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Project CHOICE: Validity of Interest and Ability Measures for Student Choice of Vocational Program

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PROJECT CHOICE: VALIDITY OF INTEREST AND ABILITY MEASURES FOR STUDENT CHOICE OF VOCATIONAL PROGRAM

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ABSTRACT

The project's overall objective was to determine whether vocational interest and ability measures can help high school students identify vocational education programs in which they will experience satisfaction and success. Career Planning Program (CPP) interest measures (6) and ability measures (15) were administered to 2,101 seniors in 19 area vocational-technical schools. At least 20 satisfied/successful seniors (as determined from student and instructor ratings) were enrolled in each of 24 diverse vocational programs. The 24 programs were grouped into six job clusters similar to Holland's occupational types. Multivariate analyses showed that job cluster differences were statistically significant at well beyond the .0001 level. Generally, students' interest and ability scores were congruent with the content of their vocational programs. About four out of five satisfied/successful seniors would have been referred, by their CPP score report, to the job cluster containing the vocational program they completed. Thus, vocational interest and ability measures appear to have potential for benefiting large numbers of prospective vocational education students.

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PROJECT CHOICE: VALIDITY OF INTEREST AND ABILITY MEASURES FOR STUDENT CHOICE OF VOCATIONAL PROGRAM

Vocational education programs provide high school students with a wide variety of opportunities--opportunities to develop reading, writing, and mathematics skills through practical applications; opportunities to develop work-specific knowledge, skills, and values; and, for some, opportunities to discover reasons for continuing education beyond the compulsory age of attendance. Project CHOICE sought to determine whether interest and ability measures can help high school students identify vocational education opportunities in which they will experience satisfaction and success. If so, several benefits might accrue.

First, high school students (e.g., sophomores) who would not otherwise have considered vocational education programs can learn of opportunities appropriate to their interests and abilities. As a result, more students may apply for vocational education programs.

Second, students who are already considering vocational education programs can have a better basis for choosing from among those programs. Likewise, vocational educators and counselors can have a better basis for guiding students into programs congruent with their interests and abilities. As a result, students may be more motivated to learn and to complete their programs.

Third, motivated students completing vocational education programs will have more appropriate work-related values and enhanced skills--including proficiency in reading, writing, and math. As a result, the work force could become increasingly productive. Thus, Project CHOICE provides a basis for determining whether enhancements in the delivery of vocational education are possible--to the potential benefit of youth, vocational educators and counselors, and the nation.

Project CHOICE objectives were as follows:

1. To determine whether the Career Planning Program (CPP) interest and ability scores of satisfied and successful ("satisfied/successful") high school seniors differ from program to program across a diverse range of vocational education programs; and if so--

2. To determine whether satisfied/successful seniors score as one would expect on the basis of the vocational programs which they completed.

3. To determine the relationship between CPP Ability Test scores and grades in specific vocational programs.

4. To determine how many satisfied/successful seniors would have been referred, by the standard CPP score report, to the vocational program they completed. If the proportion is substantial, then vocational educators and counselors may wish to use the CPP (or a similar instrument) at the time students typically consider opportunities in vocational education (e.g., Grade 10).

Procedures

Sample

A representative of the Missouri Department of Elementary and Secondary Education obtained agreements to participate in Project CHOICE from 19 area vocational-technical schools in Missouri. Each school named a project coordinator who attended one of four, half-day project orientation sessions. Of the 2,915 seniors in the project schools, 2,101 (72%) completed one or more parts of the CPP between March and May of 1989. Across schools, student participation rates ranged from 98% to 47%. Project coordinators identified non-participants primarily as absentees and students who were engaged in cooperative work placements and internships.

Of the 2,101 students completing the CPP, 33% were female and 67% were male. An optional question regarding racial/ethnic background was answered by 1,913 students (91%). Responses were as follows: Afro-American/Black (6%), American Indian (3%), Caucasian-American/White (85%), Mexican-American/Chicano, Puerto Rican, or other Hispanic Origin (1%), Asian-American, Pacific Islander (1%), and other (4%).

When students completed the CPP, they were asked to identify their vocational program on a list of 76 programs drawn from the Directory of Vocational Programs in Missouri (Missouri Department of Elementary and Secondary Education, 1987). Enrollments by program area were as follows: Agricultural Education (53); Business and Office Education (276); Marketing and Cooperative Education (239); Occupational Home Economics Education (33); Industrial Education--Health (167); Industrial Education--Industrial (1,311); unidentified (22). Programs typically included in Missouri's general high schools (e.g., agricultural programs) are underrepresented in the sample.

Assessment of Interests and Abilities

The CPP, which is published by American College Testing (ACT), consists of an interest inventory, an ability test battery, a unit collecting self-estimates of abilities, and a career-related experience inventory (not used in this study). Administration of the CPP requires about 2 1/2 hours. Descriptions of CPP materials are provided in Appendix A. The Interim Psychometric Handbook for ACT's Career Services (ACT, 1988) and its supplements describe the 1983 national norming and summarize data on the reliability and validity of CPP measures. Other sources of psychometric information include the Technical Report for the Unisex Edition of the ACT Interest Inventory (UNIACT) (Lamb & Prediger, 1981) and reports based on the

ACT Vocational Research Program (see Appendix B). CPP measures are briefly described below.

Interests. The Unisex Edition of the ACT Interest Inventory (UNIACT) contains six, 15-item scales corresponding to the six CPP Job Clusters (see below) and Holland's (1985) six occupational types. UNIACT scale names (with corresponding Holland types in parentheses) are as follows: Business Contact (Enterprising), Business Operations (Conventional), Technical (Realistic), Science (Investigative), Arts (Artistic), and Social Service (Social).

Abilities. The CPP Ability Tests assess level of development in the following six areas: Reading (40 items), Language Usage (64 items), Clerical Skills (35 items), Space Relations (35 items), Numerical Skills (32 items), and Mechanical Reasoning (30 items). In addition, students are asked to provide self-estimates for the following nine abilities: Sales, Leadership/Management, Organization, Manual Dexterity, Helping Others, Meeting People, Scientific, Creative/Artistic, and Creative/Literary. This CPP component is intended to help students clarify and record self-concepts concerning work-relevant abilities that are not easily measured by tests. Each ability is accompanied by a brief, student-oriented definition. Students estimate whether they rank in the lower 25%, middle 50%, or upper 25% of students their own age.

The ability self-estimates are combined with the CPP Ability Test scores to obtain scores for six Job Cluster Ability Scales, one scale for each of the six CPP Job Clusters. The scores for each Job Cluster Ability Scale are based on the four abilities listed in the job cluster boxes on page 1 of the CPP score report (see Appendix C).

Interpretation of Interest and Ability Scores

The section of the CPP score report titled "How to Use Your Report" contains a narrative interpretation of the student's CPP scores. This interpretation, which is tailored to each student's score profile, suggests a job cluster (or clusters) which the student may want to explore, given his/her interests and abilities. The six CPP Job Clusters are similar in nature to the occupational groups described by Roe (1956) and Holland (1985). Each job cluster subsumes from two to six job families. There are 23 job families across the six job clusters.

Students are referred to job clusters by Message 3 (interests) and Message 5 (abilities) in the score report narrative. Appendix E provides the decision rules used to determine the content of Messages 3 and 5. These decision rules are intended to approximate a counselor interpretation of CPP interest and ability scores. Each message refers a student to one, two, or three job clusters, depending on the differentiation of the student's score profile. When a profile is undifferentiated ("flat"), no clusters are suggested.

Assignment of Vocational Programs to Job Clusters

In order to address Objectives 1, 2, and 4, each vocational program was assigned to one of the CPP Job Clusters (see Figure 1). The assignment of programs (e.g., Electronic Technology, Drafting, and Business Data Programming) to the Science Job Cluster was rather arbitrary. Since these are high-school-level programs, an argument can be made for their assignment to the Technical Job Cluster. The Science Job Cluster was chosen so that all six job clusters would be represented in the analyses. One consequence is that differences between the Science and Technical Job Clusters may be blurred.

Identification of Satisfied/Successful Seniors

Upon completion of the CPP, students responded to two questions assessing the degree to which they were satisfied with their vocational program (e.g., "How satisfied are you with the fit between your vocational program and your abilities and interests? That is, would you make the same choice again?") A 3-point rating scale was used with each question. At the end of the spring term, instructors also responded to a question assessing program fit (i.e., "Satisfactoriness rating: Please indicate whether you think your vocational program was a good choice for the student. Consider only the student's job-related abilities and interests . . ."). A 4-point rating scale was used. In addition, instructors reported each student's vocational program grade. Satisfied/successful seniors were defined as those having grades of C or higher in vocational programs that were congruent with their interests and abilities, as judged by both the students and their instructors. Prediger and Brandt (1990) provide specifics.

Approximately 1,700 students (81% of the total sample) were classified as satisfied/successful. The remaining students (the "dissatisfied and/or unsuccessful group") may have met the satisfaction and success criteria for as many as three of the four screens that were used. As a result, differences between the satisfied/successful group and the remaining group may be blurred. Although the proportion of satisfied/successful students is relatively high, it does not reflect students in project high schools (and the feeder schools they serve) who dropped out in the 10th, 11th, or 12th grades.

Results

Differentiation of Vocational Programs

Three related statistical procedures--multivariate analysis of variance (MANOVA), discriminant analysis (DISANL), and hit rate analysis--were used to

determine whether the interests and abilities of satisfied/successful seniors differ across vocational programs in a manner that is both statistically significant and substantial (Objective 1). The nature and relevance of these procedures are described in Appendix D. Analyses were conducted via the SPSSX DISCRIMINANT routines (SPSS Inc., 1988). Job clusters served as the criterion groups.

Two types of analyses were conducted: weighted and unweighted. In the former analyses, the job clusters were weighted to have equal size and influence. Thus, the Arts Job Cluster (for example) would not be overwhelmed by the Technical Job Cluster, which is more than 12 times larger. All descriptive statistics are based on weighted analyses. Statistical significance tests, however, are based on unweighted analyses. Thus, they reflect actual sample sizes.

The dimensionality of job cluster differences was determined through the use of DISANL. The accuracy of job cluster membership predictions (the "hit rate") was determined from group similarity indices, as explained in Appendix D. Because the relatively small number of cases for some job clusters precluded having a cross-validation sample, hit rates may be somewhat inflated.

Results addressing Objective 1 are presented in Tables F1-F3 in Appendix F. For each of the three sets of measures--Interest Scales, Ability Tests, and Job Cluster Ability Scales--Wilks's lambda was statistically significant at the .0001 level. These results indicate that differences among job clusters (vocational programs) on each set of measures cannot reasonably be attributed to chance (i.e., the differences can be thought of as real). The proportion of total variance associated with job cluster differences (as measured by the Wilks index) ranged from .40 for the Ability Tests to .43 for the other two sets of measures. The overall hit rates for job cluster

predictions were 36% for the Ability Tests, 39% for the Job Cluster Ability Scales, and 40% for the Interest Scales. Thus, the three sets of measures performed about equally well in differentiating and predicting job clusters.

Interest Scale hit rates for the six job clusters were as follows: Business Contact (23%), Business Operations (50%), Technical (54%), Science (30%), Arts (33%), and Social Service (50%). Job cluster hit rates for the other measures are given in Tables F2 and F3. The highest hit rate was for the Technical Job Cluster for all three sets of measures. Because the Technical Job Cluster was much larger than the other clusters, the overall hit rate would have ranged from 44% to 48% for the three sets of measures had the job clusters been weighted according to actual size.

As shown in Tables F1-F3, univariate F values for the 18 variables in the three sets of measures were all statistically significant at the .0001 level. The DISANL results presented in Tables F1-F3 confirm that job cluster differentiation is multi-dimensional. From two to four independent discriminant functions appear to be warranted, depending on the set of measures. These results, loadings for the discriminant functions (not tabled), and the results for the univariate F tests, indicate that each of the CPP measures plays an important role in job cluster (vocational program) differentiation.

Appropriateness of Vocational Program Score Profiles

Mean score profiles for 24 vocational programs with at least 20 satisfied/successful students were used to determine whether satisfied/successful seniors score as one would expect on the basis of their vocational programs (Objective 2). Because standard deviations differed substantially from variable to variable for a given type of measure (e.g., interests) and from program to program, there is no easily comprehensible way to take into

account variation among students within a vocational program. Hence, the mean score profiles can best be viewed as indicating trends. The practical implications of score profile differences across vocational programs are addressed by the analyses conducted for Objective 4.

