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ABSTRACT

This study sought to identify distinguishing characteristics of high school vocational students. Academic ability, post secondary school plans, student ratings of their school, psychological variables, values, extracurricular activites, and the influence of various key people were used as independent measures for identifying vocational students. Multivariate methods were used extensively to determine which information from the Longitudinal Study of Educational Effects could be used effectively to distinguish vocational students from general and academic students in the class of 1972. After much work in developing constructs, two conclusions were reached. Academic students were superior to both general and vocational students in terms of measured academic ability. The relationship between curriculum and academic ability was both strong and reliable. No other variables appeared to distinguish strongly academic from vocational and general students. Although the relationship was less reliable and considerably less strong than was the case for distinguishing academic students, vocational students differed from general students primarily in terms of alienation, focus on the work world, channeling, sex, and race. Typically, vocational students were less alienated from school and focused more on the work world than general students. Vocational students experienced less channeling than general students; they were less frequently assigned to their high school program and expressed more choice in selecting programs than were general students. More women and whites were enrolled in vocational programs proportionally. (Author/DEP)

PR-75-3

Final Report

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A VOCATIONAL RE-EVALUATION OF THE BASE YEAR SURVEY OF THE HIGH SCHOOL CLASS OF 1972

PART II: CHARACTERISTICS DISTINGUISHING VOCATIONAL STUDENTS FROM GENERAL AND ACADEMIC STUDENTS

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Educational Testing Service

February 1975

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U. S. DEPARTMENT OF
HEALTH, EDUCATION, AND WELFARE

Office of Education
Office of Planning, Budgeting, and Evaluation

Characteristics Distinguishing Vocational Students From General and Academic Students

Knowing the characteristics unique to high school students enrolled in vocational education programs can provide valuable base-line information for program planners and evaluators. Without a knowledge of how vocational students' values, academic abilities, and future plans differ from those of other students, adequate vocational programs can not be devised. Such characteristic information also enables the evaluator to interpret program outcomes in light of varying base-line characteristics.

The vocational education literature, however, is limited with regard to the characteristics of high school vocational education students. Much of this literature presents a stereotypical view of the vocational student. He is described as a student who has little academic ability and who either chooses or is assigned to vocational courses because he cannot compete with other students (Leighbody, 1972). One study suggests that the vocational student is exposed to school experiences which reinforce handicaps to educational achievement rather than dispelling them (Bowles and Slocum, 1968). The vocational student is also described as one who has a lower self-image and who finds high school uninteresting (Bowles and Slocum, 1968). His future plans are most often influenced by parents and, less frequently, by teachers and counselors (Wisconsin State Department of Public Instruction, 1968; Colorado Research coordinating Unit, 1966; and Indiana Vocational Technical College, 1967).

One study (Wisconsin State Department of Public Instruction, 1968) indicates that more than 60 percent of high school vocational students express some interest in attending college. More typical, although it concerns community college students, are the findings by Bruce et al (1971) pointing to differences between vocational and non-vocational students in personality, interests, socioeconomic status, aptitudes and aspirations.

Perhaps the most thorough coverage of the characteristics of vocational education students to date appears in a survey conducted by the National Center for Educational Statistics (Kay, 1971). In this national survey, the majority of students enrolled in vocational education programs were women. Of those students between ages 14 and 24, 13.2 percent were non-white. About half of the students worked part-time, and the proportion working part-time increased with greater family income. About three of five students came from families with blue-collar heads of household.

The purpose of the present study was to identify distinguishing characteristics of high school vocational students. Academic ability, post secondary school plans, student ratings of their schools, psychological variables, values, extracurricular activities, and the influence of various key people were used as independent measures for identifying vocational students. In contrast to Kay's survey for the National Center for Educational Statistics, this particular study includes more independent variables, obtained from a large probability sample of seniors from the 1972 high school class.

Sample and Data Sources

The data for this study came from the base-year data collection for the Longitudinal Study of Educational Effects (see Hilton et al, 1973). This study, begun in 1972, was the result of a convergence of interests of several bureaus within the U. S. Office of Education, including the Office of Program Planning and Budgeting, the Bureau of Higher Education, and the National Center for Educational Statistics. Each of these agencies were interested in the general subject of Federal support for post-secondary, including vocational, education. The sample design called for a sample of 21,600 seniors in 1,200 randomly selected public and nonpublic schools.

Of the schools invited, 1,044 were able to participate in the base-year data collection. The resulting student sample of 17,726 produced varying response rates for each of several instruments. Student Questionnaires were completed by 16,409 students. A student test battery was taken by 15,625 students. School Record Information Forms, consisting of questions about a student's documented school record, were collected for 17,693 students. All of the data used in this study came from these three instruments.

Methodology

Since the purpose of this study was to distinguish vocational students from their academic and general curriculum peers, the dependent variable used throughout the study was the student's curriculum. This information was taken from the School Record Information Form, which generally was based on school records. Occasionally, school records did not contain sufficient information. In these cases the survey administrator interviewed the affected students and subsequently judged their curriculum.

More than 150 distinct independent variables were involved in the study. Most of these came from the Student Questionnaire, with the balance coming from the Student Test Battery and the School Record Information Form. The items from the Student Questionnaire are displayed in Appendix 1.

Data Reduction

The first step in the analysis of data was to reduce the large number of independent variables to a more manageable number. This was accomplished by a series of factor analyses. Students were first classified by sex and race (black, white, other), resulting in six groups. Since the "other" category did not have enough students for additional analysis, those two groups were set apart from the remaining four groups. Only the four groups and a total group (containing blacks, whites, and others) were factor analyzed.

Before factoring, however, most of the independent variables were sorted into sets, or clusters, based on their similarity in content. The resulting sets were:

Set A: Students' ratings of school quality (from Student Questionnaire items 17, 18, and 19)

Set B: Student values and psychological scales (from Student Questionnaire items 20, 21, 24, and 26)

Set C: Other items (Student Questionnaire items 3, 10, 13, and 14).

Independent variables which directly related to students' plans or aspirations were not sorted into sets. Missing data were imputed in order to preserve a uniform number of degrees of freedom throughout the analysis.* After this had been accomplished, correlations among the items were computed and factor analyses were performed separately for each of the five groups of students.**

The factor analyses were performed using the Minres technique with a Varimax rotation (see Harman, 1968). The number of factors for each analysis which must be specified, was determined as suggested by Kaiser (1960). Factor analyses also were performed using fewer specified common factors in order to determine the effectiveness of the fit. When similar factors were found in four of the five groups, the items with high factor loadings ($\pm$ 0.50 or higher)

*The technique used was to impute the group mean for students in any of the four sex-race groups or the mean for the total if a student was not previously classified. For example, on that item if a value were missing for a black-male, the mean for black males were imputed. If a value were missing for an oriental-female, the mean for the total group on that item was imputed.

**Correlation matrices were obtained for each group; sex and race were partialled from each of the correlations. These correlation matrices subsequently served as imput to the factor analyses. They were based on weighted data. The appropriate weights varied by instrument and are given in Appendix E of Hilton et al. (1973).

were grouped. A composite variable was then formed for these items. This was done by standardizing all item responses and then adding all of the standardized item responses in the group. After obtaining composite scores for each student, the composites were themselves standardized to have a mean of zero and a standard deviation of one. Student Questionnaire items that did not have high factor loadings on any of the factors also were standardized and retained as independent variables.

In creating composite variables two advantages were gained. First, the number of independent variables was reduced from over 150 to 60. Second, the reliability of the independent variables was increased, thus strengthening the subsequent analyses.

