean ranges at the 95% confidence interval for the white, Hispanic, and black groups are listed in Table 9.

TABLE 9

Years of Age Means, Standard Deviations, Standard Errors, and Mean Ranges for White, Hispanic, and Black Groups

Group	Mean	SD	SE	Range (95% C.I.)
White	25.76	5.87	1.02	23.68 to 27.84
Hispanic	25.82	5.00	0.87	24.05 to 27.59
Black	25.73	4.96	0.86	23.97 to 27.49
Total Sample	25.77	5.24	0.53	24.72 to 26.81

The results of the analysis of variance of age by race, shown in Table 10, indicate that no significant differences ($p < .05$) exist among the white, Hispanic, and black groups, F (2, 96) = 0.01, $p < 1.00$. The age by race analysis of variance results support Null Hypothesis #5.

TABLE 10

Analysis of Variance

Age by Race

Source	df	Mean Squares	F	p
Between Groups	2	0.07	0.01	1.00
Within Groups	96	28.02		
Total	98			

Null Hypothesis #6

This hypothesis, stated in the null form, asserted that the mean years of education attained by the white, Hispanic, and black groups are not significantly different ($p < .05$). The means, standard deviations, standard errors, and mean ranges at the 95% confidence interval of years of education attained by the white, Hispanic, and black groups are presented in Table 11.

TABLE 11

Years of Education Means, Standard Deviations, Standard Errors, and Mean Ranges for White, Hispanic, and Black Groups

Group	Mean	SD	SE	Range (95% C.I.)
White	11.97	1.94	0.34	11.28 to 12.66
Hispanic	10.03	3.19	0.55	8.90 to 11.16
Black	11.55	1.75	0.30	10.92 to 12.17
Total Sample	11.18	2.50	0.25	10.68 to 11.68

The results of an analysis of variance of years of education attained by race are presented in Table 12. This analysis of variance indicated that a significant difference exists among the white, Hispanic, and black groups, F (2, 96) = 6.05, $p < .01$. This finding rejects Null Hypothesis #6. A Tukey HSD analysis of the between groups variance

indicated that the Hispanic group was significantly different ($p < .05$) from the white group and the black group on years of education attained. Also, the white group and the black group were not found to be significantly different ($p < .05$) in years of education attained.

TABLE 12

Analysis of Variance

Years of Education Attained by Race

Source	df	Mean Squares	F	p
Between Groups	2	34.30	6.05	0.01
Within Groups	96	5.67		
Total	98			

Null Hypothesis #7

This hypothesis stated that males and females in the total research sample are not significantly different ($p < .05$) on the SPM IQ score, GMRT grade level, WRAT grade level, cumulative vocational potential rating, age and years of education attained. A series of one way analyses of variances were performed on these variables to show possible sex differences in psychometric test performances or demographics.

An analysis of variance of SPM IQ by sex found no significant differences between the males and females of

the current sample on general mental ability, F (1, 97) = 0.54, $p < .46$. The GMRT by sex analysis of variance resulted in a finding of no significant differences between the males and females on reading comprehension ability, F (1, 97) = 0.00, $p < 1.00$. The analysis of variance of the WRAT grade level by sex also found no significant differences between the males and females of this sample on arithmetic computation ability, F (1, 97) = 0.08, $p < .77$. An analysis of variance of cumulative vocational potential ratings by sex resulted in a finding of no significant differences between the male group and the female group, F (1, 97) = 0.61, $p < .44$.

An analysis of variance of age by sex determined no significant differences between the male group and the female group, F (1, 97) = 0.92, $p < .34$. Also, an analysis of variance of years of education attained by sex indicated no significant differences between males and females composing the current sample, F (1, 97) = 0.42, $p < .52$.

In each analysis procedure reported above, no significant differences ($p < .05$) on the psychometric and demographic variables was evidenced between the male and female adult rehabilitation clients composing the current sample. This series of findings supports Null Hypothesis #7.

While disability type was not specified as a factor to be examined in this study, this factor was analyzed for

possible sex-related or race-related differences which might be a source of variance on the psychometric, demographic, or vocational potential rating variables under investigation. No significant differences ($p < .05$) were found to exist between the males and females of this sample on an analysis of variance of disability type by sex, F (1, 97) = 0.55, $p < .46$. Also, an analysis of variance of disability type on race found no significant differences ($p < .05$) among the white, Hispanic, and black groups, F (2, 96) = 0.82, $p < .44$.