Two approaches can be used to determine whether interest and ability profiles meet expectations based on vocational program content. Through an intra-program analysis, the mean profile for a given vocational program can be examined in light of the tasks characterizing the program. Do Drafting students, for example, score higher on Mechanical Reasoning and Space Relations than on the other four Ability Tests? Through an inter-program analysis, the mean scores for a given measure can be compared across vocational programs. Expectations regarding which programs will score highest and lowest on Numerical Skills, for example, can be checked against study results.

Intra-program Analyses. Mean score profiles for the largest vocational program in each of the six CPP Job Clusters are presented in Figures 2-7. The horizontal line on each figure shows the performance of a nationally representative sample of high school seniors (the CPP norm group). Tables F4-F6 provide means for the six job clusters and all vocational programs with 20 or more satisfied/successful seniors.

Interest Scale means for vocational programs (Figures 2 and 3) are about as one would expect on the basis of program content. For example, Marketing and Distributive Education students (Business Contact Job Cluster, as shown by Table F4) score highest on the Business Contact Scale; Auto Mechanics students (Technical Job Cluster) score highest on the Technical Scale; and Typing and General Office students (Business Operations Job Cluster) score highest on the Business Operations Scale. There are two apparent exceptions. Nursing

students were assigned to the Social Service Job Cluster but they score highest on the Science Scale. Social Service is the second highest scale. This pattern was also observed in seven of nine samples of 2-year and 4-year college students (Lamb & Prediger, 1981). Thus, it is not exceptional. Nursing may be more appropriately assigned to the Science Job Cluster.

Students in the Electronic Technology program provide the other possible exception to expected results. They score highest on the Technical Scale, although their program is assigned to the Science Job Cluster. Recall, however, that the decision to assign high-school-level vocational programs to the Science Cluster rather than the Technical Cluster was somewhat arbitrary. Hence, it is not surprising that programs assigned to the Science Job Cluster score high on the Technical Scale. Also, note that Electronic Technology students had similar scores on the Science and Technical Scales; whereas, Auto Mechanics students (Technical Job Cluster) scored much lower on the Science Scale.

Due to the lack of a close correspondence between some of the abilities assessed by the CPP and the tasks characterizing some of the vocational programs, it is sometimes difficult to determine whether the Ability Test profiles (see Figures 4 and 5) are congruent with program content. (For example, what ability profile would one expect for Marketing and Distributive Education students?) Profile differentiation (distance between peaks and valleys) is greatest for students in Auto Mechanics and Electronic Technology. Both programs have peak scores on Mechanical Reasoning and Space Relations, as one would expect on the basis of program content. The difference in profile elevation is also according to expectation.

Because the Job Cluster Ability Scales parallel the CPP Job Clusters, expectations regarding vocational program profiles are clearer than for the

less comprehensive Ability Tests. Four of the six vocational programs have peak scores on the scales corresponding to their job cluster assignments (see Figures 6 and 7). One exception, Electronic Technology, was already discussed in conjunction with the review of Interest Scale results. The other exception is the Typing and General Office program (Business Operations Job Cluster). It is not clear why students in this program score higher on the Social Service and Arts Scales than on the Business Operations Scale. Their Interest Scale profile (Figure 3) and Ability Test profile (Figure 5) are about as one would expect on the basis of program content.

Profile differentiation is substantial for most vocational programs. Across the six programs shown in Figures 2 and 3, the mean difference between Interest Scale peaks and valleys is 1.6 stanine units. (The standard deviation for students in the national norm group is 2.0 stanine points). Mean differences for the Ability Tests and Job Cluster Ability Scales are 1.6 and 1.4 stanine units, respectively. Such data simply document what can be observed--that most vocational programs have distinctive profiles. Readers may wish to conduct similar intra-program analyses for other vocational programs (see Tables F4-F6).

Inter-program Analyses. Inter-program comparisons can also be conducted through reference to Tables F4-F6.

Comparison of Students Who Did and Did Not Meet Screens. Job cluster profiles for seniors who met the four satisfaction/success criteria ("screens") and those who did not are shown in Appendix G. (Readers should keep in mind that score profiles for a given job cluster mainly reflect data for the largest vocational programs in the job cluster--see Figure 1 for program enrollments.) Generally, the Interest Scale profiles for students meeting the satisfaction/success screens are more differentiated and more appropriate than the profiles

for students not meeting the screens (see Figures G1-G6). Students not meeting the screens generally have lower Ability Test profiles (see Figures G7-G12); and, as one would expect, this finding also held for the Job Cluster Ability Scales (see Figures G13-G18).

Correlations Between Ability Test Scores and Grades

All students for whom vocational program grades and CPP Ability Test scores were available were included in the analyses addressing Objective 3. That is, students were not screened for satisfaction/success. Because correlations were needed for specific vocational programs, data for programs had to be pooled across Project CHOICE schools in order to have samples large enough to warrant analysis. An arbitrary cutoff of 30 students was established for this purpose.

Correlations between Ability Test scores and grades in vocational courses are reported in Table 1. Correlations that are statistically significant at the .01 level (i.e., correlations that cannot reasonably be attributed to chance variations from a population correlation of zero) are indicated by an asterisk. Readers will recall that indicators of statistical significance are sensitive to sample size. Hence, some relatively low correlations (e.g., .16) have an asterisk while some relatively high correlations (e.g., .42) do not. Readers will also recall that differences in level of correlation from measure to measure and program to program are likely to be unstable when sample sizes are small. Thus, attention should be focused on the general trends shown by Table 1.

Correlations for the Academic Ability composite (G) ranged from .04 (Auto Body Repair) to .63 (Agribusiness/Production, Miscellaneous). The median was .36. Although each of the Ability Tests had the highest correlation for at least 1 of the 22 programs, there is no clear evidence of differential

validity. Perhaps the best indicators of trends are provided by the median correlations reported for the Business Operations, Technical, and Social Service Job Clusters. For each job cluster, the highest medians are in the .30s, a result that would be disappointing if the correlations had been based on within-school data rather than on data pooled across schools. Because of the likelihood of across-school differences in student abilities, program content, and grading standards (e.g., see Brandt, Ferguson, & Reed, 1988), correlations obtained through pooling across schools are probably underestimates of the correlations to be expected within a specific school.

The vocational program ability profiles presented in Table F5 and summarized in the right-hand column of Table 1 provide a different perspective on the usefulness of the Ability Tests. The profiles show that the abilities of satisfied/successful seniors are generally in accord with expectations based on the content of their vocational programs. This finding suggests that ability test profiles can be used to help prospective vocational students identify programs enrolling satisfied/successful students who have ability profiles similar to their profiles. In a review of vocational program counseling and selection procedures, Pucel (1980) concludes that this similarity approach to the use of ability test scores provides a promising alternative to grade predictions based on correlational data.

Appropriateness of Suggestions Provided by CPP Score Report

The analyses addressing Objective 4 determined the agreement between (a) the job cluster suggestions provided by the narrative interpretation on each student's CPP score report and (b) the job cluster containing the student's vocational program. Only satisfied/successful seniors were included in the analyses. To the extent that the CPP interest and ability measures have concurrent validity, one would expect a high rate of agreement (a high "hit

rate"). The hit rate for interests and abilities, combined, provides an overall indication of the appropriateness of the score report's narrative interpretation.

Hit rates for interests are summarized in Table 2. Three job clusters were suggested to 156 students; two job clusters were suggested to 822 students; and one job cluster was suggested to 633 students. The overall hit rate for the 1,611 satisfied/successful seniors was 64%. The 99% confidence limits for the overall hit rate range from 61% to 67%. Since these limits do not include the chance hit rate (28%), the overall hit rate cannot be reasonably attributed to chance. In fact, it is highly significant, statistically.

Table 3 shows that the overall hit rate for the Job Cluster Ability Scales was 58%, more than twice the chance rate of 28%. The 99% confidence limits for the overall hit rate range from 55% to 61%.

Because the CPP score report encourages students to explore job clusters on the basis of interests and abilities, the hit rate was determined for interests and abilities used in combination. First, the hit rate for interests was determined, as described above and reported in Table 2. Next, the 584 students who were not referred to their own job cluster ("Interest Scale misses") were identified and combined with the 98 students who had missing interest scores or flat interest profiles. (The CPP score report does not use flat profiles to suggest job clusters.) Of these 682 students, 66 lacked ability scores or had flat ability profiles. Finally, the "residual hit rate" was determined for the remaining 616 students (682 minus 66) on the basis of their Job Cluster Ability Scale scores. Results are reported in Table 4. As can be seen, the ability-based interpretations of 273 of the 616

students included the job cluster containing the student's vocational program. Thus, the residual hit rate was 44%.

Altogether, Interest Scale and Job Cluster Ability Scale interpretations were made for 1,643 students--the 1,611 students whose interest results are reported in Table 2, plus 98 students who had missing interest scores or flat interest profiles, minus 66 students who had missing ability scores or flat ability profiles. Of these 1,643 students, 1,300 were referred to the job cluster containing their vocational program (1,027 by interests and 273 by abilities). Hence, the combined hit rate was 79% (1,300/1,643). The 99% confidence limits for the combined hit rate range from 76% to 82%.

One way to estimate the chance hit rate is to compare the total number of students in the analysis with the total number of hits expected on the basis of chance. Through this procedure, the effect of providing both interest and ability interpretations to Interest Scales misses will be reflected in the chance hit rate. The number of hits expected on the basis of chance is 458 for interests (see Table 2) and 179 for abilities (see Table 4), for a total of 637. Thus, the combined chance hit rate is 39% (637 divided by 1,643, the total number of students in the analysis). The actual hit rate (79%) is more than twice as large as the chance hit rate.

Summary and Discussion

Project CHOICE sought to determine whether interest and ability measures can help high school students identify vocational education programs in which they will experience satisfaction and success. Generally, satisfied/successful seniors scored as one would expect on the basis of the vocational programs which they completed. Similar results were obtained, previously, in a longitudinal study of community college students in 22 vocational, technical, and transfer programs (ACT, 1988). Ability Test correlations with vocational

program grades were relatively low, possibly because they were based on data pooled across schools. Other studies suggest that the Ability Tests, when used in combination (ACT, 1988; Prediger, 1971; Swaney & Prediger, 1988) and in conjunction with past grades (Prediger, 1971), can provide useful within-school correlations.

The narrative section of the CPP score report translates a student's interest and ability scores into suggestions regarding job clusters the student may wish to explore. Analyses show that about four out of five satisfied/successful seniors would have been referred, by their CPP score report, to the job cluster containing the vocational program they completed. From the standpoint of practical applications, this appears to be the most important Project CHOICE finding.

Since project results are promising, vocational educators and counselors may wish to consider ways in which interest and ability measures can aid high school students who face choices regarding vocational education opportunities. One approach would be to supplement the standard CPP score report with a list of vocational programs available to students in a given school district. If the vocational programs were grouped by job cluster (as in Figure 1), prospective vocational students could easily identify vocational education opportunities in line with their interests and abilities. Furthermore, vocational educators and counselors would have a better basis for guiding students into programs that would provide both satisfaction and success.

In summary, project results indicate that interest and ability measures can help high school students identify vocational education programs appropriate to their interests and abilities--programs pursued with satisfaction and success by students who have similar interests and abilities.

REFERENCES

American College Testing Program. (1988). Interim psychometric handbook for the 3rd edition ACT Career Planning Program. Iowa City, IA: Author.

Brandt, W., Ferguson, J., & Reed, J. (1988). Using ASVAB, DAT, and GATB aptitude test scores to predict success in Missouri area vocational technical schools: Preliminary report. Unpublished manuscript.

Brennan, R. L., & Prediger, D. J. (1981). Coefficient Kappa: Some uses, misuses, and alternatives. Educational and Psychological Measurement, 41, 687-699.

Holland, J. L. (1985). Making vocational choices (2nd ed.). Englewood Cliffs, NJ: Prentice-Hall.

Huberty, C. J. (1983). Some univariate-multivariate generalizations. Educational and Psychological Measurement, 43, 705-721.

Huberty, C. J. (1984). Issues in the use and interpretation of discriminant analysis. Psychological Bulletin, 95, 156-171.