Discriminant Analyses

Within each of the five groups, students were randomly separated into two subgroups. The first subgroup in each group contained 2/3 of the students in that group. These students were used to compute the estimated regression weights for the discriminant analyses. This subgroup was termed the "calibration" subgroup. The remaining students in each group, consisting of 1/3 of the students in each group, was designated the "validation" subgroup. The validation sample would be used to evaluate the effectiveness of the discriminant functions.

The discriminant method applied was a stepwise regression procedure (see Draper and Smith, 1966). Two separate regressions were computed for each of the five groups of students. The first regression was designed to discriminate between vocational and general students, while the second was designed to discriminate between vocational and academic students. The application of a stepwise procedure allowed the important predictor

variables, i.e., those capable of discriminating vocational students from others, to be identified.*

Having identified discriminator variables in this fashion, a three-group discriminant analysis was performed, separately for each of the five groups, using the students of the calibration sample. This analysis attempted to distinguish the three curricula from one another using the discriminator variables identified earlier. The discriminant function weights which resulted were then cross-validated on the validation sample. Correlations between the independent variables and the discriminant functions were obtained to interpret the discriminant functions. Distributions of the discriminant function scores for the three groups were obtained on both the calibration and validation samples.

Results of the Independent Variable Reduction

After performing the factor analyses there were sixty independent variables, including characteristic, composite, single item, plans, and ability variables. A summary description of these variables appears below. A more precise description which includes the composition of each composite appears in the Appendix II. In summary, the variables were as follows:

Academic abilities variables: These variables included percentile rank in class, self-reported grades, and tests of vocabulary, reading, picture-number association, mathematics, mosaic comparisons (a speeded test of visual pattern discrimination), and letter groups (identifying a group of letters which were dissimilar from other groups of letters).

Psychological variables: These variables included self-esteem in a scale similar to one used by Rosenberg (1965) and control of environment, which was somewhat similar to Rotter's (1963) scale.

Values variables: These variables included occupational security, social needs, prestige, family importance, occupational contacts, and independence.

* A criterion of $\alpha = .10$ was used to stop the stepwise procedure. This criterion was chosen because more variables would be selected. It was believed better to err by selecting too many variables than to eliminate any potentially useful variables.

Some of the initial variables upon which these composites were based were first given by Richards (1966). Holland and Nichols (1964) and Baird (1969) used these same items to predict academic and non-academic achievement. They were related to student's vocational choices by Astin and Nichols (1964), Holland (1968), and Baird (1970). Studies by Davis (1965) and Sharp (1970) have related the work values in some of the items to vocational choice, vocational interest, and some personality characteristics.

Student ratings of school quality: These variables included an overall school rating, counseling rating, alienation from school, interference with school, vocational opportunity, opportunity to learn basics, instructional technologies, and difficulty with school. The initial items upon which these composites were based were developed by Horwitz and Bayless (1971) as part of the design of the base-year data collection. Items which were not included in composite measures (and which, therefore, were used as separate variables in the stepwise regression analysis) included transportation to school is difficult, the school's job placement, teacher's interest in students, courses were a waste, school should help find jobs, and poor health, which was not selected as a discriminating variable in any of the stepwise regressions.

Participation in Extracurricular Activities: A single composite variable represented this construct, which has been related to obtaining certain types of occupations. Super (1957), for example, noted that participation in extracurricular activities is regarded as important in choosing certain occupations, such as sales, junior executive, and educational positions, because such participation is viewed as evidence of the student's ability to work with people.

Influencing variables: These composites included channeling (whether the student was assigned to, or chose, his curriculum), influence of the state employment service, influence of friends, teachers, clergy, principal,

self-influence (not selected by the stepwise regression), influence of counselor, adults, relatives, and family. Both Super and Ginzberg et. al. (1951) indicated the importance of the family and educational system in determining occupational choice although Ginzberg et al. point to factors that militate against their positive influence.

Plans variables: These variables included working full-time, beginning an apprenticeship, homemaker, vocational school, junior college, four-year school, and other.

Characteristic variables: These included race, sex, socioeconomic status and size of community. Sex and race were dichotomous variables that were used only in the total group. Socioeconomic status was a composite of father's education, mother's education, and family income. Size of community was measured on a five point scale, ranging from a rural or farming community to a metropolitan area with a central city of more than 500,000 people.

Results of the Discriminant Analyses

Means and standard deviations of the independent variables are given in Table 1 for each of the three program groups. Each independent variable scale was standardized so its total sample mean was 0.00 and its standard deviation was 1.00. Means and standard deviations were obtained for each of the four subgroups also. Since the relationships between the program group means remained generally the same for the subgroups, only means for the total sample are presented.

Several characteristics distinguishing vocational students from academic and general students are suggested in the table. Proportionately, more women were enrolled in vocational programs; more non-whites were enrolled in academic programs. Vocational students had the lowest average socio-economic status of the three program groups. Although vocational students were as low as, and in some instances lower than, general program students

Table 1

Means (M) and Standard Deviations (SD) of Independent Variables* by Group**

Variable	Vocational N = 4424		Academic N = 7537		General N = 5746	
	M	SD	M	SD	M	SD
Academic Abilities						
Percentile rank	-0.29	0.85	0.49	0.77	-0.47	0.82
Grades***	0.28	0.83	-0.44	0.79	0.41	0.92
Vocabulary	-0.41	0.73	0.49	0.86	-0.37	0.80
Reading	-0.44	0.83	0.50	0.72	-0.37	0.89
Picture number	-0.25	0.99	0.31	0.86	-0.25	0.96
Mathematics	-0.54	0.68	0.61	0.65	-0.45	0.79
Mosaic comparisons	-0.21	0.95	0.26	0.82	-0.20	1.13
Letter group	-0.34	1.07	0.45	0.55	-0.37	1.08
Psychological Variables						
Self-esteem	0.10	0.92	-0.08	1.03	0.04	1.00
Control environment	-0.21	1.00	0.28	0.85	-0.24	1.02
Value Variables						
Occupational security	0.16	0.95	-0.10	0.98	0.02	1.03
Social needs	-0.06	0.95	0.06	1.00	-0.04	1.03
Prestige	0.02	0.91	-0.05	0.99	0.06	1.07
Family importance	0.18	0.76	-0.13	1.09	0.05	1.00
Occupational contacts	0.19	0.98	-0.15	0.96	0.06	1.00
Independence	-0.07	0.98	0.02	1.03	0.03	0.97
Being successful	0.03	0.94	0.01	0.94	-0.04	1.13
Avoid pressure	0.05	0.97	-0.06	1.03	0.05	0.97
Get away	0.01	1.00	-0.07	0.94	0.09	1.06
Steady progress	0.11	0.95	-0.08	1.02	0.02	0.99
Work-hobby	-0.04	0.96	0.00	1.04	0.04	0.97
Friendship	-0.05	1.05	0.08	0.87	-0.07	1.13

Table 1 (Continued)