Null Hypothesis #8

This hypothesis, stated in the null form, asserted that SPM IQ is not the initially selected predictor variable in a stepwise discriminant function analysis equation which attempts to predict the vocational potential ratings of individuals represented in the research sample. A single discriminant function analysis based on the cumulative vocational potential rating was not possible, due to the space limitations of the SPSS computer program employed in this study (Hull and Nie, 1981). Therefore, three separate discriminant function analyses were performed with the Data, People, and Things vocational potential ratings designated as dependent variables. SPM IQ score, GMRT grade level, WRAT grade level, years of education attained, age, and sex were designated predictor variables for this analysis.

The order of inclusion of the predictor variables, the percentage of the variance attributed to each variable, and the cumulative percentage of the variance accounted for as each variable is added to the discriminant function equation on the Data vocational potential rating are listed in Table 13.

TABLE 13

Significant Predictor Variables in the Prediction of the Data Vocational Potential Rating

Order of Inclusion	% of Variance	Cumulative % of Variance
1. WRAT	68.57	68.57
2. GMRT	24.03	92.60
3. Age	6.85	99.45
4. SPM IQ	0.55	100.00

The order of inclusion of the predictor variables into a discriminant function equation on the People vocational potential rating, based on the total sample is listed in Table 14. This table also lists the percentage of the variance accounted for by each predictor variable included in the equation. Further, the cumulative percentage of the variance of the prediction equation accounted for as the predictor variables are included is noted.

TABLE 14

Significant Predictor Variables in the Prediction of the People Vocational Potential Rating

Order of Inclusion	% of Variance	Cumulative % of Variance
1. GMRT	58.67	58.67
2. SPM IQ	23.35	82.01
3. Sex	10.59	92.61
4. Education	4.70	97.31
5. Age	2.69	100.00

The order of inclusion of the predictor variables, the percentage of variance attributed to each predictor variable, and the cumulative percentage of the variance accounted for as each variable is added to the discriminant function equation on the Things vocational potential rating are listed in Table 15.

TABLE 15

Significant Predictor Variables in the Prediction of the Things Vocational Potential Rating

Order of Inclusion	% of Variance	Cumulative % of Variance
1. WRAT	59.25	59.25
2. Education	22.85	82.11
3. SPM IQ	14.61	96.71
4. GMRT	2.79	99.50
5. Age	0.50	100.00

A review of Tables 13, 14, and 15 indicates that in none of the three discriminant function equations developed to predict Data, People, and Things vocational potential ratings was SPM IQ the primary predictor variable selected. These findings support Null Hypothesis #8.

Null Hypothesis #9

This hypothesis stated that the order of inclusion of the predictor variables into a discriminant function equation which predicts vocational potential ratings does not vary among the white, Hispanic, and black groups of the current sample. Discriminant function analyses were performed on the Data, People, and Things vocational potential ratings. SPM IQ score, GMRT grade level, WRAT grade level, years of education attained, age, and sex were the

predictor variables employed in the discriminant function equations.

The order of inclusion of the predictor variables of the Data vocational potential rating for the white group, the Hispanic group, the black group, and the total sample are listed in Table 16.

TABLE 16

Order of Inclusion of Predictor Variables in the Discriminant Function Equations on the Data Vocational Potential Ratings for Racial Groups and the Total Sample

Predictor Order	White	Hispanic	Black	Total Sample
1.	WRAT	GMRT	WRAT	WRAT
2.	GMRT	Sex	Sex	GMRT
3.	Age	SPM IQ	SPM IQ	Age
4.	Sex		Education	SPM IQ
5.			Age	

Table 17 lists the order of inclusion of the predictor variables of the People vocational potential rating for the white group, the Hispanic group, the black group, and the total sample.

TABLE 17

Order of Inclusion of Predictor Variables in the Discriminant Function Equations on the People Vocational Potential Ratings for Racial Groups and the Total Sample

Predictor Order	White	Hispanic	Black	Total Sample
1.	GMRT	SPM IQ	Education	GMRT
2.	SPM IQ	Age		SPM IQ
3.		Education		Sex
4.		Sex		Education
5.		GMRT		Age

The order of inclusion of the predictor variables of the Things vocational potential rating for the white group, the Hispanic group, the black group, and the total sample are listed in Table 18.