Huberty, C. J., & Smith, J. D. (1982). The study of effects in MANOVA. Multivariate Behavioral Research, 17, 417-432.

Lamb, R. R., & Prediger, D. J. (1981). Technical report for the Unisex Edition of the ACT Interest Inventory (UNIACT). Iowa City, IA: American College Testing.

Missouri Department of Elementary and Secondary Education, Division of Vocational and Adult Education. (1987). Directory of vocational programs in Missouri. Jefferson City, MO: Author.

Norusis, M. J. (1985). SPSSX advanced statistics guide. New York: McGraw-Hill.

Prediger, D. J. (1971). Converting test data to counseling information: System trial--with feedback. Journal of Educational Measurement, 8, 161-169.

Prediger, D. J., & Brandt, W. E. (1990, January). Project CHOICE: Validity of interest and ability measures for student choice of vocational program (Final Rep.). Iowa City, IA: American College Testing.

Pucel, D. (1980). Review and synthesis of criteria useful for the selection and admission of vocational students. Columbus, OH: National Center for Research in Vocational Education.

Roe, A. (1956). The psychology of occupations. New York: Wiley.

SPSS Inc. (1988). SPSSX user's guide. New York: McGraw-Hill.

Swaney, K. B., & Prediger, D. J. (1988). Relationship between CPP Ability Tests and course grades. In Supplement I, Interim psychometric handbook for the ACT Career Planning Program (pp. 1-29). Iowa City, IA: American College Testing.

Table 1

Ability Test Correlations with Grades; Highest Vocational Program Means

JOB CLUSTER and Vocational Program	N[b]	Ability Test Correlations[a] RS	LU	CS	SR	NS	MR	G	Highest means
BUSINESS CONTACT CLUSTER									CS, SR
31. Marketing & Distrib. Ed.	131	40*	47*	38*	19	36*	-18	46*	CS, SR
BUSINESS OPERATIONS CLUSTER[c]		34	30	17	24	35	19	37	CS, LU
20. Accounting & Bookkeeping	42	19	23	05	-01	-01	-06	14	CS, NS
24. Data Processing & Related	59	39*	41*	08	24	35*	28	42*	CS, RS
25. Secretarial & Related	53	24	30	25	19	27	19	37*	LU, CS
27. Typing & General Office	79	34*	27*	31*	30*	36*	09	35*	CS, LU
30. Business & Office Ed.	53	53*	58*	17	28	41*	49*	56*	LU, CS
TECHNICAL CLUSTER[c]		25	21	24	29	36	31	28	MR, SR
10. Agribusiness/Prod., Miscl.	30	53*	54*	47*	56*	63*	42	63*	MR, SR
68. Carpentry	150	22*	19*	19	29*	27*	34*	27*	MR, SR
70. Electrical, Miscl.	34	25	28	24	42*	42*	25	37	MR, SR
77. Heating, A.C., & Refrig.	76	27*	21	12	40*	28*	33*	28*	MR, SR
81. Aircraft Mechanics	55	37*	36*	42*	36*	46*	31	47*	MR, SR
82. Auto Body Repair	182	-01	00	09	05	01	15	04	MR, SR
83. Auto Mechanics	240	13	07	29*	16*	23*	31*	19*	MR, SR
90. Machine Tool/Shop	64	02	-02	05	25	36*	27	16	MR, SR
92. Welding & Soldering	66	35*	29*	30*	15	39*	28	48*	MR, SR
SCIENCE CLUSTER									MR, SR
64. Electronic Technology	83	35*	24	02	18	35*	07	38*	MR, SR
87. Drafting	59	27	14	16	37*	35*	24	28	MR, SR
ARTS CLUSTER									CS, SR
88. Graphic & Printing Comm.	81	26*	27*	14	29*	23	18	29*	CS, SR
SOCIAL SERVICE CLUSTER[c]		35	34	35	28	27	32	38	CS, SR
56. Practical Nursing	37	27	26	21	11	25	36	36	CS, RS
57. Nursing Related Services	81	36*	33*	32*	31*	22	15	36*	CS, RS
59. Allied Health, Other	46	34	45*	39*	26	30	28	41*	RS, CS
62. Cosmetology	35	63*	36	63*	38	31	42*	57*	CS, SR

Note. Correlations (decimals omitted) are with grade average in vocational courses. Data for vocational programs have been pooled across schools. Highest means (G excluded) are based on students meeting satisfaction/success screens (see Table F5 in Appendix F).

[a]Abbreviations for ability tests are as follows: Reading Skills (RS), Language Usage (LU), Clerical Skills (CS), Space Relations (SR), Numerical Skills (NS), and Mechanical Reasoning (MR). Academic Ability (G) is a composite of RS, LU, and NS.

[b]Sample sizes vary slightly from test to test. The smallest sample size is reported.

[c]When there are three or more programs in a cluster, median correlations are shown.

*$p < .01$, 1-tailed test.

Table 2

Students Referred, by Interest Scale Interpretation, to the Job Cluster Containing Their Vocational Program ("Interest Hit Rate")

Number of job clusters suggested	N	Number of hits		Hit rate	
		Chance	Interests	Chance	Interests
3	156	78[a]	124	50%	79%
2	822	274[b]	563	33%	68%
1	633	106[c]	340	17%	54%
Total	1,611	458	1,027	28%	64%

Note. Excluded were 98 students with missing interest scores or a flat interest profile. The Career Planning Program score report does not use flat profiles to suggest job clusters.

[a]N/2. [b]N/3. [c]N/6.

Table 3

Students Referred, by Job Cluster Ability Scale Interpretation, to the Job Cluster Containing Their Vocational Program ("Ability Hit Rate")

Number of job clusters suggested	N	Number of hits		Hit rate	
		Chance	Abilities	Chance	Abilities
3	141	71[a]	108	50%	77%
2	811	270[b]	527	33%	65%
1	618	103[c]	273	17%	44%
Total	1,570	444	908	28%	58%

Note. Excluded were 139 students with missing ability scores or a flat ability profile. The Career Planning Program score report does not use flat profiles to suggest job clusters.

[a]N/2. [b]N/3. [c]N/6.

Table 4

Interest Scale "Misses" Referred, by Job Cluster Ability Scale Interpretation, to the Job Cluster Containing Their Vocational Program ("Residual Hit Rate")

Number of job clusters suggested	N	Number of residual hits		Residual hit rate	
		Chance	Abilities	Chance	Abilities
3	64	32[a]	46	50%	72%
2	330	110[b]	162	33%	49%
1	222	37[c]	65	17%	29%
Total	616	179	273	29%	44%

Note. Excluded were 66 students with missing ability scores or a flat ability profile. The Career Planning Program score report does not use flat ability profiles to suggest job clusters.

[a]N/2. [b]N/3. [c]N/6.

1. **BUSINESS CONTACT (148)**

A. Marketing and Sales[a]
Marketing/Distributive Ed. (137)

B. Management and Planning
Agri-Business & Management (11)

2. **BUSINESS OPERATIONS (309)**

C. Records and Communications
Business Admin. Support (Other) (4)
Business & Office Education (54)
Legal Secretary (0)
Secretarial & Related (55)
Typing, General Office, & Related (84)

D. Financial Transactions
Accounting & Bookkeeping (44)

F. Business Machine/Computer Operation
Computer & Console Operation (3)
Data Entry Equipment Operation (4)
Data Processing & Related (61)
Typing (0)

3. **TECHNICAL (1,092)**

G. Vehicle Operation and Repair
Agriculture Mechanics (9)
Aircraft Mechanics (55)
Auto Body Repair (192)
Auto Mechanics (250)
Diesel Engine Mechanics (2)
Marine Maintenance (13)
Small Engine Repair (23)
Truck/Bus Driving (0)
Vehicle & Mobile Equipment Mechanics (1)

H. Construction and Maintenance
Brick/Block/Stone Masonry (13)
Building Maintenance (11)
Carpentry (159)
Construction Equipment Operation (18)
Custodial Services (0)
Electrical/Power Transmission/Instal. (1)
Electrician (23)
Plumbing/Pipefitting/Steamfitting (0)

I. Agriculture and Natural Resources
Agribusiness & Ag. Production (Other) (10)
Agriculture Production (8)
Agriculture Services & Supplies (2)
Horticulture (12)
Renewable Natural Resources (1)

J. Crafts and Related Services
Crafts (General) (0)
Custom Apparel/Garment Seamstress (0)
Dry Cleaning/Laundering Services (1)
Food Production/Mgmt./Services (29)

K. Home/Business Equipment Repair
Electrical/Electronics Equipment Repair (28)
Heating, Air Condit., & Refrig. Mechanics (85)
Major Appliance Repair (0)

L. Industrial Equipment Operation/Repair
Commercial Garment/Apparel Seamstress (0)
Industrial Equipment Maintenance/Repair (0)
Machine Tool Operation/Machine Shop (69)
Metal Fabrication (5)
Millwork & Cabinet Making (0)
Stationary Energy Sources (0)
Welding/Brazing/Soldering (72)

4. **SCIENCE (187)**

M. Engineering & Applied Technologies
Avionics (5)
Business Data Programming (21)
Civil Tech. (1)
Chemical Manufacturing Technology (0)
Communications Electronics (1)
Communications Technology (0)
Drafting (62)
Electronic Technology (84)
Fire Control & Safety Technology (0)
Industrial Electronics (11)

N. Medical Specialties and Technologies
Emergency Medical Tech.--Ambulance (2)
Emergency Medical Tech.--Paramedic (0)
Radiologic Medical Tech. (0)
Respiratory Therapy Assisting (0)

O. Natural Sciences and Mathematics
Applied Math (0)

5. **ARTS (90)**

Q. Applied Arts (Visual)
Commercial Art (7)
Commerical Photography (0)
Fashion/Fabric Coordination (1)
Graphic/Printing Communications (82)
Home Furnishings Mgmt/Prod./Services (0)

6. **SOCIAL SERVICE (218)**

T. General Health Care
Allied Health (Other) (46)
Dental Assisting (0)
Geriatric Aide (1)
Health Combination Coop. Ed. (13)
Medical Assisting (0)
Nursing Related Services (Other) (81)
Practical Nursing (37)

V. Social and Government Services
Public Safety (0)

W. Personal/Customer Services
Child Care Aide/Assisting (3)
Cosmetology (37)

Note. The numbers of Project CHOICE students enrolled in the vocational programs and job clusters are shown in parentheses.

[a]CPP Job Family with related vocational programs listed below. For research purposes, each program was assigned to only one job family.