Variable	Vocational N = 4424 M	Vocational N = 4424 SD	Academic N = 7537 M	Academic N = 7537 SD	General N= 5746 M	General N= 5746 SD
School Ratings						
Overall quality	0.06	1.02	0.08	0.92	-0.16	1.06
Counseling	0.22	0.94	-0.12	1.00	0.00	0.99
Alienation	0.06	1.06	-0.19	0.83	0.23	1.10
Interference	0.06	1.08	-0.13	0.85	0.14	1.11
Vocational opportunity	-0.10	1.06	0.13	0.92	-0.11	1.03
Basics opportunity	0.01	0.98	0.05	1.00	-0.08	1.00
Technology	0.00	0.98	0.04	1.02	-0.06	0.98
Difficulty	0.00	1.00	-0.10	0.95	0.14	1.04
Transportation	0.03	1.10	-0.08	0.76	0.09	1.24
Job placement	0.12	1.29	-0.01	0.80	-0.08	1.04
teacher interest	-0.06	1.00	0.12	0.95	-0.12	1.04
courses waste	-0.06	1.03	0.09	0.95	-0.08	1.03
help find jobs	-0.08	0.97	0.02	0.96	0.03	1.07
poor health	0.05	1.10	-0.11	0.70	0.12	1.32
Extracurricular Activities	-0.21	0.79	0.20	1.07	-0.12	0.95
Influence Variables						
Channeling	-0.01	1.02	-0.13	0.66	0.20	1.40
State employment	0.13	1.34	-0.14	0.55	0.10	1.33
Friends	0.00	1.02	-0.01	0.96	0.02	1.04
Teachers	0.00	1.00	0.06	1.01	-0.08	0.96
Clergy	-0.05	0.80	0.00	1.01	0.04	1.14
Principal	0.00	0.96	-0.06	0.89	0.09	1.17
Self	-0.07	1.13	0.14	0.64	-0.15	1.36
Counselor	-0.08	0.96	0.10	1.01	-0.07	0.99
Adults	0.05	1.05	-0.07	0.94	0.06	1.03
Relatives	0.02	0.98	0.00	1.00	-0.01	1.01
Family	-0.03	1.07	0.05	0.89	-0.05	1.10
Plans with parents	-0.11	1.15	0.16	0.73	-0.15	1.21
Plans						
Working full-time	0.48	1.31	-0.38	0.43	0.17	1.16
Apprenticeship	0.05	1.26	-0.09	0.45	0.10	1.56
Homemaker	0.11	1.62	-0.11	0.35	0.07	1.41
Vocational school	0.22	1.58	-0.16	0.54	0.05	1.15
Junior college	-0.12	0.82	0.05	1.06	0.02	1.04
Four-year school	-0.56	0.28	0.56	1.09	-0.35	0.62
Other	0.07	1.20	-0.13	0.62	0.13	1.34

Table 1 (Continued)

Variable	Vocational N = 4424		Academic N = 7537		General N = 5746	
	M	SD	M	SD	M	SD
Characteristic Variables						
Sex	0.13	0.98	-0.03	1.00	-0.06	1.00
Race	-0.06	1.11	0.15	0.73	-0.17	1.24
SES	-0.41	0.53	0.36	1.17	-0.20	0.78
Community size	-0.18	0.92	0.16	1.01	-0.09	0.97

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* Independent variables are standardized so that the mean for the total group is 0.0 and the standard deviation is 1.00.

** N's are unweighted. Means and standard deviations, however, were calculated using weighted data.

*** High values indicate low grades.

in tested ability, vocational students had higher percentile rank in class and grade average than did general students. This finding was true for all subgroups except black females. Black females in vocational education scored consistently lower than did black females in general education; their percentile rank and grades were lower too.

Vocational and general students both scored higher than did academic students on the self-esteem scales. They scored lower, however, on the control of environment scale. Higher scores on self-esteem were particularly notable for black students in vocational education. Although black students scored lower than white students on the self-esteem scale, black students in vocational programs scored consistently higher on this scale than did black academic and general students. With the exception of black males, where academic students scored highest on the occupational security scale, vocational students scored consistently higher than academic and general students on occupational security. Vocational students also scored high on family importance and occupational contacts.

Care must be taken in interpreting the difference in means on the vocational opportunity scale. Items in this scale were structured so that students with low scores indicated a preference for more emphasis on practical or vocational activities. The low mean for vocational students indicated that they desired even more vocational activity in school relative to other students. Vocational students rated the counseling they received highly. Although the grades and participation in extracurricular activities for vocational students was considerably lower than that for academic students, vocational students' overall ratings of their schools were almost as high as that for academic students. In a similar vein, alienation scores for vocational students were lower than those for general students.

Some means on influence variables showed a pattern for vocational and general students distinct from that of academic students. Vocational and general students were influenced by external persons (state employment service, adults, and principal) more frequently than were academic students. Academic students, however, were influenced more by traditional sources of influence (self, teachers, counselors, and family).

Table 1 only suggested how vocational students differed from academic and general students. Even though the construction of the independent variables was based on a series of orthogonal factor analyses, the independent variables were correlated, sometimes substantially. The effect of this correlation among the independent variables might have been to distort interpretation of the differences between the curriculum groups. For example, if there were substantial differences between academic and vocational students on several independent variables, all of which were highly correlated, one might distinguish between the two groups using all of the variables. Some of the large measured differences between means, however, may have been due to the effects of other independent variables and thus be entirely spurious. Perhaps a more parsimonious set of variables might distinguish the two groups as well.

Discriminant analyses represent an ideal way to overcome the correlation among the independent variables. In a discriminant function analysis, the aim is to find a linear function of the independent variables which best discriminates among the groups involved. Thus if score distributions on a

discriminant function for the groups involved were obtained, the distributions would be "separated" as much as the data would allow. In cases where more than two groups are involved, more than one discriminant functi can be found. subsequent discriminant functions are orthogonal to previous discriminant functions and as many can be found as there are groups, less one, i.e., (n-1).

Since the two discriminant functions provide the best discrimination of the three curriculum groups, interpreting them will provide a parsimonious description of how the three curriculum groups differ. Although there are many ways to interpret discriminant functions, one of the best and most simple is to examine the correlations of the independent variables with the discriminant functions. Independent variables that correlate highly with the discriminant function are interpreted as comprising most of the discriminant function. In that way, many of the variables that correlate low with the discriminant functions can be eliminated from the interpretation, providing a more simple explanation.

Multiple correlations for the stepwise regressions appear with their cross-validated values in Table 2.* The canonical correlations, which indicate the strength of the discriminant function, and the cross-validated canonical correlations are given in this table also. The discrimination between academic and vocational students appeared strong (R = 0.70 in the total sample and stable (no shrinkage in R). On the other hand, the multiple R for general versus vocational students was only .33 in the total

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* Regression analysis with a dichotomous variable is identical to performing a two-group discriminant analysis. The only different between the regression function and the discriminant function developed by Fisher (1936) is that one is a linear transformation of the other.

Table 2

Multiple and Canonical Correlations in the Calibration Samples and Cross-Validated Multiple and Canonical Correlations, by Group

Sample/Dependent Variable	Calibration Sample		Validation Sample	
	Multiple R	Canonical R	Multiple R	Canonical R
White - Males				
Vocational vs. general	0.35	....	0.27	....
Vocational vs. academic	0.72	....	0.70	....
Vocational vs. general vs. academic I	....	0.68	....	0.67
II	....	0.24	....	0.12
White - Females				
Vocational vs. general	0.37	....	0.32	....
Vocational vs. academic	0.72	....	0.72	....
Vocational vs. general vs. academic I	....	0.69	....	0.68
II	....	0.27	....	0.21
Black - Males				
Vocational vs. general	0.36	....	0.08	....
Vocational vs. academic	0.69	....	0.53	....
Vocational vs. general vs. academic I	....	0.60	....	0.46
II	....	0.27	....	0.12
Black - Females				
Vocational vs. general	0.38	....	0.11	....
Vocational vs. academic	0.69	....	0.57	....
Vocational vs. general vs. academic I	....	0.61	....	0.57
II	....	0.34	....	0.09
Total				
Vocational vs. general	0.33	....	0.28	....
Vocational vs. academic	0.70	....	0.70	....
Vocational vs. general vs. academic I	....	0.67	....	0.67
II	....	0.24	....	0.19

sample, which accounts for only about one-ninth of the variation in the dependent variable. Furthermore, the shrinkage was quite substantial, especially for black students. Although there was some noticable shrinkage in the canonical correlation for black males, the first discriminant function in the three group analysis appeared both significant and stable. Less significant and stable for each subgroup, the second discriminant function appeared stable only in the total sample.