TABLE 18

Order of Inclusion of Predictor Variables in the Discriminant Function Equations on the Things Vocational Potential Ratings for Racial Groups and the Total Sample

Predictor Order	White	Hispanic	Black	Total Sample
1.	WRAT	Education	Sex	WRAT
2.	Education	Age	WRAT	Education
3.	Sex	SPM IQ	Education	SPM IQ
4.	SPM IQ	GMRT	GMRT	GMRT
5.	GMRT	WRAT		Age

Data in each of Tables 16, 17, and 18 shows that the order of inclusion of the predictor variables is not the same among the white, Hispanic, and black groups, and the total sample on the prediction equations of Data, People, and Things vocational potential ratings. This finding rejects Null Hypothesis #9.

Null Hypothesis #10

This last hypothesis, stated in the null form, asserted that the discriminant function equations do not correctly classify the individuals of the total sample into the actual Data, People, and Things categories to which they were actually assigned through comprehensive vocational

evaluations, in a minimum of 70 percent of the cases.

The cumulative percentages of correct classifications of individual cases into actual Data, People, and Things categories, based on discriminant function equations of the total sample are listed in Table 19.

TABLE 19

Cumulative Percentages of Correct Vocational Potential Rating Classifications from Discriminant Function Equations

Vocational Potential Rating Category	Cumulative Percentages of Correct Classifications
Data	53.54
People	38.38
Things	30.30

The listing of correct classifications of individual cases into their actual vocational potential rating categories in Table 19 shows that none of the discriminant function equations achieved the 70% correct level. These findings support Null Hypothesis #10.

DISCUSSION

The present study employed analysis of variance statistical procedures to determine the possibility of racial and sex differences on psychometric and demographic variables used in rehabilitative decision-making. The variables that demonstrated significant differences ($p < .05$) among the white, Hispanic, and black groups were further analyzed through the Tukey HSD method to specify the between groups interactions. Also, discriminant function analyses were performed to determine the predictive importance and usefulness of the psychometric and demographic variables.

Psychometric Variables

General mental ability, reading comprehension ability, and arithmetic computation ability performances were employed in this study because these abilities are often measured in the vocational evaluation of disabled persons (Wright, 1980).

General Mental Ability

The SPM test scores were not found to significantly differ ($p < .05$) among the white, Hispanic, and black groups of the current research sample. This finding does not support the Vincent and Cox (1974) study in which a white group

was found to be significantly different from a black group on SPM IQ. The authors of that study suggested that the differences in general mental ability they found were possibly attributable to the different educational experiences of the white, Latin, and black groups involved in their study.

As noted in the Literature Review and Problem chapters of this investigation, educational, familial, and socioeconomic factors have been demonstrated to be sources of differences in general mental ability performance (Klineberg, 1935; Lee, 1951; Davis, 1951; Eells, Davis, Havighurst, Herrick, and Tyler, 1951; Bernstein, 1960, 1961a, 1961b; Hess and Shipman, 1965; Brophy, 1970; Schultz and Aurbach, 1971; Garber and Heber, 1977; Olson, 1977; Luria, 1979; Grover, 1981). Also, notable changes in the character of some of these factors in the United States population since the time of the Vincent and Cox (1974) study have been cited (U.S. Congressional Budget Office, 1977; Grant and Eiden, 1982).

The age range of the current sample (18 to 35 years of age at the time of vocational evaluation, with a mean age of 25.77 years) provided a comparative sample to the Vincent and Cox (1974) sample. The finding of no significant differences ($p < .05$) among the white, Hispanic and black groups on a measure of general mental ability in the current study supports Vincent and Cox's statement that education

may be an important variable in the development of intellectual functions.

Also, the current findings of no significant differences (p .05) on the SPM among the white, Hispanic, and black groups do not support Jensen's (1969, 1974a, 1981) hypothesis of significant differences in racial general mental abilities existing into adulthood. The present study does not identify specific environmental factors which may contribute to the development of general intellectual functioning. However, general mental ability, as measured on the SPM, clearly is a construct which may be increased through increases or changes in the totality of environmental experiences. Thus, the differences in SPM performance that Jensen (1974a, 1974b; Jensen and Inouye, 1980) demonstrated in children may be reduced as the child develops through educational and other environmental experiences. The current findings of nonsignificant differences in SPM IQ among the white, Hispanic, and black adult rehabilitation groups suggest that Jensen's bypothesis and observations do not apply to the populations studied. Since no significant differences (p .05) in SPM IQ were demonstrated in an adult sample, a possible explanation is that differences in general mental ability may be restricted to the earlier developmental periods of childhood and adolescence.