Figure 1. Missouri Vocational Programs Arranged by CPP Job Clusters and Job Families

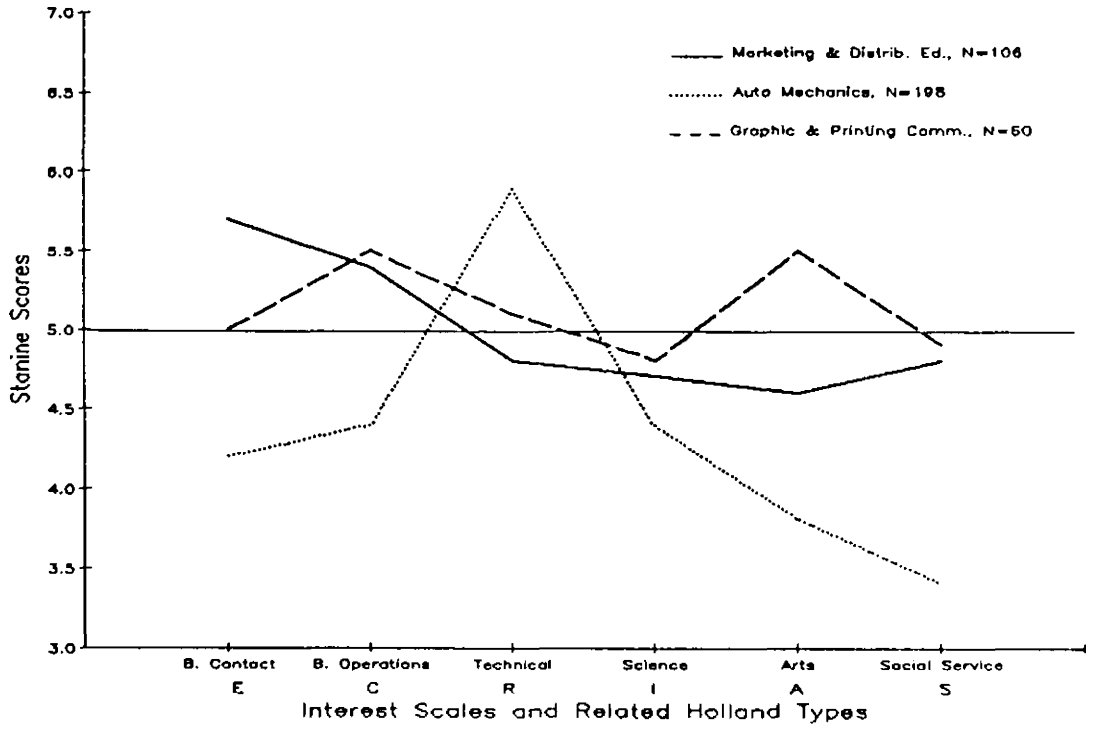


Figure 2. Interest Scale Profiles for Students Meeting Screens: Largest Program in Business Contact, Technical, and Arts Job Clusters

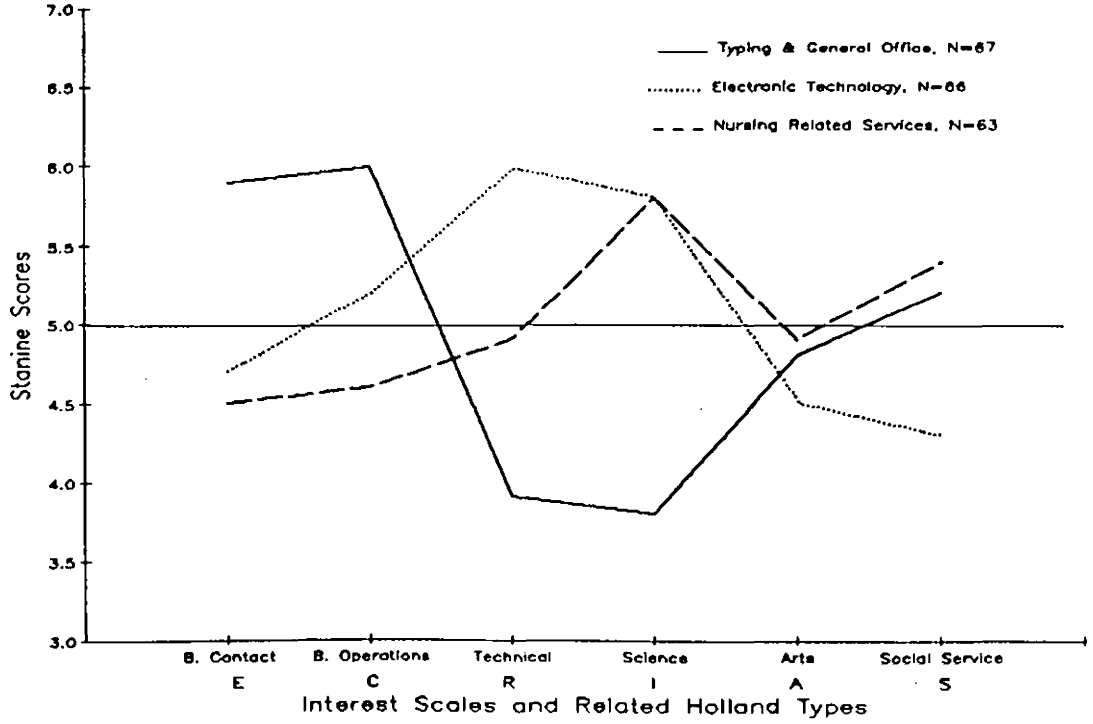


Figure 3. Interest Scale Profiles for Students Meeting Screens: Largest Program in Business Operations, Science, and Social Service Job Clusters

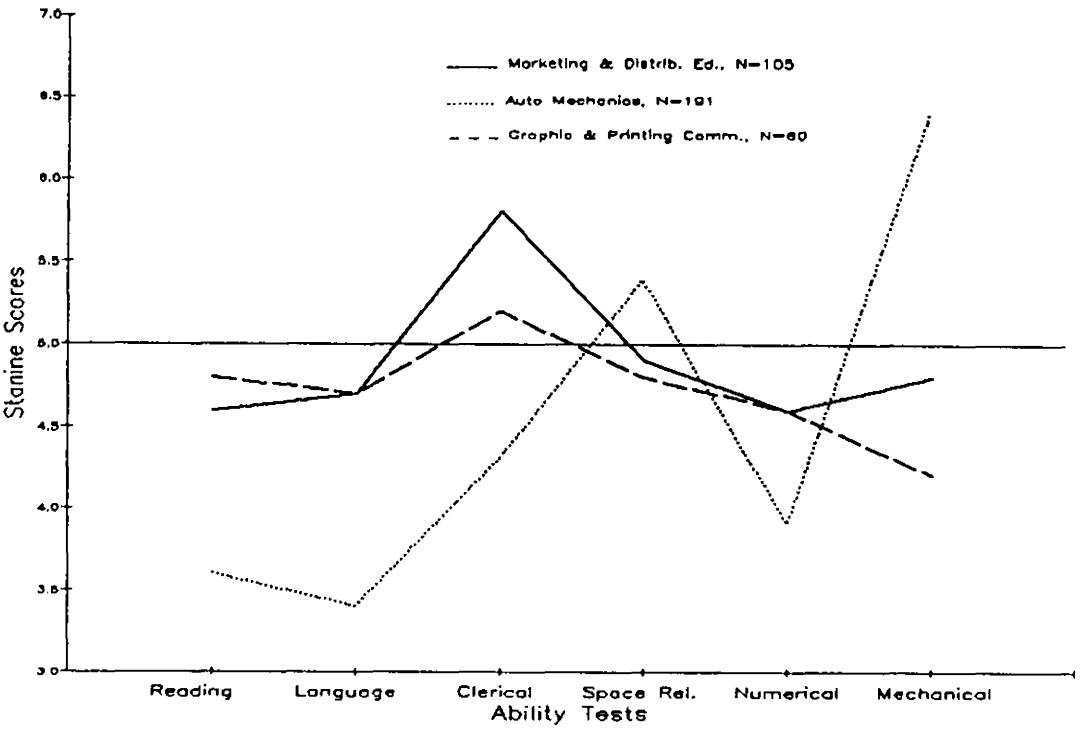


Figure 4. Ability Test Profiles for Students Meeting Screens: Largest Program in Business Contact, Technical, and Arts Job Clusters

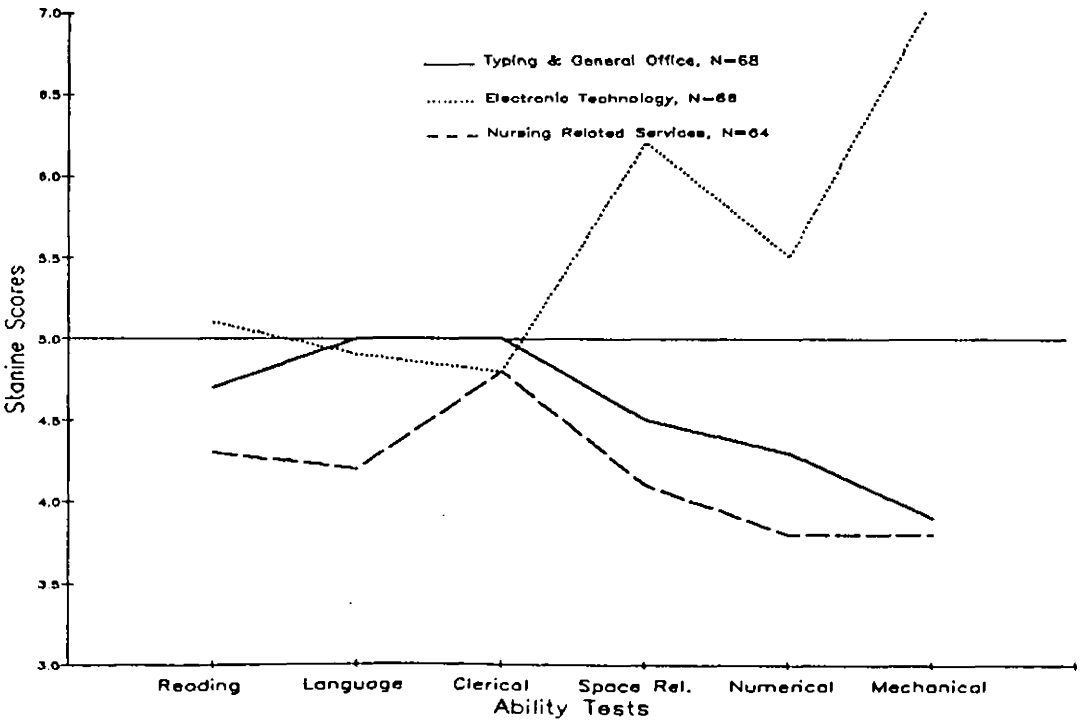


Figure 5. Ability Test Profiles for Students Meeting Screens: Largest Program in Business Operations, Science, and Social Service Job Clusters

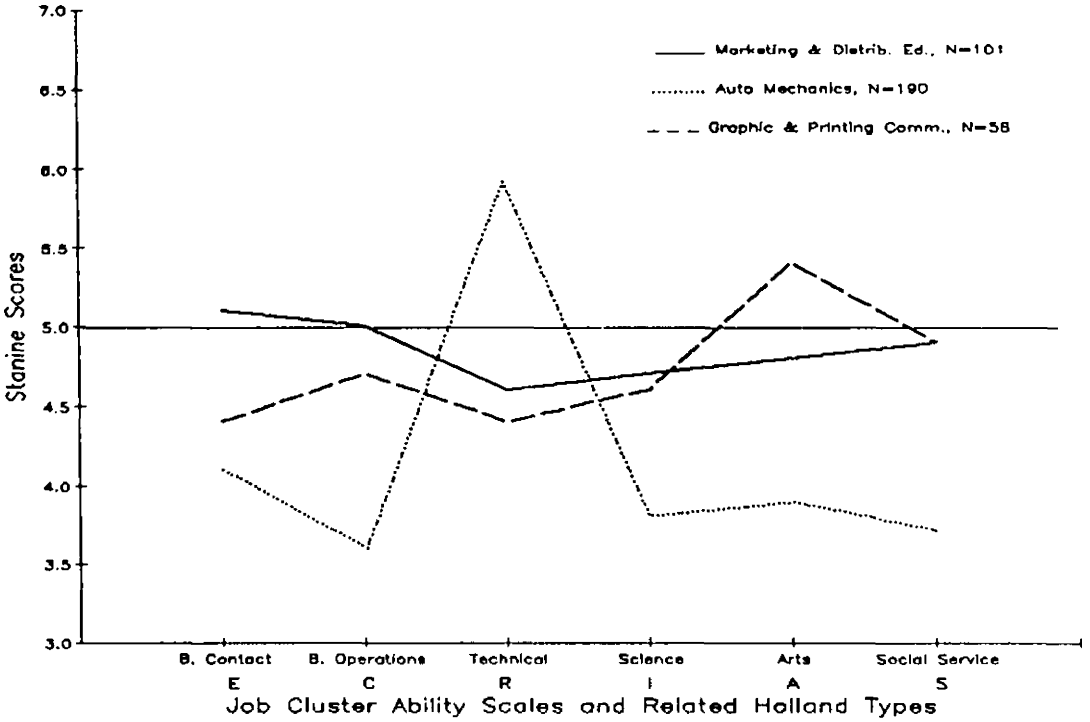


Figure 6. Job Cluster Ability Scale Profiles for Students Meeting Screens: Largest Program in Business Contact, Technical, and Arts Job Clusters