Plots of the program group centroids and contours at one standard deviation for the calibration sample are given in Figure 1. The first discriminant function separated academic students from the remaining students. The mean for academic students was more than one standard deviation higher than the means for vocational and general students. On the other hand, the mean for general students was less than one half of a standard deviation higher than the mean for vocational students on the first discriminant function. Correlations between this discriminant function and the independent variables indicated that the discriminant function could be interpreted as a composite of measured academic ability. Mathematics test score ($r = 0.80$), reading test score ($r = 0.64$), percentile rank in class ($r = 0.64$), vocabulary test score ($r = 0.62$), and letter group test score ($r = 0.57$) each correlated high with the discriminant function. Other measures correlating highly with the discriminant function included plans to attend a four-year school ($r = 0.74$), plans to work full-time ($r = -0.52$), and socioeconomic status ($r = 0.46$).

As Figure 1 demonstrates, there was much overlap between scores on the first discriminant function for vocational and general program students. The amount of overlap and separation of academic students can be seen in greater detail in Figure 2, which presents a histogram of scores on the first discriminant function obtained by students in the three program groups. Academic students scored significantly higher than did either

Figure I. Discriminant Score Means and Contours at One Standard Deviation for the Program Groups

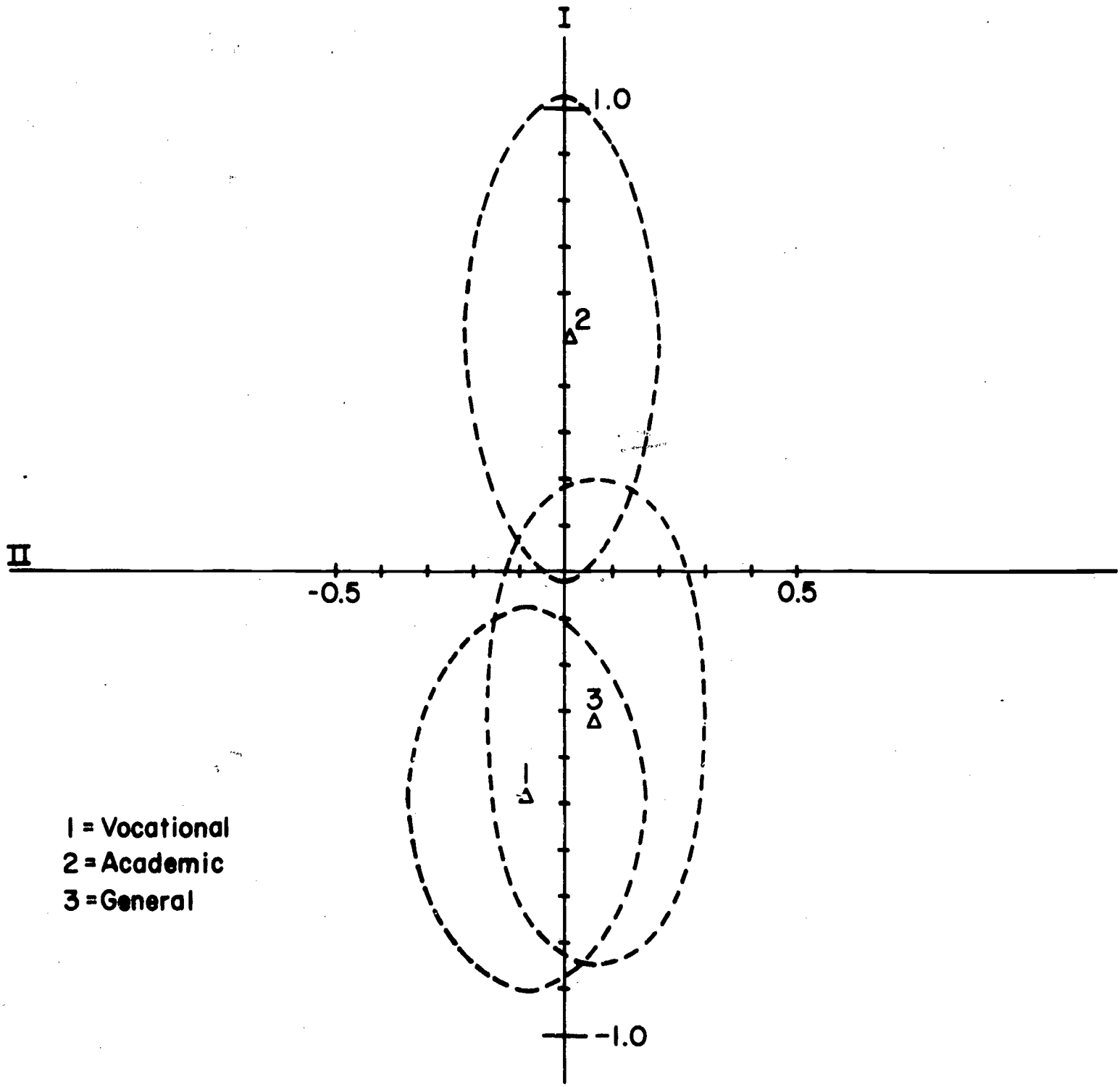
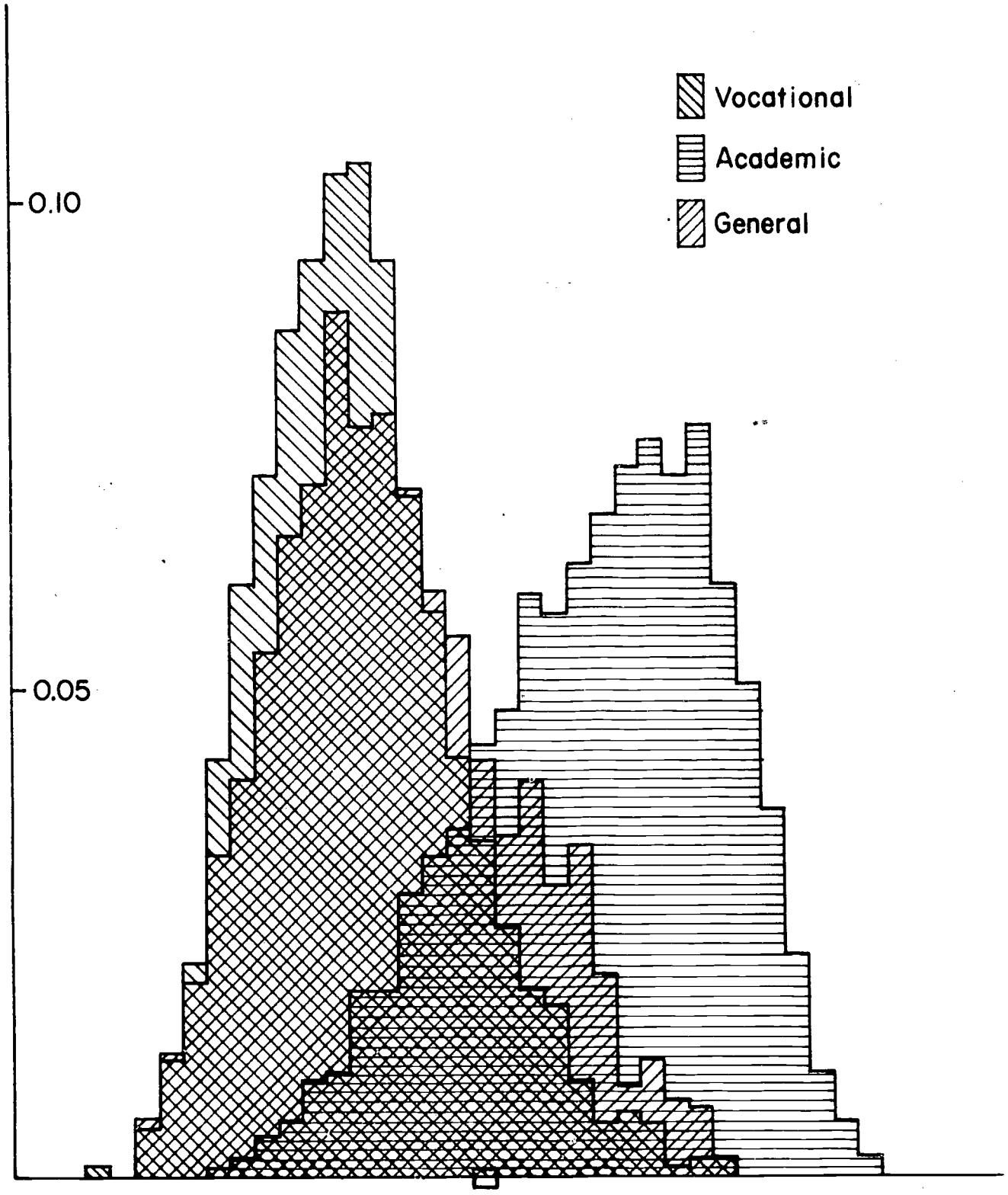