Further, the current study demonstrated that the SPM IQ measure is not the primary predictor of vocational

potential. In none of the discriminant function equations on the total sample in the current study did SPM IQ account for the largest portion of the variance in the prediction of vocational potential ratings. This finding does not support Jensen's (1981) contention that general mental ability measures are the best predictors of vocational outcomes.

Academic Achievement

The GMRT measure of reading comprehension ability and the WRAT measure of arithmetic computation ability were found to very significantly ($p < .05$) among the white, Hispanic, and black groups of the current research sample.

An analysis of variance and Tukey HSD post hoc test of the GMRT mean performances demonstrated that the white group and the Hispanic group were significantly different (p .05) on mean reading comprehension. The language-related skills assessed on the GMRT thus were different in the white and Hispanic adult rehabilitation client population. However, caution should be exercised in drawing conclusions regarding differences in general language-related skills from a screening instrument such as the GMRT. In the individual case, comprehensive reading ability assessment may be warranted, particularly when general mental ability estimates show adequate reasoning and learning abilities.

The WRAT scores by race analysis of variance and Tukey post hoc procedures applied to the white, Hispanic, and black groups of this sample demonstrated a significant difference ($p < .05$) between the white group and the black group on mean arithmetic computation performances. Again this observation has been based on a screening instrument (Buros, 1972), and validation with comprehensive arithmetic ability testing should confirm the differences found in this study.

The discriminant function equations produced in this investigation showed that the GMRT and WRAT achievement tests are useful predictors of vocational potential ratings. However, even when these achievement tests were combined with the SPM and certain demographic variables, the predictive power of this limited set of factors employed in discriminant function equations was not sufficient for general clinical use.

The differences between the racial groups on these achievement tests can be viewed as differences which may require further investigation in the vocational evaluation of minority individuals. Recommendations for clients performing poorly on the GMRT or the WRAT may include training in these skills prior to or concurrent with vocational training, to achieve consistency with demonstrated general mental ability.

Sex Differences

Analysis of variance procedures on the psychometric test performances by sex yielded no significant differences ($p < .05$) between males and females on general mental ability, reading comprehension ability, or arithmetic computation ability. These findings confirmed that differences in performance between males and females does not confound the racial group performances and the analysis of variance or discriminant function analysis procedures.

Demographic Variables

Data on age, sex, and years of education attained were collected on each case in the current sample. These variables were employed in analysis of variance and discriminant function analysis procedures to assess possible racial differences and the predictive usefulness of demographic variables. An age by race analysis of variance indicated no significant differences ($p < .05$) among the white, Hispanic, and black groups. No significant differences were found to exist between males and females composing the current sample on six analysis of variance procedures of sex by SPM IQ, GMRT grade level, WRAT grade level, cumulative vocational potential rating, age, and years of education. An analysis of variance of race by years of education attained yielded a significant difference ($p < .05$) among the white, Hispanic, and black groups of the current sample. A Tukey HSD

procedure specified that the significant between groups interaction on years of education attained was the difference between the white group and the Hispanic group.

Discriminant function analysis procedures which attempted to predict the Data, People, and Things vocational potential ratings, shown in Tables 13 through 18, indicated that age, sex, and years of education were selected predictor variables. These findings support the use of demographic variables in the prediction of vocational outcomes (Thrustone, 1919; Thomsen, 1938; Kappel, 1962). However, the finding that the discriminant function equations were unable to sufficiently predict the vocational potential ratings also supports research that has shown demographic variables alone or in combination with psychometric variables to be insufficient predictors of vocational outcomes (Gillman, 1957; Meadow and Kalman, 1963).

Vocational Potential Ratings

The cumulative vocational potential rating, composed of the additive combination of the Data, People, and Things numerical codes, was not found to vary significantly ($p < .05$) among males and females or among the white, Hispanic, and black groups of the research sample. These findings are strong indicators that race and sex are not significant factors in the determination of vocational potentials of adult

rehabilitation clients by professional vocational evaluators and rehabilitation psychologists.