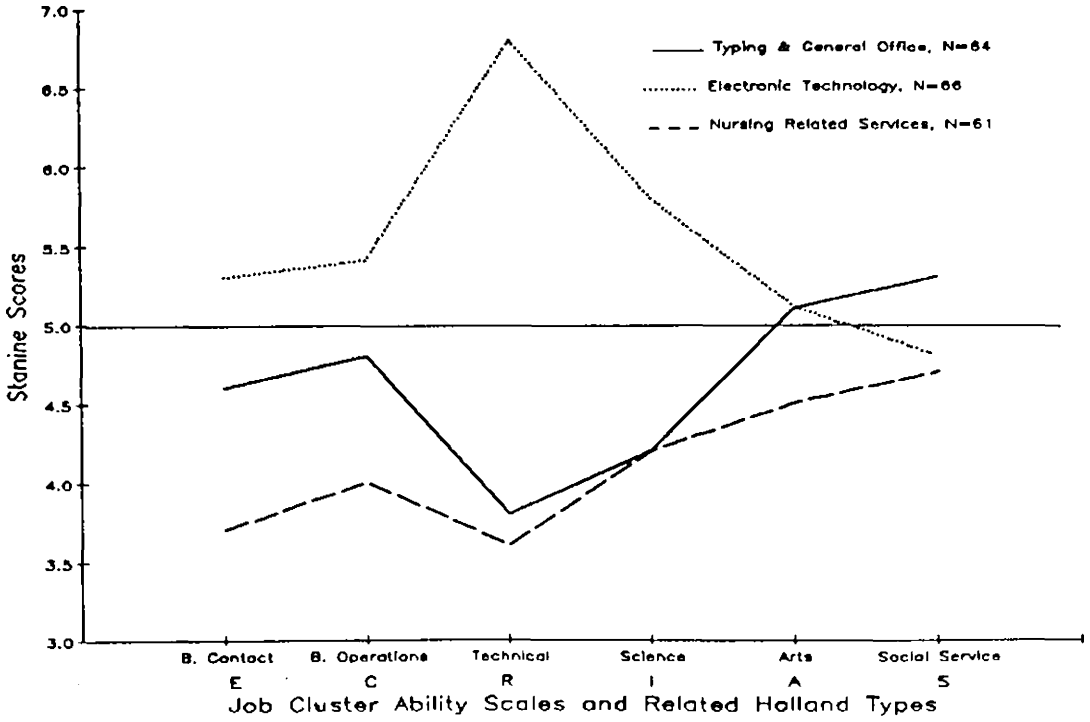


Figure 7. Job Cluster Ability Scale Profiles for Students Meeting Screens: Largest Program in Business Operations, Science, and Social Service Job Clusters

APPENDICES

APPENDIX A

Description of ACT Career Planning Program Materials

EXAMINATION KIT
Designed to help counselors and administrators review the various components of the CPP prior to adoption, each kit contains those materials central to use of the program: one Assessment Booklet and Career Guidebook, answer folder, scoring and reporting services for one participant, a Counselor's Manual, an ACT World-of-Work Map Poster, and a CPP Action Guide.

ASSESSMENT BOOKLET—Form JX (new in August 1989)
This reusable booklet contains all assessment items needed for any of the three CPP administration options described below. The quantity needed depends on local administration plans. Because revisions to the UNIACT Interest Inventory (Unit 4) have resulted in changes to the CPP scoring system, those using Form JX Assessment Booklets with Option A or B below must also use the revised CPP Answer Folder Form JX for machine scoring and reporting by ACT.

CAREER PLANNING PACKET

Option A provides a CPP Career Guidebook, answer folder with prepaid scoring, and two copies of a personalized narrative score report. Consumable. One packet per participant is required.

Option B provides the same materials as Option A *plus* a self-scoring or NCS-scannable answer sheet for immediate scoring of the ability measures. Consumable. One packet per participant is required.

Option C provides only the self-scoring or NCS-scannable answer sheet for the ability measures and an ability score profile. *For local scoring only.* Consumable. One packet per participant is required.

COUNSELOR'S MANUAL
This booklet provides important information for counselors, including a description of CPP assessment components, administration and scoring procedures, suggestions for interpretation and use of CPP results, and selected psychometric documentation. One copy of the CPP Counselor's Manual is provided with all first-time orders. Additional copies can be requested at any time at no cost.

DIRECTIONS FOR ADMINISTRATION
This manual provides directions for administering the CPP in one-, two-, and three-session administration. One copy of Directions for Administration of the CPP is provided with all first-time orders. Additional copies can be requested at any time at no cost.

ACTION GUIDE
The contents of this booklet were revised and expanded to include suggestions for involving school staff, sample communications to parents and the community, ideas for conducting warm-up and group interpretation sessions, follow-through activities, and methods for evaluating the effectiveness of the program. A special section focuses on the needs and concerns of individuals beyond high school age.

WORLD-OF-WORK MAP POSTER
This 17" x 24" color wall poster can be placed in your career center, school library, guidance office, or classroom to reinforce and support career exploration based on the ACT occupation classification system.

The publications listed below provide information on CPP rationale, development, occupational structure, national norming, reliability, and validity. The *Supplement* series, introduced in 1988, includes reports completed since publication of the *Interim Psychometric Handbook*. *Supplements* will be included with all orders for the *Handbook* at no additional charge. Previous *Handbook* purchasers may request any or all of the *Supplements* at no cost.

INTERIM PSYCHOMETRIC HANDBOOK FOR THE 3rd EDITION ACT CPP
This handbook provides extensive discussion of the research related to the development of the 3rd Edition CPP, including descriptions of reliability and validity studies.

HANDBOOK SUPPLEMENT 1
This supplement to the CPP *Psychometric Handbook* includes 3 reports: "Bases for the Assignment of Abilities to CPP Job Clusters"; "Relationship between CPP Ability Tests and Course Grades"; and "Relationship between CPP Ability Tests and Other Ability Tests."

HANDBOOK SUPPLEMENT 2
This supplement to the CPP *Psychometric Handbook* includes 4 reports: "Differentiation of Occupational Choice Groups by [CPP Ability Tests] ASVAB-14 Composites and ASVAB-14 Job Cluster Scales"; "Differentiation of Occupational Choice Groups by CPP Ability Tests and Job Cluster Scales"; "Differentiation of Occupational Groups by CPP Ability Tests" (a 6-year longitudinal study); and "Differentiation of Educational Groups by CPP Ability Tests and Rated Abilities."

TECHNICAL REPORT FOR THE UNISEX EDITION OF THE ACT INTEREST INVENTORY (UNIACT)
Because UNIACT is a major component of the CPP, this 90-page report is a companion to the *Handbook*. The report describes the development of UNIACT, provides data on degree of sex-balance, and summarizes reliability and validity evidence. Included are correlations with other interest inventories.

ABILITY DIFFERENCES ACROSS OCCUPATIONS: MORE THAN *g*
This reprint from the *Journal of Vocational Behavior* reports research on the relevance of 14 cognitive and noncognitive abilities to the CPP job clusters.

APPENDIX B

THE ACT VOCATIONAL RESEARCH PROGRAM: SUMMARY OF REPORTS (9/89 update)

Dale J. Prediger
Research Division
American College Testing

Vocational research has been conducted at American College Testing (ACT) for over 20 years. Early work involved the construction of vocational assessment instruments (ACT, 1969; 1972; 1974a; & 1974b), the refinement of Holland's system for classifying occupations (Holland, Whitney, Cole, & Richards, 1969; Cole, Whitney, & Holland, 1971), and analyses of the basic structure of vocational interests (Cole, 1973; Cole & Hanson, 1971). Much of this early work was summarized by Hanson and Cole (1973).

In 1972, in conjunction with ACT's decision to include a career exploration component in the ACT Assessment Program (the "ACT"), a formal program of vocational research was begun. Pages 3-8 of this paper provide an index to 57 published reports in the ACT Vocational Research Program. For each report, the most relevant topics are indicated (see list below), and page references for abstracts are given. The index and abstracts are arranged in the following two sections of this paper: Research; Discussion of Issues and Procedures.

Major Topics Addressed by the ACT Vocational Research Program

A. Definition and determination of sex bias in interest inventories.

B. Validity of various procedures for reporting interests to counselees (e.g., sex-balanced vs. sex-divergent scores).

C. Dimensions and procedures for classifying occupations and interests (e.g., work tasks, job families).

D. Relationship of personal characteristics to various educational and vocational outcome criteria.

E. Effects of interest inventories on counselees.

F. Vocational choice and development.

G. Role of assessment in career counseling and development.

References (in addition to abstracted studies)

American College Testing Program. The ACT Guidance Profile (Rev. ed.). Iowa City, Iowa: Author, 1969.

American College Testing Program. Handbook for the ACT Career Planning Program (1972 ed.). Iowa City, Iowa: Author, 1972.

American College Testing Program. Assessment of Career Development handbook. Boston: Houghton Mifflin, 1974. (a)

American College Testing Program. Career Planning Program, Grades 8-11, handbook. Boston: Houghton Mifflin, 1974. (b)

Cole, N. S. On measuring the vocational interests of women. Journal of Counseling Psychology, 1973, 20, 105-112.

Cole, N. S., & Hanson, G. R. An analysis of the structure of vocational interests. Journal of Counseling Psychology, 1971, 18, 478-486.

Cole, N. S., Whitney, D. R., & Holland, J. L. A spatial configuration of occupations. Journal of Vocational Behavior, 1971, 1, 1-9.

Hanson, G. R., & Cole, N. S. The vocational interests of young adults (ACT Monograph No. 11). Iowa City, Iowa: American College Testing Program, 1973.

Holland, J. L., Whitney, D. R., Cole, N. S., & Richards, J. M., Jr. An empirical occupational classification derived from a theory of personality and intended for practice and research (ACT Research Report No. 29). Iowa City, Iowa: American College Testing Program, 1969.

INDEX TO ABSTRACTED REPORTS

B. Discussions of Issues and Procedures

		Topic	Page
12.	Brennan, R. L., & Prediger, D. J. Coefficient kappa: Some uses, misuses, and alternatives. Educational and Psychological Measurement, 1981, 41, 687-699.	D	33
13.	Prediger, D. J. Errors in O'Neil et al.'s (1980) Career Factor Checklist validity analyses. Journal of Counseling Psychology, 1984, 31, 274-277.	F	34
14.	Prediger, D. J. Why we need professional preparation guidelines in measurement and evaluation. Measurement and Evaluation in Counseling and Development, 1984, 17, 175-178.	G	34
15.	Prediger, D. J., & Garfield, N. J. Testing responsibilities and competencies: A checklist for career counselors. In J. T. Kapes & M. M. Mastie (Eds.), A counselor's guide to career guidance instruments (2nd ed.). Alexandria, VA: National Career Development Association, 1988.	G	34

ABSTRACTS AND COPIES OF REPORTS

For abstracts or copies of any ACT Vocational Research Program reports, please contact the Student Services Department, ACT Research Division, P.O. Box 168, Iowa City, IA 52243. Single copies of reports are available at no charge.