Figure 2. Histogram of Score Intervals for the Three Program Groups on the First Discriminant Function*



* Each Interval on the Horizontal Axis Represents a Length of .1 on the Discriminant Scale. The Interval Marked is (-0.025, 0.075).

of the other two groups. Vocational students scored slightly lower on the first discriminant function than general students.

The plots and contours for the four race-sex subgroups were almost identical to those for the total sample. In each case, the first discriminant function separated academic students from vocational and general students. The plots for black students, however, showed more overlap between academic students and general and vocational students. Indicating less difference in tested academic ability. The overlap for vocational and academic students remained about the same in the four groups.

The second discriminant function attempted to separate vocational and general students. General students scored highest on this function; vocational students scored lowest. The canonical correlations in Table 2 indicated that this function was not stable in the race-sex subgroups. Nevertheless, some stability was recorded in the total sample. Correlations between the independent variables and the second discriminant function indicated that the function required an interpretation involving three parts. Correlations of counseling effectiveness ($r = -0.31$), over all school quality rating ($r = -0.36$), alienation ($r = 0.31$), and difficulty with school ($r = 0.23$) each suggested an alienation component. This was suggested further by the correlation of percentile rank ($r = -0.45$), which indicated that vocational students had higher percentile rank than did general students.* Occupational security ($r = -0.21$), plans to work full-time ($r = -0.30$), and job placement ($r = -0.30$), with vocational students scoring higher on each, indicated a focus on the working world by the vocational student. Other variables correlating highly with the second discriminant function included

* Correlations on the second discriminant function were such that negatively correlated independent variables were variables where vocational students score high; on positively correlated independent variables, general students score high.

channeling (r = 0.36), sex (r = -0.29), indicating that proportionally more women were enrolled in vocational programs, and race (r = -0.20) indicating that proportionally more whites were enrolled in vocational programs.

Three histograms of discriminant scores on the second discriminant function for each of the three program groups are given in Figure 3. The histograms were developed from frequency distributions of discriminant scores in the calibration sample. The figure showed that there was significant overlap between the three groups, indicating that the significance of the second discriminant function should be interpreted with care.

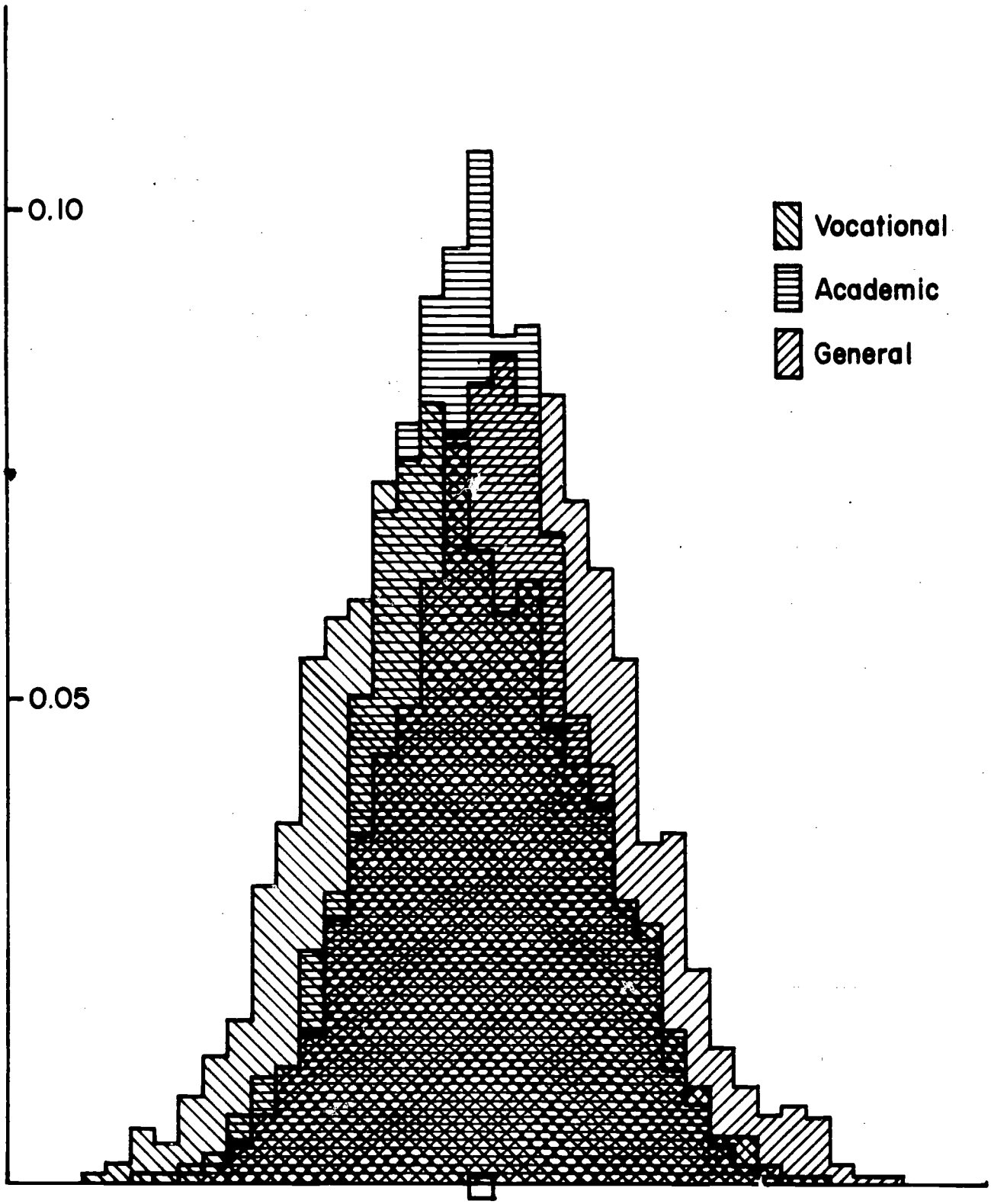
A better discrimination of vocational students from general students was gained by examining the standardized independent variable weights for the regression of vocational versus general program on the independent variables. Those weights and their standard errors are given in Table 3.

This regression function was similar to the second discriminant function. Weights for the alienation and concern with the working world variables were relatively high, as were the correlations between these same variables and the second discriminant function.