The discriminant function equations generated to predict the Data, People, and Things vocational potential ratings have indicated that SPM IQ is not the primary predictor of vocational potential ratings for the total sample. In fact, SPM IQ was the first selected predictor variable only in the People vocational potential rating equation for the Hispanic group (Table 17). Also, perusal of Tables 13 through 18 shows that no single predictor variable was the primarily selected variable across all racial groups in any of the discriminant function equations. Cleary (1968) has indicated that differences in the predictive value of a test score or series of test scores among racial groups demonstrates external culture bias. The current findings suggest that the prediction of vocational potential may involve some external culture bias when such a prediction is based on a limited number of psychometric and demographic variables. Further, since the predictive equations were not able to correctly classify individual cases to the predetermined criterion level, the predictive usefulness of the psychometric and demographic variable combination employed in this study is low.

Recommendations to Vocational Evaluators

This study has shown that race and sex are not significant determinants of vocational potential in adult rehabilitation clients evaluated in three large rehabilitation facilities in the western United States. Also demonstrated was that a limited number of psychometric and demographic variables are not adequate to establish a mathematical equation which can effectively and fairly predict vocational potential. Based on this knowledge, evaluators will provide the best service to clients and referring agencies by compiling a wide array of client data. Thus, the administration of a comprehensive battery of psychometric tests and work samples is appropriate. The results of this study may be interpreted to indicate that the larger the data base and the broader the data base, the more valid will be the treatment recommendations.

This study has also shown that the three psychometric tests employed (SPM, GMRT, WRAT) are reasonably useful screening instruments of general mental ability, reading comprehension ability, and arithmetic computation ability. The performance differences demonstrated in this study on the GMRT and the WRAT tests may be more indicative of educational deficiencies than of future ability. Further, the SPM scores of the white, Hispanic, and black groups having been found to be not significantly different

($p < .05$) suggests that the groups scoring low on achievement or aptitude tests possess sufficient general mental ability to learn academic skills necessary for successful vocational performance. For individual cases of adequate SPM scores and poor achievement tests scores, a comprehensive assessment of abilities and capacities to learn may be indicated. In particular, the SPM, GMRT, and WRAT test scores are more appropriately used as prescriptive indicators, and are not appropriately used to exclude a client from a program or treatment.

Recommendations for Future Research

Based upon the results of this study and the acknowledged limitations of the study, future research is suggested. The following recommendations are made:

1. That similar research be conducted in which work sample performances, aptitude test results, and behavior observations are added to the variables employed in the present study. This procedure may broaden the data base sufficiently to arrive at a prediction equation which can be useful in clinical practice.
2. That longitudinal follow-up research be conducted to provide data on the long term employment of rehabilitation clients participating in vocational evaluation. Such research could validate the training and placement recommendations resulting from the predictions of vocational

potential developed by vocational evaluators.

3. That the SPM be standardized on a large sample of the United States population. In particular, such a large research sample should include numbers of minorities and disabled persons proportional to the United States population at all ages.

APPENDIX A

Explanation of Data, People, and Things

The best explanation of the usefulness of the Data, People, and Things worker trait classifications has been presented in the Dictionary of Occupational Titles (Department of Labor, 1977, p. 1369).

> Much of the information in [the Dictionary of Occupational Titles] is based on the premise that every job requires a worker to function in some degree to Data, People and Things. These relationships are identified and explained below. They appear in the form of three listings arranged in each instance from the relatively simple to the complex in such a manner that each successive relationship includes those that are simpler and excludes the more complex. The identifications attached to these relationships are referred to as worker functions, and provide standard terminology for use in summarizing exactly what a worker does on the job.
>
> A job's relationship to Data, People and Things can be expressed in terms of the lowest numbered function in each sequence. These functions taken together indicate the total level of complexity at which the worker performs. The fourth, fifth and sixth digits of the occupational code numbers reflect relationships to Data, People and Things, respectively. These digits express a job's relationship to Data, People and Things by identifying the highest appropriate function [in each listing].

Definitions of Worker Functions

The following definitions of Data, People, and Things worker trait classifications are cited from the Dictionary of Occupational Titles (Department of Labor, 1977, p. 1369 - 1371).

Data. Information, knowledge, and conceptions, related to data, people or things, obtained by observation, investigation, interpretation, visualization, and mental creation. Data are tangible and include numbers, words, symbols, ideas, concepts, and oral verbalization.