APPENDIX C

Career Planning Program Score Report

YOUR CAREER PLANNING REPORT

CAROL P. PAULSON
923 ORCHARD DRIVE
GARDEN GROVE CO 80023
PHONE 305/555-1070

Trial Job Choices You Reported

Accountant [Job Family D]
Engineer [Job Family M]
How sure were you?--Not Sure

6. SOCIAL SERVICE

JOB FAMILIES AND SAMPLE JOBS

— T. GENERAL HEALTH CARE
Nursing aides; dental assistants; licensed practical nurses; physical therapy assistants; registered nurses; dieticians; occupational therapists; physicians; speech pathologists

— U. EDUCATION AND RELATED SERVICES
Teacher aides; preschool teachers; athletic coaches; college teachers; guidance/career/etc. counselors; elementary and secondary school teachers; special education teachers

— V. SOCIAL AND GOVERNMENT SERVICES
Security guards; recreation leaders; police officers; health/safety/food/etc. inspectors; child welfare workers; home economists; rehabilitation counselors; sanitarians; social workers

— W. PERSONAL/CUSTOMER SERVICES
Grocery baggers; bellhops; flight attendants (stewards, stewardesses); waitresses and waiters; cosmetologists (beauticians); barbers; butlers and maids

Your Interests Rank*	Middle
Your Experiences Rank*	Lowest
Your Level on Some Relevant Abilities**	
Reading Skills	Medium
Language Usage	High
Meeting People (Self-rated)	Low
Helping Others (Self-rated)	Medium

1. BUSINESS CONTACT

JOB FAMILIES AND SAMPLE JOBS

— A. MARKETING AND SALES
Sales workers in stores; route drivers (milk, etc.); buyers; travel agents; sales workers who visit customers (real estate and insurance agents; stock brokers; farm products, office-, and medical-supplies sales workers)

— B. MANAGEMENT AND PLANNING
Store, motel, restaurant, and agribusiness managers; office supervisors; purchasing agents; managers in large businesses; recreation/parks managers; medical records administrators; urban planners

Your Interests Rank*	Highest
Your Experiences Rank*	Middle
Your Level on Some Relevant Abilities**	
Numerical Skills	High
Language Usage	High
Sales (Self-rated)	Low
Leadership/Management (Self-rated)	High

2. BUSINESS OPERATIONS

JOB FAMILIES AND SAMPLE JOBS

— C. RECORDS AND COMMUNICATIONS
Office, library, hotel, and postal clerks; receptionists; computer tape librarians; office, medical, and legal secretaries; court reporters

C D. FINANCIAL TRANSACTIONS
Bookkeepers; accountants; grocery check-out clerks; bank tellers; ticket agents; insurance underwriters; financial analysts

— E. STORAGE AND DISPATCHING
Shipping clerks; mail carriers; truck and cab dispatchers; air traffic controllers

— F. BUSINESS MACHINE/COMPUTER OPERATION
Computer console, printer, etc. operators/office machine operators; typists; word-processing equipment operators; statistical clerks

Your Interests Rank*	Highest
Your Experiences Rank*	Highest
Your Level on Some Relevant Abilities**	
Numerical Skills	High
Language Usage	High
Clerical Speed/Accuracy	Medium
Organization (Self-rated)	High

JOB CLUSTERS

5. ARTS

JOB FAMILIES AND SAMPLE JOBS

— Q. APPLIED ARTS (VISUAL)
Floral designers; merchandise displayers; commercial artists; fashion designers; photographers; interior designers; architects; landscape architects

— R. CREATIVE/PERFORMING ARTS
Entertainers (comedians, etc.); actors-actresses; dancers; musicians; singers; composers; writers; art, music, etc. teachers

— S. APPLIED ARTS (WRITTEN AND SPOKEN)
Advertising copywriters, disk jockeys, legal assistants; advertising account executives, interpreters; reporters; public relations workers; lawyers; librarians; technical writers

Your Interests Rank*	Lowest
Your Experiences Rank*	Middle
Your Level on Some Relevant Abilities**	
Language Usage	High
Space Relations	Low
Creative/Artistic (Self-rated)	Low
Creative/Literary (Self-rated)	Medium

4. SCIENCE

JOB FAMILIES AND SAMPLE JOBS

C M. ENGINEERING/OTHER TECHNOLOGIES
Engineers and engineering technicians; lab technicians; computer programmers and technicians; drafters; food technologists

— N. MEDICAL SPECIALTIES/TECHNOLOGIES
Dental hygienists; EEG and EKG technicians; opticians; prosthetics technicians; X-ray technologists; dentists; pharmacists; veterinarians

— O. NATURAL SCIENCES AND MATHEMATICS
Agronomists; biologists; chemists; mathematicians; physicists; soil scientists

— P. SOCIAL SCIENCES
Marketing research analysts; anthropologists; economists; political scientists; psychologists

Your Interests Rank*	Lowest
Your Experiences Rank*	Lowest
Your Level on Some Relevant Abilities**	
Reading Skills	Medium
Numerical Skills	High
Language Usage	High
Scientific (Self-rated)	Low

3. TECHNICAL

JOB FAMILIES AND SAMPLE JOBS

— G. VEHICLE OPERATION AND REPAIR
Bus, truck, and cab drivers; mechanics; forklift operators; airplane pilots; ship officers

— H. CONSTRUCTION AND MAINTENANCE
Carpenters; electricians; painters; bulldozer operators; building inspectors; custodians

— I. AGRICULTURE AND NATURAL RESOURCES
Farmers; foresters; ranchers; landscape gardeners; tree surgeons; plant nursery workers

— J. CRAFTS AND RELATED SERVICES
Cooks; meatcutters; bakers; shoe repairers; piano/organ tuners; tailors; jewelers

— K. HOME/BUSINESS EQUIPMENT REPAIR
Repairers of TV sets, appliances, typewriters, telephones, heating systems, photocopiers, etc.

— L. INDUSTRIAL EQUIPMENT OPERATION AND REPAIR
Machinists; printers; welders; industrial machinery repairers; production painters; firefighters; machine operators

Your Interests Rank*	Middle
Your Experiences Rank*	Highest
Your Level on Some Relevant Abilities**	
Mechanical Reasoning	Medium
Space Relations	Low
Numerical Skills	High
Manual Dexterity (Self-rated)	Medium

LEVEL 2 REPORT
for the
ACT
CAREER PLANNING PROGRAM

*Ranking shows how your interests or experiences in this cluster compare to your interests or experiences in the other clusters. See pages 22-24 of your *CPP Career Guidebook*.

**Ability levels are based on CPP tests, unless otherwise noted. Reading, language, and numerical skills are important in each cluster. However, these skills are listed only in the clusters in which they are most important. See pages 22-24 of your *CPP Career Guidebook*.

CAREER PLANNING SERVICES
ACT

CPP

CAREER PLANNING PROGRAM

HOW TO USE YOUR REPORT

Check off each step as you finish it.

☐ 1. Each of the six boxes above contains a Job Cluster. Look over the Clusters and the Job Families in each.

☐ 2. When you took the CPP, you reported trial job choices of Accounting and Engineering. Look at the Job Families containing these jobs: Family D and Family M. Note that the computer has printed a "C" [for "choice"] by each.

☐ 3. Your interest scores ranked highest for Clusters 1 and 2. [These scores summarize the likes and dislikes you marked for work-related activities.] Look through the Job Families in Clusters 1 and 2. Then print an "I" [for interests] by Job Families for which you would like to see a list of jobs.

☐ 4. Your experience scores ranked highest for Clusters 2 and 3. Print an "E" [for experiences] by Job Families in these clusters you might want to examine further.

☐ 5. The overall level of your abilities appears to be highest in Clusters 1 and 2. Print an "A" [for abilities] by Job Families in these clusters you might want to examine further.

☐ 6. By now you may have several Job Families marked "C," "I," "E," or "A." Circle at least three of these for which you would like to see a list of jobs. At least one should be a "C" family. In choosing, think about what you want most from a job. For example, if liking the day-to-day job tasks is important, pay special attention to the families marked "I."

☐ 7. Turn to the Job Family Charts on pages 14-21 of your CPP Career Guidebook. Find the Job Families you circled and circle any jobs that might be right for you. Then, copy the information on those jobs onto the lines below. List at least three jobs.

Job Possibilities	Job Description*	Preparation Level*

Use lines on the back if you need more room. *See key on back of report.

☐ 8. See pages 6-9 of your CPP Career Guidebook for the next steps.

INFORMATION FOR COUNSELORS AND ADVISORS

(Pages 22-24 of your *CPP Career Guidebook* explain this section.)

CAROL P. PAULSON
SOC. SEC. NO.: 393-11-0971
DATE OF BIRTH: 1/29/1971 SEX: F

H.S. GRAD. YR.: 1989
ED. LEVEL: H.S. junior
DATE SCORED: 10/87

INSTITUTION: GARDEN GROVE H.S.
GARDEN GROVE, CO
ADVISOR CODE: 14

INTERESTS	Natl Stanine (1-9)	Lower Quarter	Middle Half	Upper Quarter	Rank of Experience Scores
		Percentile Rank: 5 10 25 40 60 75 90 95			
Business Contact	7			--XX--	Middle
Business Operations	8			--XX--	Highest +
Technical	5		--XX--		Highest +
Science	2	--XX--			Lowest
Arts	1	XX--			Middle -
Social Service	4		--XX--		Lowest -

Local Items: 1-B, 2-E, 3-A, 13(35)

Additional Stanines *	ABILITIES	Natl Stanine (1-9)	Lower Quarter	Middle Half	Upper Quarter
			Percentile Rank: 5 10 25 40 60 75 90 95		
4	Reading Skills (RS)	4		--XX--	
6	Numerical Skills (NS)	8			--XX--
6	Language Usage (LU)	7			--XX--
6	RS + NS + LU	6		--XX--	
5	Mechanical Reasoning	5		--XX--	
3	Space Relations	3	--XX--		
6	Clerical Speed/Accuracy	6		--XX--	

*State norms for CPP-tested H.S. juniors

WORLD-OF-WORK MAP SUMMARY (See Back of Report)

Job Choice Regions:	04	07	08
Interest Regions:	03	04	05
Experience Regions:	04	05	06
Ability Regions:	03	04	05

ASKED FOR HELP WITH:	Reading Skills	Study Skills	Writing Skills	Math Skills	Career Plans	Physical Disability	Financing Educ.
	Yes	Yes	No	No	Yes	No	?

Long Range Educational Goal:
2-year college degree (voc/tech, college transfer, nursing, etc.)

Institutional Choices:
ARAPAHOE CMTY COL
LITTLETON CO

LINCOLN INSTITUTE OF TECH
NORTH FORK CO

Planned Enrollment Date	Full-time Student	Day or Evening Classes
09/89	Yes	Day

Plans to Work	Local Program Codes	Est. ACT Composite Range
10 hrs/ week	1st: 027 2nd: 153	14-20

HIGH SCHOOL RECORD

Courses Taken or Planned	No. of Years	Last Grade
Biology	1	C
Chemistry	0	
Physics	0	
Algebra	1	A
Geometry	0	
Trigonometry	0	
English	3	B
Foreign Lang	0	
Business	1	B
Vocational	1	A

2230/083

ANOTHER WAY TO FIND JOB POSSIBILITIES

Check (✓) each step as you finish it.

☐ 1. Work tasks provide a key to understanding the world of work. Begin by reading the section below titled "Work Tasks."

☐ 2. Next, mark your regions on the World-of-Work Map. Your regions are listed at the bottom left on the front of this report. On the map below, print a "C" (for choice) in the regions listed for your trial job choices. Similarly, print an "I" (for interests), an "E" (for experiences), and an "A" (for abilities) in the appropriate regions.

About Region 99

If your CPP scores do not show any clear pattern, a region "99" is reported. (This may happen, for example, if several scores are tied or nearly tied for highest.)

☐ 3. Look over the Job Families in the regions which you marked C, I, E, or A. Draw a circle on the map around the name of each Job Family that you think you might like. (For examples of jobs in each Job Family, see the "Job Clusters" on the front.) Try to circle at least two or three Job Families. In choosing, think about what you want most from a job. For example, if liking the day-to-day job tasks is important, pay special attention to the families marked "I."

For People Who Are "All over the Map"

There is no law that says your interests, abilities, and trial job choice must be the same! They provide **different** ways of looking at yourself. Each deserves some attention. Think of the Job Families you pick now as starting points. (You can explore others later.) Perhaps a counselor can help you sort things out.

☐ 4. Turn to the Job Family Charts on pages 14-21 of your *CPP Career Guidebook*. Use them to find the Job Families you circled on the map, and circle the names of any jobs that you want to learn more about. Then, copy the information about those jobs on the lines below. Try to list at least three job possibilities. Your *CPP Career Guidebook* has ideas for exploring these jobs. For example, see page 7.

Job Possibilities	Job Description*	Preparation Level*

***KEY**

Job Description provides the page number where a description can be found in the *Occupational Outlook Handbook*. When a job is not covered but related jobs are, the page number has the following symbol (■).

Preparation Level shows the **typical** amount of formal preparation (education and training) of workers.

1 = High School
2 = High School + 1 or 2 years
3 = High School + 4 or more years

Example: "1.2" means that workers typically have a high school education, but some have up to two years of training beyond high school.

Example: "1,2*" means the job may also require apprenticeship training (shown by *).