Discussion

The first discriminant function, interpreted as academic ability, supported the notion that vocational students are less able in terms of traditional academic measures. The strength of this finding was evidenced by a substantial canonical correlation for the first discriminant function, which showed little shrinkage in cross-validation. Not only did academic ability distinguish academic from vocational students, but it also distinguished academic from general students, whose tested academic ability

Figure 3. Histogram of Score Intervals for the Three Program Groups on the Second Discriminant Function *



* Each Interval on the Horizontal Axis Represents 0.05 on the Discriminant Scale. The Interval Marked is (-0.25, 0.25).

Table 3

Standardized Regression Weights of Independent Variables in the Calibration Total Sample with Vocational Versus General Program as the Dependent Variable

Variable	Standardized Regression Weight	Standard Error of Weight
Academic Abilities		
Percentile rank	0.10	0.01
Math	-0.06	0.02
Mosaic comparisons	-0.02	0.01
Psychological Variables		
Self-esteem	0.03	<0.01
Value Variables		
Occupational security	0.06	<0.01
Social needs	-0.04	<0.01
Family importance	0.03	0.01
Occupational contacts	0.03	0.01
Work-hobby	-0.03	0.01
School Ratings		
Overall quality	0.06	<0.01
Counseling	0.08	<0.01
Alienation	-0.04	<0.01
Basics opportunity	0.03	0.01
Job placement	0.06	0.01
Teacher interest	-0.06	0.01
Courses a waste	-0.04	0.01
Help find jobs	-0.04	0.01
Extracurricular Activities	-0.02	<0.01
Influence Variables		
Channeling	-0.06	0.01
Teacher	0.07	0.01
Principal	-0.03	0.01
Friends	-0.03	0.01
Counselor	-0.03	0.01
Clergy	-0.03	0.01
Plans		
Working full-time	0.12	0.01
Vocational school	0.09	0.01
Four-year school	-0.07	0.02
Other	0.05	0.01
Characteristic Variables		
Sex	0.07	0.02
SES	-0.07	<0.01

was only slightly greater than that for vocational students. These results supported conclusions of writers such as Leighbody (1972) regarding the academic ability of vocational students.

Although the first discriminant function was more clearly defined, the second function had a greater potential impact for vocational education. This function was interpreted as a combination of alienation from school and immediate concern for the working world, among other things. If vocational students exhibit less alienation than general students, and have academic abilities similar to general students, then vocational education programs may have provided students with a positive educational environment, in contradiction of the conclusions of Bowles & Slocum (1968). The second discriminant function, however, was found weak (canonical correlation = 0.24 in the total sample) and shrinkage was noticable, suggesting that the function should be interpreted with caution. Nevertheless, it was inevitable that such a weak relationship would be found in the data. Significant response errors were found in both the dependent and independent variables. These response errors lowered the measured relationships between sets of data (see Cochran, 1970). Response errors in the academic ability measures were less significant than were those in alienation and focus on working would measures. This meant that the measured relationships in the second discriminant function were bound to be weak.*

The extent of the significance of the response errors in the dependent variable is indicated in Table 4. Since the same item, concerning the student's program, was answered once by Survey Administrators and a second time by students,

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* Reliabilities for the ability tests correlating highly with the first discriminant function were: Mathematics (0.87), Reading (.80) Vocabulary (0.78), and Letter Group (0.86).

Table 4

Accuracy of the Dependent Variable: Program of Study

Dependent Variable	Student Questionnaire Response			Total	NDR[1]	R^2
	General	Academic	Vocational			
General	18.27%	5.99%	5.80%	30.06%	2.07%	0.40
Academic	7.86%	36.29%	1.89%	46.04%	-1.90%	0.64
Vocational	6.00%	1.86%	16.04%	23.90%	-0.17%	0.57
Total	32.13%	44.14%	23.73%	100.00%	-	0.54

1. Calculated by subtracting School Record Infromation Form Response mean from the student Questionnaire response mean.

2. See Hansen, M., Hurwitz, W., & Pritzker, L. The estimation and interpretation of gross differences and the simple response variance, in Contributions to Statistics. Calcutta: Statistical Publishing Co., 1964.

cross tabulations of the two responses were possible. The table shows that in about 71 percent of the cases, there was agreement between the dependent variable and the student's responses to the program classification item. The column labeled "NDR" presents the net difference rate or the difference between dependent variable responses and the student responses. The net differences show more students reported they were in general programs and fewer in academic programs.

Considering the dependent variable responses as more accurate than the students' respones, the numbers in the column labeled "R" indicate lower bounds to the category reliabilities. The extent to which these lower bounds underestimate the category reliabilities depends on the accuracy of the student responses. If the student responses were almost as accurate as the dependent variable, the underestimate will be small. The overall item reliability estimate of 0.54 is at best mediocre. The estimate, however, is a lower bound and suggests that the dependent variable is useful although only weak results will be possible.

One of the reasons composite variables were constructed from the independent variables was to increase the reliability of those independent variables. Category and item reliabilities were given by Hilton et al (1973, appendix F). The reliabilities in that appendix were low for the items concerning attitudes and opinions. Although no item in the occupational security scale had a reliability of more than 0.36, the reliability for the composite was 0.69, which was significantly higher, though much lower than the ability test reliabilities. Since many of the scales that correlated highly with the second discriminant function had fewer items than the occupational security scale, and in some instances were single items, their reliabilities were undoubtedly less than that for occupational security.

Perhaps if the independent variables had been more reliable, the canonical correlation of the second discriminant function might have been higher and less subject to shrinkage.

Conclusions

In this study, multivariate methods were used extensively to determine which information from the Longitudinal Study of Educational Effects could be used effectively to distinguish vocational students from general and academic students in the class of 1972. After much work in developing constructs, two conclusions were reached. Acedemic students were superior to both general and vocational students in terms of measured academic ability. The relationship between curriculum and academic ability was both strong and reliable. No other variables appeared to distinguish strongly academic from vocational and general students. Although the relationship was less reliable and considerably less strong than was the case for distinguishing academic students, vocational students differed from general students primarily in terms of alienation, focus on the work world, channeling, sex, and race. Typically, vocational students were less alienated from school and focused more on the work world than general students. Vocational students experienced less channeling than general students; they were less frequently assigned to their high school program and expressed more choice in selecting their high school programs than were genreal students. Proportionally more women and whites were enrolled in vocational programs than general programs.

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APPENDIX I

ITEMS FROM STUDENT QUESTIONNAIRE

3. How important was each of the following in influencing your choice of your present high school program?

(Circle one number on each line.)

	Not important	Somewhat important	Very important
Your parents	1	2	3
A relative other than your parents	1	2	3
A guidance counselor	1	2	3
A teacher other than a guidance counselor	1	2	3
The principal or assistant principal	1	2	3
Clergyman (minister, priest, rabbi, etc.)	1	2	3
An adult not mentioned above	1	2	3
Friends your own age	1	2	3
Yourself	1	2	3
I had no choice; it was the only program available at my school	1	2	3
I had no choice; I was assigned to it	1	2	3

10. Have you participated in any of the following types of activities, either in or out of school this year?

(Circle one number on each line.)

	Have not participated	Have participated actively	Have participated as a leader or officer
Athletic teams, intramurals, letterman's club, sports club	1	2	3
Cheerleaders, pep club, majorettes	1	2	3
Debating, drama, band, chorus	1	2	3
Hobby clubs such as photography, model building, hot rod, electronics, crafts	1	2	3
Honorary clubs such as Beta Club or National Honor Society	1	2	3
School newspaper, magazine, yearbook, annual	1	2	3
School subject matter clubs such as science, history, language, business, art	1	2	3
Student council, student government, political club	1	2	3
Vocational education clubs such as Future Homemakers, Teachers, Farmers of America, DECA, OEA, FBLA, or VICA	1	2	3

13. How often have you discussed your plans for after high school with the following people?

(Circle one number on each line.)