0. Synthesizing: Integrating analyses of data to discover facts and/or develop knowledge concepts or interpretations.
1. Coordinating: Determining time, place, and sequence of operations or action to be taken on the basis of analysis of data; executing determination and/or reporting on events.
2. Analyzing: Examining and evaluating data. Presenting alternative actions in relation to the evaluation is frequently involved.
3. Compiling: Gathering, collating, or classifying information about data, people, or things. Reporting and/or carrying out a prescribed action in relation to the information is frequently involved.
4. Computing: Performing arithmetic operations and reporting on and/or carrying out a prescribed action in relation to them. Does not include counting.
5. Copying: Transcribing, entering, or posting data.
6. Comparing: Judging the readily observable functional, structural, or compositional characteristics (whether similar to or divergent from obvious standards) of data, people, or things.

People. Human beings; also animals dealt with on an individual basis as if they were human.

0. Mentoring: Dealing with individuals in terms of their total personality in order to advise, counsel, and/or guide them with regard to problems that may be resolved by legal, scientific, clinical, spiritual, and/or other professional principles.
1. Negotiating: Exchanging ideas, information, and opinions with others to formulate policies and programs and/or arrive jointly at decisions, conclusions, or solutions.
2. Instructing: Teaching subject matter to others, or training others (including animals) through explanation, demonstration, and supervised practice; or making recommendations on the basis of technical disciplines.
3. Supervising: Determining or interpreting work

procedures for a group of workers, assigning specific duties to them, maintaining harmonious relations among them, and promoting efficiency. A variety of responsibilities is involved in this function.

4. Diverting: Amusing others. (Usually accomplished through the medium of stage, screen, television, or radio.)
5. Persuading: Influencing others in favor of a product, service, or point of view.
6. Speaking-Signaling: Talking with and/or signaling people to convey or exchange information. Includes giving assignments and/or directions to helpers or assistants.
7. Serving: Attending to the needs or requests of people or animals or the expressed or implicit wishes of people. Immediate response is involved.
8. Taking Instructions-Helping: Helping applies to "non-learning" helpers. No variety of responsibility is involved in this function.

Things. Inanimate objects as distinguished from human beings, substances or materials; machines, tools, equipment, and products. A thing is tangible and has shape, form, and other physical characteristics.

0. Setting up: Adjusting machines or equipment by replacing or altering tools, jigs, fixtures, and attachments to prepare them to perform their functions, change their performance, or restore their proper functioning if they break down. Workers who set up one or a number of machines for other workers or who set up and personally operate a variety of machines are included here.
1. Precision Working: Using body members and/or tools or work aids to work, move, guide, or place objects or materials in situations where ultimate responsibility for the attainment of standards occurs and selection of appropriate tools, objects, or materials, and the adjustment of the tool to the task require exercise of considerable judgement.
2. Operating-Controlling: Starting, stopping, controlling, and adjusting the progress of machines or equipment. Operating machines involves setting up and adjusting the machine or material(s) as the work progresses. Controlling involves observing gages, dials, etc., and turning valves and other devices to regulate factors such as temperature, pressure, flow of liquids, speed of

pumps, and reactions of materials.

3. Driving-Operating: Starting, stopping, controlling the actions of machines or equipment for which a course must be steered, or which must be guided, in order to fabricate, process, and/or move things or people. Involves such activities as observing gages and dials; estimating distances and determining speed and direction of other objects; turning cranks and wheels; pushing or pulling gear lifts or levers. Includes such machines as cranes, conveyor systems, tractors, furnace charging machines, paving machines and hoisting machines. Excludes manually powered machines, such as handtrucks and dollies, and power assisted machines, such as electric wheelbarrows and handtrucks.
4. Manipulating: Using body members, tools, or special devices to work, move, guide, or place objects or materials. Involves some latitude for judgement with regard to precision attained and selecting appropriate tool, object, or material, although this is readily manifest.
5. Tending: Starting, stopping, and observing the functioning of machines and equipment. Involves adjusting materials or controls of the machine, such as changing guides, adjusting timers and temperature gages, turning valves to allow flow of materials, and flipping switches in response to lights. Little judgement is involved in making these adjustments.
6. Feeding-Offbearing: Inserting, throwing, dumping, or placing materials in or removing them from machines or equipment which are automatic or tended or operated by other workers.
7. Handling: Using body members, handtools, and/or special devices to work, move or carry objects or materials. Involves little or no latitude for judgement with regard to attainment of standards or in selecting appropriate tool, object, or material.

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