WORK TASKS

Occupations ("jobs") differ in how much they involve working with:

PEOPLE: People you help, serve, care for, or sell things to. Sales workers, hospital attendants, and teachers work mainly with **PEOPLE.**

DATA: Facts, numbers, files, business procedures. Bank tellers, bookkeepers, and computer programmers work mainly with **DATA.**

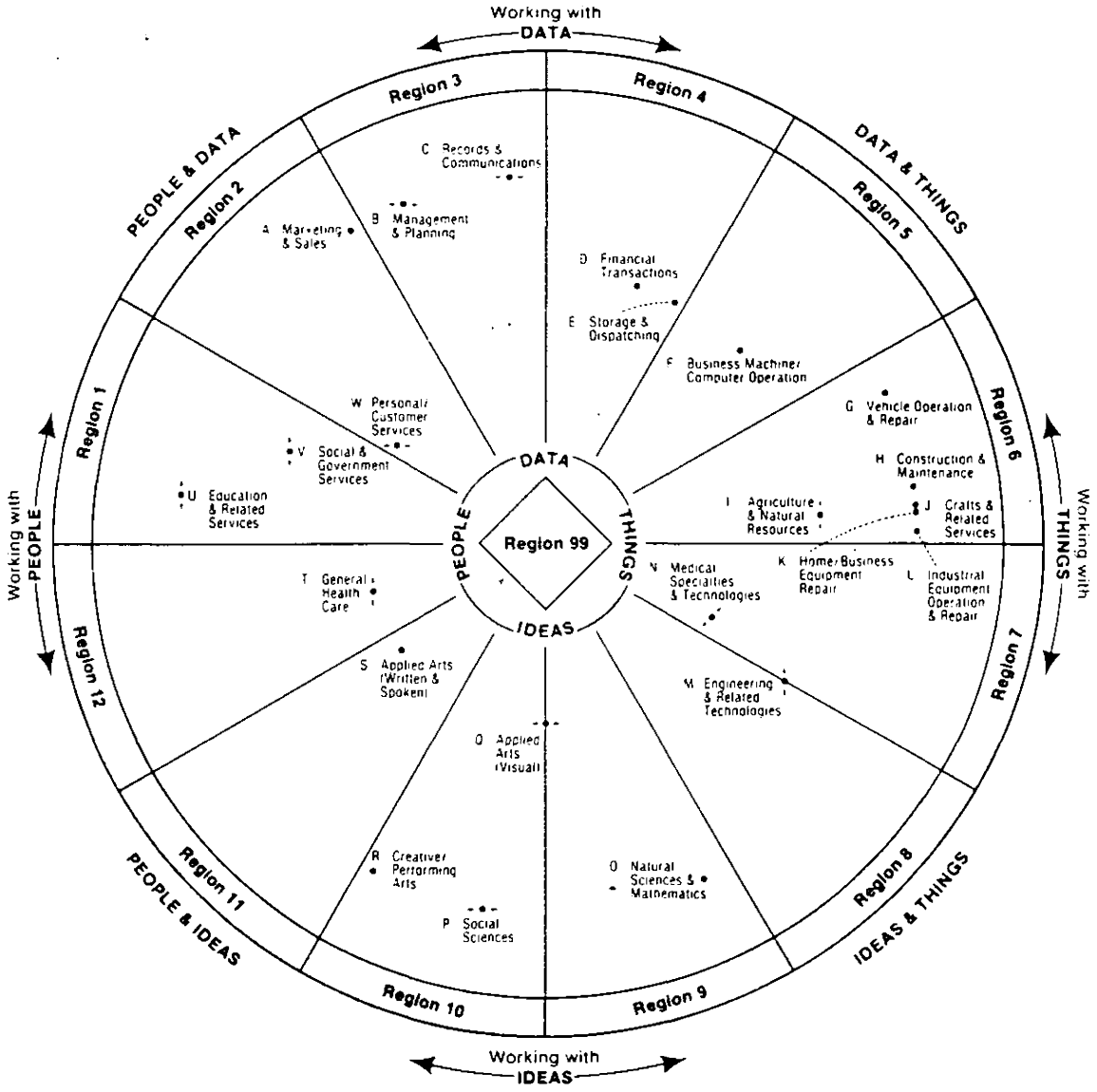
THINGS: Machines, tools, living things, and materials such as food, wood, or metal. Technicians, cooks, and mechanics work mainly with **THINGS.**

IDEAS: New ways of saying something—for example, with words, equations, or music. Song writers, scientists, and artists work mainly with **IDEAS.**

Any job will require some work with PEOPLE, DATA, THINGS, and IDEAS. But most jobs mainly involve only one or two of these four work tasks. The World-of-Work Map at the right arranges the work tasks by "Map Region." Jobs mainly involving PEOPLE are located in regions on the left of the map. (For example, see Job Family U—Education and Related Services.) Jobs mainly involving DATA are located at the top (for example, Job Family C); and so on.

Your CPP results can help you find world-of-work regions in line with your interests, experiences, and abilities. For example, if your interest scores fall in Regions 3 and 4, this might mean you would like working with DATA. Region 8 would indicate IDEAS and THINGS because it involves both IDEAS and THINGS work tasks. The steps at the top of this sheet will help you find jobs in your world-of-work regions.

WORLD-OF-WORK MAP (2nd Edition)



About the World-of-Work Map

Although each Job Family is shown as a single point, the jobs in a family vary in their locations. Most jobs, however, are located near the point shown for the Job Family. Arrows by a Job Family show that work tasks often heavily involve both PEOPLE and THINGS (- -) or DATA and IDEAS (¦).

APPENDIX D

DESCRIPTION OF STATISTICAL ANALYSIS PROCEDURES

Multivariate Analysis of Variance (MANOVA)

MANOVA, a multivariate generalization of analysis of variance, can be used to determine the extent to which two or more groups, considered simultaneously, differ on a set of two or more measures, considered simultaneously. When there are only two groups (e.g., criterion groups), MANOVA procedures (and the discriminant analysis procedures described below) have a number of similarities with point-biserial multiple regression analysis. When there are more than two groups, however, MANOVA procedures and results are unique.

The Wilks's lambda statistic is typically used as an index of group differentiation in MANOVA. This statistic reflects the ratio of within-group variance to total-group variance, as determined from multivariate estimates of variance. The value of lambda can range from zero to one. When there are no group differences on a set of measures (i.e., when among-group variance is zero), lambda will equal one. Lambda approaches zero as group differences increase.

Although lambda ranges from zero to one, it does not directly provide an index of explained variance analogous to R^2 in regression analysis. In MANOVA, one would prefer to have an index that provides the proportion of total variance in a set of measures (among-group plus within-group variance, across all measures) that is attributable to criterion group differences. Huberty (1983) cites seven indices proposed for this task. Four of the seven provide similar results when sample sizes are "large" (p. 710) relative to the number of measures. One of these, the "Wilks index," is simply one minus Wilks's lambda.

Since there does not appear to be a single, best index of explained variance in MANOVA (Huberty, 1983, p. 712), the Wilks index is used here. The index estimates the proportion of total variance in individual differences across a set of measures that is attributable to inter-group differences. More briefly, the Wilks index "is a variance-explained index" (Huberty & Smith, 1982, p. 419). Because lambda is commonly available in MANOVA, the Wilks index can be easily obtained and compared across studies with comparable criterion groups.

An F value based on Wilks's lambda is used for tests of statistical significance in MANOVA. If Wilks's lambda is significant at the chosen significance level, it is common to examine univariate Fs to determine the extent to which each measure in the analysis differentiates the groups. If the measures have overlapping variance, a different approach is needed to determine the unique contribution of each measure to group differentiation. One possibility, suggested by Huberty (1984), is to note the change in lambda when a measure is removed from the set. Thus, if there are six measures in a set, the overall lambda is compared with lambdas obtained for six sets of five measures, a different measure being omitted from each set. Degree of change in lambda can then be used to rank the measures with respect to their unique contribution to group differentiation.

Discriminant Analysis (DISANL)

If MANOVA indicates that criterion groups differ significantly on a set of variables, the dimensionality of the differences can be examined through DISANL. Although a number of statistical procedures are sometimes grouped under the term, DISANL might best be thought of as a statistical technique for finding uncorrelated combinations of measures (discriminant functions) which best differentiate among a set of criterion groups. A discriminant function is defined as a linear combination of measures which maximizes the ratio of among-group variance to within-group variance, with variances represented by multivariate estimates. After each discriminant function is obtained, variance associated with it is removed and successive uncorrelated functions are obtained until residual among-group variance is exhausted.

The eigenvalue associated with a discriminant function can be used to estimate the proportion of overall group differentiation (among-group variance) that is accounted for by the function. Successive functions will account for successively smaller proportions of variance.

Although there is no generally accepted test of statistical significance for a specific discriminant function, it is possible to determine, through a chi-square transformation, whether significant group differences remain after the function is extracted. Thus, one may find that criterion group differences remaining after the first (or second, etc.) function is extracted can be reasonably attributable to chance. (The .0001 level of statistical significance was required to reject the null hypothesis of no group differences in the studies reported here.) Together, the chi-square test and the "variance-explained" estimate for each function provide a basis for deciding whether criterion group differences can be adequately represented by a given number of dimensions.

Two types of data are typically used to determine the nature of the dimensions (discriminant functions) on which groups differ. First, correlations of the measures with the functions can be examined, much as in factor analysis. Second, group means and standard deviations can be obtained for the functions.

Hit Rate Analysis

Another indicator of group differentiation is the extent to which group members can be assigned into their own groups through use of a set of measures. If the measures fail to differentiate criterion groups, the proportion of correct assignments (the "hit rate") will approximate chance. On the other hand, if there is no overlap among the criterion groups, all group members will be assigned to their own group and a hit rate of 100% will be obtained. Thus, hit rate and discrimination power co-vary. (Sampling anomalies result in less than a perfect correlation, however.)

Although frequently associated with DISANL, hit rate analyses can be conducted for any set of scores--e.g., original test scores, factor scores, discriminant function scores. In the studies reported here, hit rates are based on scores for all available discriminant functions. Hit rates determined from all discriminant functions generally approximate those obtained directly from the original variables.

In order to determine hit rates, indices of group similarity are needed for each member of a sample. Thus, if there are six criterion groups in a study, six indices of group similarity are needed. Each person in the study can then be assigned to the group for which he or she has the highest index. In the studies reported here, similarity indices were based on Bayes' rule, as described by Norusis (1985). The pooled within-group covariance matrix was used, and group sizes were considered to be equal.

Hit rates can generally be improved by taking relative group size into account. However, information on group size was not used in the analyses reported here. Instead, criterion group assignments were based solely on similarity indices derived from the three sets of measures. This approach to validation is compatible with the use of test scores in career counseling. Few counselors, for example, would reason as follows: "Mary scores like persons in Occupation A. But there are few persons in Occupation A. So I will suggest something else." Most counselors would not hesitate to tell a counselee that he or she has scores similar to persons in Occupation A, even though its size might be quite small in comparison to other occupations. Job opportunities could then be considered, separately, as part of counseling.

Although hit rates have concrete meaning, their evaluation (are the hit rates "high" or "low"?) is not straightforward. Among the factors to be considered are the following.

1. What is the chance hit rate and to what extent does the observed hit rate improve upon chance? Brennan and Prediger (1981) discuss various indices of agreement beyond chance. They show that when there are no restrictions on the number of persons assigned to a given criterion group in a classification study, chance should be defined as $1/n$, where n is the number of criterion groups.

2. How many groups are in the analysis? This question is important because the number of groups directly influences the chance hit rate ($1/n$). Thus, if there are two groups, a hit rate of 51% would not be impressive.

3. What is the nature of the criterion groups in the analysis? They may differ, for example, from comprehensive categories covering all recognized occupations (e.g., CPP Job Clusters) to highly diverse, specific vocational programs (e.g., Legal Secretary, Dental Assisting, Carpentry, Horticulture). Greater criterion group differentiation (hence, higher hit rates) can be expected for specific vocational programs because comprehensive groups, by their very nature, shade into each other. If only a few specific programs are included in an analysis, however, the relevance of results to comprehensive career counseling would be in doubt.

4. Are the hit rates statistically significant? This question is addressed by providing confidence limits for hit rates and comparing the limits with the chance hit rate. Also, it is related to the question of group differentiation. The latter question, as noted above, is addressed by an F test based on the Wilks's lambda statistic.

APPENDIX E

Rules for Using CPP Interest and Ability Scores to Identify Job Clusters for Exploration

A. Interests (Message 3 on CPP score report)

1. Note the national stanines for interests printed in the lower left of the CPP score report ("Your Career Planning Report"). Note, also, that CPP interests and job clusters have identical titles.

2. Rank the interests on the basis of the stanines.

3. Use decision rules listed below to determine job clusters identified in Step 3 of CPP score report.

B. Abilities (Message 5 on CPP score report)

1. Assign points as follows to the four abilities listed on the CPP score report for each job cluster: 3 points for each "high," 2 points for each "medium," and 1 point for each "low."