	Never	Seldom	Often
Your parents	1	2	3
A relative other than your parents	1	2	3
A guidance counselor	1	2	3
A teacher other than a guidance counselor	1	2	3
The principal or assistant principal	1	2	3
Clergyman (minister, priest, rabbi, etc.)	1	2	3
State employment service officer	1	2	3
An adult not mentioned above	1	2	3
Friends your own age	1	2	3

14. How much has each of the following persons influenced your plans for after high school?

(Circle one number on each line.)

	Not at all	Somewhat	A great deal
Your parents	1	2	3
A relative other than your parents	1	2	3
A guidance counselor	1	2	3
A teacher other than a guidance counselor	1	2	3
The principal or assistant principal	1	2	3
Clergyman (minister, priest, rabbi, etc.)	1	2	3
State employment service officer	1	2	3
An adult not mentioned above	1	2	3
Friends your own age	1	2	3
Yourself	1	2	3

17. How much has each of the following interfered with your education at this school?

(Circle one number on each line.)

	Not at all	Somewhat	A great deal
Courses are too hard	1	2	3
Teachers don't help me enough	1	2	3
School doesn't offer the courses I want to take	1	2	3
My job takes too much time	1	2	3
Transportation to school is difficult	1	2	3
Parents aren't interested in my education	1	2	3
Don't feel part of the school	1	2	3
Find it hard to adjust to school routine	1	2	3
Poor teaching	1	2	3
Worry over money problems (repayment of loan, support of dependents, family income, etc.)	1	2	3
My own ill health	1	2	3
Poor study habits	1	2	3
Family obligations (other than money problems)	1	2	3
Lack of a good place to study at home	1	2	3

18. Please rate your school on each of the following aspects.

(Circle one number on each line.)

	Poor	Fair	Good	Excellent	Don't know
Condition of buildings and classrooms	1	2	3	4	5
Equipment used in vocational courses	1	2	3	4	5
Extracurricular facilities	1	2	3	4	5
Job placement of graduates	1	2	3	4	5
Library facilities	1	2	3	4	5
Quality of academic instruction	1	2	3	4	5
Quality of vocational instruction	1	2	3	4	5
Reputation in the community	1	2	3	4	5
Student guidance and counseling	1	2	3	4	5
Teacher interest in students	1	2	3	4	5

19. How much do you agree with each of the following statements about your high school?

(Circle one number on each line.)

	Agree strongly	Agree somewhat	Disagree somewhat	Disagree strongly	Does not apply
School should have placed more emphasis on basic academic subjects (math, science, English, etc.)	1	2	3	4	5
School should have provided more help for students who were having trouble with subjects like math and reading	1	2	3	4	5
Most required courses here are a waste of time	1	2	3	4	5
School should have placed more emphasis on vocational and technical programs	1	2	3	4	5
School did not offer enough practical work experience	1	2	3	4	5
School provided me with counseling that will help me continue my education	1	2	3	4	5
School gave me new ideas about the type of work I wanted to do	1	2	3	4	5
School provided me with counseling that helped me get a better idea of myself and my relations with other people	1	2	3	4	5
School provided me with counseling that will help me find employment	1	2	3	4	5
School should help students find jobs when they leave school	1	2	3	4	5
School should have used more television lectures	1	2	3	4	5
School should have used teaching machines or computer-assisted instruction more extensively	1	2	3	4	5

20. How important is each of the following to you in your life?

(Circle one number on each line.)

	Not important	Somewhat important	Very important
Being successful in my line of work	1	2	3
Finding the right person to marry and having a happy family life	1	2	3
Having lots of money	1	2	3
Having strong friendships	1	2	3
Being able to find steady work	1	2	3
Being a leader in my community	1	2	3
Being able to give my children better opportunities than I've had	1	2	3
Living close to parents and relatives	1	2	3
Getting away from this area of the country	1	2	3
Working to correct social and economic inequalities	1	2	3

21. How do you feel about each of the following statements?

(Circle one number on each line.)

	Agree strongly	Agree	Disagree	Disagree strongly	No opinion
I take a positive attitude toward myself	1	2	3	4	5
Good luck is more important than hard work for success	1	2	3	4	5
I feel I am a person of worth, on an equal plane with others	1	2	3	4	5
I am able to do things as well as most other people	1	2	3	4	5
Every time I try to get ahead, something or somebody stops me	1	2	3	4	5
Planning only makes a person unhappy since plans hardly ever work out anyway	1	2	3	4	5
People who accept their condition in life are happier than those who try to change things	1	2	3	4	5
On the whole, I'm satisfied with myself	1	2	3	4	5

24. How important is each of the following to you in selecting a job or career?

(Circle one number on each line.)

	Not important	Somewhat important	Very important
Making a lot of money	1	2	3
Opportunities to be original and creative	1	2	3
Opportunities to be helpful to others or useful to society	1	2	3
Avoiding a high-pressure job that takes too much out of you	1	2	3
Living and working in the world of ideas	1	2	3
Freedom from supervision in my work	1	2	3
Opportunities for moderate but steady progress rather than the chance of extreme success or failure	1	2	3
The chance to be a leader	1	2	3
Opportunities to work with people rather than things	1	2	3
Having a position that is looked up to by others	1	2	3

26. How important was each of the following factors in determining the kind of work you plan to be doing for most of your life?

(Circle one number on each line.)

	Not important	Somewhat important	Very important
Previous work experience in the area	1	2	3
Relative or friend in the same line of work	1	2	3
Job openings available in the occupation	1	2	3
Work matches a hobby interest of mine	1	2	3
Good income to start or within a few years	1	2	3
Job security and permanence	1	2	3
Work that seems important and interesting to me	1	2	3
Freedom to make my own decisions	1	2	3
Opportunity for promotion and advancement in the long run	1	2	3
Meeting and working with sociable, friendly people	1	2	3

31. What is the one thing that most likely will take the largest share of your time in the year after you leave high school?

(Circle only one number and then follow the directions beside that number.)

	(Circle one.)	Directions
Working full-time	01	→ *Go to question 32 and complete Section D.*
Entering an apprenticeship or on-the-job training program	02	→ *Skip to page 15 and complete Section E.*
Going into regular military service (or service academy)	03	→ *Skip to page 17 and complete Section F.*
Being a full-time homemaker	04	→ *Skip to page 20 and complete Section G.*
Taking vocational or technical courses at a trade or business school full-time or part time	05	→ *Skip to page 22 and complete Section H.*
Taking *academic courses* at a junior or community college full-time or part-time	06	→ *Skip to page 25 and complete Section I.*
Taking *technical or vocational subjects* at a junior or community college full-time or part-time	07	
Attending a four-year college or university full-time or part-time	08	
Working part-time, but not attending school or college	09	→ *Skip to page 29 and complete Section J.*
Other (travel, take a break, no plans)	10	→ *Skip to page 31 and complete Section K.*

APPENDIX II

RESULTS OF THE INDEPENDENT VARIABLE REDUCTION

After performing the factor analyses, there were sixty independent variables, including characteristic, composite, single item, plans, and ability variables. Those variables were:

I. Academic abilities variables. These variables included percentile rank in class, self-reported grades (5)*, and six academic ability tests, which were from the test files of Educational Testing Service.

A. Vocabulary Test was a five minute test with 15 multiple-choice items, asking for definitions of words.

B. Reading Test was a fifteen minute test with reading passages of about 150 words given with questions following.

C. Picture Number Test was a two part, ten minute test. It was a speed test of the ability to remember the associations between pictures and numbers.

D. Mathematics Test was a fifteen minute test where two quantities were presented and the student chose which of the quantities was the largest, or denoted their equality.

E. Mosaic Comparisons test was a nine minute speed test requiring the discrimination of pairs of mosaic patterns.

F. Letter Groups test was a fifteen minute test with 25 items. Students identified an uncommon characteristic in a group of letter combinations.

II. Psychological Variables. The sub-items of question 21 were chosen from two psychological scales. Although the scales were different,

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* Numbers in parentheses refer to Student Questionnaire items. When letters follow the numbers, the letters indicate the sub-item of the numbered item. For example, 17a refers to Student Questionnaire item 17 and the sub-item "courses are too hard".

the same constructs were used previously by Coleman (1966).

A. Self-esteem (21a + 21c + 21d + 21h) was a scale similar to one used by Rosenberg (1965) although only four of Rosenberg's ten questions were used in the Student Questionnaire item. Two of the self-esteem items had been included in the New York State scale, reported by Rosenberg and Simmons (1966).

B. Control of Environment (21b + 21e + 21f + 21g) was similar to a scale developed by Rotter (1963). Three of the four items in this scale were also used by Coleman.

III. Values Variables. The sub-items of Student Questionnaire items 20, 24, and 26 were similar, distinguishing only between the student's values in life and those he might derive from a career. This distinction was removed in making up composites. The values, or perhaps better termed life goals, in item 20 were first given by Richards (1966). Holland and Nichols (1964) and Baird (1969) used these same items to predict academic and non-academic achievement. They were related to student's vocational choices by Astin and Nichols (1964), Holland (1968), and Baird (1970). Studies by Davis (1965) and Sharp (1970) related the work values of item 24 to vocational choice, vocational interest, and other personality characteristics. Past research demonstrated that people who choose different careers have different work values (Rosenberg, 1957; Marsh & Stafford, 1966). The reasons for choosing future careers, item 26, were discussed by Rosenberg (1957), Centers and Bugenthall (1966), and Sharp (1970). Sub-items that were not included in any composites were: being successful (20a), avoiding high pressure jobs (24d), getting away from home (20i), having strong personal friendships (20d), preferring steady progress (24g), and choice of work matches hobby (26d).

A. Occupational Security (26c + 26e + 26f + 26g + 26i). The student chose an occupation because it offered job security, a good income, opportunity for advancement, had openings, and was interesting.

B. Social Needs (20f + 20j + 24c + 24i + 26j). The student desired to correct social inequities, be useful to society, live in the world of ideas, work with people rather than things, meet friendly people, and be a community leader.

C. Prestige (20c + 20f + 24a + 24h + 24j) was similar to Richard's (1964) construct of prestige. The variable, however, was not used for subsequent analyses because it was not selected in any of the stepwise regressions.

D. Family Importance (20b + 20e + 20g + 20h) involved finding the right person to marry, finding steady work, giving children opportunities better than theirs, and living close to parents. It was similar to Richard's construct of personal happiness.

E. Occupational Contacts (26a + 26b + 26c) involved previous work experience, having a friend in the same job, and available openings as reasons for choosing an occupation.

F. Independence (24b + 24e + 24f + 26h) involved the freedom to make one's own decisions, opportunities to be creative, living in a world of ideas, and freedom from supervision.

IV. Student Ratings of School Quality. Student Questionnaire items 17, 18, and 19 made up this set of independent variables. These items were developed by Horwitz and Bayless (1971) as part of the design of the base-year data collection. Single items, not loading highly on any of the factors, included transportation to school is difficult (17e), the school's job placement (18d), teacher's interest in students (18j), courses were a waste (19c), school should help find jobs (19j), and poor health (17k), which was not selected on the stepwise regression.

A. Overall School Rating (18a + 18b + 18c + 18e + 18f + 18g + 18h) included ratings of buildings, facilities, instruction and community reputation.

B. Counseling Rating ((5 -x) 18i* + 19f + 19g + 19h + 19i) included the rating of counseling as regards future educational plans, future employment, and self-perception.

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* Item 18 has an opposite polarity from that of item 19. Since the item responses were coded from one to five, to reverse the scale one subtracted the item response of 18i from two, i.e. (5-x)18i. This placed the item on the same scale as those items from 19.

C. Alienation from School (17b + 17c + 17f + 17g + 17h) concerned teachers not helping, courses not desirable, parents not interested, hard to adjust to school routine, and don't feel part of school.

D. Interference with School (17 d + 17j + 171 + 17m + 17n) concerned interference with school work due to work, money problems, poor study habits, family obligations, and lack of a place to study.

E. Vocational Opportunity (19d + 19e) concerned satisfaction with the amount of emphasis the school placed on vocational study. Low scores on this composite indicated a desire for more vocational and practical courses.

F. Opportunity to Learn Basics (19a + 19b) concerned satisfaction with the amount of emphasis the school places on basic subjects, such as Math and English. Low scores on this composite indicated a desire for more emphasis by their schools on basic subjects.

G. Instructional Technologies (19k + 191) concerned satisfaction with the use of television and teaching machines in the school.

H. Difficulty with school (17 a + 17b + 17i + 171) concerned hard courses, teachers not helping, poor teaching, and poor study habits.

V. Participation in Extracurricular Activities Variable. (10a + 10b + 10c + 10d + 10e + 10f + 10g + 10h + 10i). This variable has been related to obtaining certain types of occupations. Super (1957), for example, noted that participation in extracurricular activities is regarded as important in choosing certain occupations, such as sales, junior executive, and educational positions, because such participation is viewed as evidence of the student's ability to work with people.

VI. Influencing Variables. Both Super (1957) and Ginzberg et al (1951) indicated the importance of the family and educational system in determining occupational choice although Ginzberg et al point to factors that militate against their positive influence. Student Questionnaire items 3, 13, and 14 concerned the importance of these influencing persons during different stages of life. Nevertheless, factor analyses resulted in composites being developed by source of influence. Discussing plans with parents (13a) was the only item that did not load highly on any factor.

dichotomous variables that were used only in the total group. Socieoconomic status was a composite of father's education, mother's education, and income. Size of community was measured on a five point scale, ranging from a rural or farming community to a metropolitan area with a central city of more than 500,000 people.

A. Channeling (3j + 3r) referred to a lack of choice by the student. He was either assigned to a program, or there was only one program available.

B. Influence of State Employment Service (13g + 14g).

C. Influence of Friends (3h + 13i + 14i).

D. Influence of Teachers (3d + 13d + 14d).

E. Influence of Clergy (3f + 13f + 14f).

F. Influence of Principal (3e + 13e + 14e).

G. Influence of Self (3i + 14j) was not selected on any of the stepwise regressions.

H. Influence of Counselor (3c + 13c + 14c).

I. Influence of Adults (3g + 13h + 14h).

J. Influence of Relatives (13b + 14b) was not selected on any of the stepwise regressions.

K. Influence of Family (3a + 3b + 14a).

VII. Plans Variables. Question 31 concerned the student's immediate plans after high school. Categories were combined, and the resulting plans variables were: working full-time (31a), beginning an apprenticeship (31b), homemaker (31d), vocational school (31e), junior college (31f + 31g), four-year school (31h), and other (31j + 31i + 31c).

VIII. Characteristic Variables. These included race, sex, socioeconomic status, and size of community. Sex and Race (white versus non-white) were

dichotomous variables that were used only in the total group. Socioeconomic status was a composite of father's education, mother's education, and income. Size of community was measured on a five point scale, ranging from a rural or farming community to a metropolitan area with a central city of more that 500,000 people.