2. Obtain a Job Cluster Ability Scale score for each job cluster by adding up the points for the four abilities assigned to the cluster.

3. Rank the Job Cluster Ability Scale scores.

4. Use decision rules listed below to determine job clusters identified in Step 5 of CPP score report.

	DECISION RULES (Read across)			Decision
RULE	# of scores ranked highest	# of scores 1 point less than highest	# of scores 2 points less than highest	# of clusters cited on score report
S	1	0	0	1[a]
T	1	0	1	2[b]
U	1	0	2 or more (tied)	1[a]
V	1	1	any #	2[b]
W	1	2 or more (tied)	any #	1[a]
X	2 (tied)	any #	any #	2[b]
Y	3 (tied)	any #	any #	3[c]
Z	4 (tied)	any #	any #	0[d]

[a]The cluster with the highest score is cited.

[b]The two highest clusters are cited.

[c]The three tied clusters are cited.

[d]The following is printed for Message 3: "Your interest results for several Job Clusters tie for highest, when considered as a whole. Hence, it is not possible to single out a few for special attention. As you do the next step, you may wish to give priority to other information on your CPP report." Message 5 is similar.

APPENDIX F

Supplementary Tables

Table

Table F1

Differentiation, by CPP Interest Scales, of Vocational Programs Grouped by Job Cluster

Statistics (See Appendix D for description)	Weighted-sample results
MANOVA	
Wilks's lambda[a]	.57
Wilks's variance-explained index	43%
Univariate F[b] (and rank for unique contribution)	
Business Contact Scale	18.0 (5)
Business Operations Scale	23.3 (3)
Technical Scale	37.2 (1)
Science Scale	19.4 (6)
Arts Scale	15.5 (4)
Social Service Scale	29.0 (2)
DISANL	
No. of functions warranted by significance tests[c]	4
Among-group variance for all 5 functions: 53%, 28%, 12%, 5%, 2%	
Hit rate: E=23%, C=50%, R=54%, I=30%, A=33%, S=50%; Total=40%.	

Note. The analyses excluded 57 students who could not be assigned to a job cluster, 335 students who did not meet the satisfaction/success screens, and 156 students who had missing scores for the Interest Scales, Ability Tests, or Job Cluster Ability Scales. Job Cluster Ns were as follows: Business Contact (E) = 100, Business Operations (C) = 260, Technical (R) = 796, Science (I) = 151, Arts (A) = 63, Social Service (S) = 183. The total N was 1,553.

[a] $p < .0001$, based on analysis of unweighted data.

[b] $p < .0001$ for each scale, based on analysis of unweighted data.

[c] $p < .0001$, based on analysis of unweighted data. A chi-square test for remaining functions was used.

Table F2

Differentiation, by CPP Ability Tests, of Vocational Programs Grouped by Job Cluster

Statistics (See Appendix D for description)	Weighted-sample results
MANOVA	
Wilks's lambda[a]	.60
Wilks's variance-explained index	40%
Univariate F[b] (and rank for unique contribution)	
Reading Skills	17.0 (4)
Language Usage	33.6 (2)
Clerical Skills	20.4 (3)
Space Relations	20.2 (6)
Numerical Skills	12.9 (5)
Mechanical Reasoning	93.5 (1)
DISANL	
No. of functions warranted by significance tests[c]	2
Among-group variance for all 5 functions: 80%, 12%, 7%, 2%, 0%	
Hit rate: E=31%, C=42%, R=55%, I=46%, A=24%, S=16%; Total=36%.	

Note. The analyses excluded 57 students who could not be assigned to a job cluster, 335 students who did not meet the satisfaction/success screens, and 156 students who had missing scores for the Interest Scales, Ability Tests, or Job Cluster Ability Scales. Job Cluster Ns were as follows: Business Contact (E) = 100, Business Operations (C) = 260, Technical (R) = 796, Science (I) = 151, Arts (A) = 63, Social Service (S) = 183. The total N was 1,553.

[a] $p < .0001$, based on analysis of unweighted data.

[b] $p < .0001$ for each scale, based on analysis of unweighted data.

[c] $p < .0001$, based on analysis of unweighted data. A chi-square test for remaining functions was used. A third function would be warranted if $p < .001$ were used.

Table F3

Differentiation, by CPP Job Cluster Ability Scales, of Vocational Programs Grouped by Job Cluster

Statistics (See Appendix D for description)	Weighted-sample results
MANOVA	
Wilks's lambda[a]	.57
Wilks's variance-explained index	43%
Univariate F[b] (and rank for unique contribution)	
Business Contact Scale	16.8 (5)
Business Operations Scale	23.6 (3)
Technical Scale	63.1 (1)
Science Scale	27.2 (4)
Arts Scale	13.2 (6)
Social Service Scale	32.1 (2)
DISANL	
No. of functions warranted by significance tests[c]	3
Among-group variance for all 5 functions: 74%, 12%, 10%, 3%, 0%	
Hit rate: E=27%, C=32%, R=57%, I=51%, A=35%, S=31%; Total=39%.	

Note. The analyses excluded 57 students who could not be assigned to a job cluster, 335 students who did not meet the satisfaction/success screens, and 156 students who had missing scores for the Interest Scales, Ability Tests, or Job Cluster Ability Scales. Job Cluster Ns were as follows: Business Contact (E) = 100, Business Operations (C) = 260, Technical (R) = 796, Science (I) = 151, Arts (A) = 63, Social Service (S) = 183. The total N was 1,553.

[a] $p < .0001$, based on analysis of unweighted data.

[b] $p < .0001$ for each scale, based on analysis of unweighted data.

[c] $p < .0001$, based on analysis of unweighted data. A chi-square test for remaining functions was used.

Table F1

Interest Scale Mean Stanines for Students Meeting Satisfaction/Success Screens

JOB CLUSTER and Vocational Program	N[b]	Interest Scale[a] BC (E)	BO (C)	TEC (R)	SCI (I)	ART (A)	SOC (S)
BUSINESS CONTACT (BC)	110	5.7	5.4	4.9	4.7	4.6	4.8
31. Marketing & Distrib. Ed.	106	5.7	5.4	4.8	4.7	4.6	4.8
BUSINESS OPERATIONS (BO)	271	5.7	6.2	4.2	4.3	4.4	5.0
20. Accounting & Bookkeeping	40	6.4	7.3	4.5	4.6	4.2	5.2
24. Data Processing & Related	49	5.7	6.1	4.5	4.9	4.5	4.9
25. Secretarial & Related	53	5.5	6.3	4.1	4.1	3.8	4.8
27. Typing & General Office	67	5.9	6.0	3.9	3.8	4.8	5.2
30. Business & Office Ed.	47	5.3	6.0	3.9	4.3	4.7	5.1
TECHNICAL (TEC)	883	4.5	4.7	6.2	4.7	4.2	3.8
10. Agribusiness/Prod. Miscl.	24	5.3	5.2	5.8	5.6	4.3	4.1
44. Food Production & Mgmt.	23	5.7	5.5	5.7	5.3	5.3	5.7
68. Carpentry	124	4.8	4.8	6.6	4.4	4.2	4.0
70. Electrician Services	20	4.9	5.2	6.7	5.1	5.0	3.8
73. Electrical Equip. Repair	24	5.4	5.4	6.3	5.8	5.3	4.3
77. Heating, A.C., & Refrig.	67	4.7	4.9	6.3	5.0	4.2	3.8
81. Aircraft Mechanics	48	6.2	5.8	7.1	6.5	5.4	5.4
82. Auto Body Repair	160	4.3	4.5	6.0	4.6	4.2	3.5
83. Auto Mechanics	198	4.2	4.4	5.9	4.4	3.8	3.4
90. Machine Tool/Shop	52	4.2	4.6	6.5	4.6	4.1	3.5
92. Welding & Soldering	62	4.1	4.2	6.3	4.6	4.2	3.5
SCIENCE (SCI)	153	4.6	5.1	5.7	5.5	4.6	4.1
64. Electronic Technology	66	4.7	5.2	6.0	5.8	4.5	4.3
87. Drafting	52	4.4	5.0	5.5	5.0	4.8	3.5
ARTS (ART)	67	5.0	5.5	5.2	4.9	5.5	4.9
88. Graphic & Printing Comm.	60	5.0	5.5	5.1	4.8	5.5	4.9
SOCIAL SERVICE (SOC)	190	4.7	4.8	4.9	5.7	4.8	5.5
56. Practical Nursing	36	4.6	4.6	4.7	6.1	4.1	5.4
57. Nursing Related Services	63	4.5	4.6	4.9	5.8	4.9	5.4
59. Allied Health, Other	43	4.8	4.8	4.7	5.9	5.2	5.9
62. Cosmetology	34	5.4	5.5	5.5	5.1	5.3	5.4
TOTAL SAMPLE	2,055	4.8	5.0	5.5	4.9	4.5	4.3

Note. Stanines range from 1-9. The mean is 5 and standard deviation is 2 for a nationally representative sample of 12th graders. Vocational programs are grouped according to CPP Job Cluster. Project ID numbers precede program titles.

[a]Related Holland types are shown in parentheses.

[b]Sample sizes vary slightly from scale to scale. The smallest sample size is reported. Data are not shown for vocational programs with less than 20 students.

Table F5

Ability Test Mean Stanines for Students Meeting Satisfaction/Success Screens

JOB CLUSTER and Vocational Program	N[b]	Ability Test[a] RS	LU	CS	SR	NS	MR	G
BUSINESS CONTACT (BC)	109	4.6	4.7	5.8	5.0	4.7	5.0	4.7
31. Marketing & Distrib. Ed.	105	4.6	4.7	5.8	4.9	4.6	4.8	4.6
BUSINESS OPERATIONS (BO)	271	5.1	5.3	5.3	5.0	4.7	4.3	5.0
20. Accounting & Bookkeeping	40	5.6	5.5	5.9	5.5	5.6	4.3	5.5
24. Data Processing & Related	49	5.3	5.3	5.3	5.3	4.7	4.8	5.2
25. Secretarial & Related	52	5.1	5.6	5.6	5.1	4.5	4.3	5.0
27. Typing & General Office	68	4.7	5.0	5.0	4.5	4.3	3.9	4.6
30. Business & Office Ed.	47	5.1	5.6	5.2	4.8	5.0	4.5	5.2
TECHNICAL (TEC)	885	3.7	3.5	4.2	5.4	4.1	6.1	3.7
10. Agribusiness/Prod. Miscl.	26	4.3	4.1	5.1	5.5	5.1	6.1	4.4
44. Food Production & Mgmt.	23	3.2	3.7	3.8	3.9	2.9	3.4	3.3
68. Carpentry	125	3.6	3.3	3.9	5.6	4.1	5.8	3.6
70. Electrician Services	20	3.8	3.5	4.0	5.0	4.4	5.9	3.8
73. Electrical Equip. Repair	24	4.2	4.6	4.5	5.3	5.3	6.7	4.8
77. Heating, A.C., & Refrig.	67	4.0	3.5	4.6	5.3	4.2	6.0	4.0
81. Aircraft Mechanics	51	5.2	4.2	4.4	5.9	5.5	7.1	5.0
82. Auto Body Repair	156	3.4	3.4	4.3	5.5	3.8	6.2	3.6
83. Auto Mechanics	191	3.6	3.4	4.3	5.4	3.9	6.4	3.6
90. Machine Tool/Shop	51	3.5	3.3	4.4	5.4	4.5	6.1	3.8
92. Welding & Soldering	62	3.3	3.2	3.5	5.2	3.5	5.8	3.4
SCIENCE (SCI)	153	4.7	4.7	4.8	5.9	5.2	6.5	4.8
64. Electronic Technology	66	5.1	4.9	4.8	6.2	5.5	7.1	5.2
87. Drafting	52	4.4	4.3	5.2	5.9	4.8	6.4	4.4
ARTS (ART)	67	4.6	4.5	4.9	4.7	4.5	4.1	4.6
88. Graphic & Printing Comm.	60	4.8	4.7	5.2	4.8	4.6	4.2	4.7
SOCIAL SERVICE (SOC)	193	4.5	4.5	5.0	4.6	4.2	4.0	4.4
56. Practical Nursing	36	5.8	5.6	6.1	5.6	5.3	5.1	5.6
57. Nursing Related Services	64	4.3	4.2	4.8	4.1	3.8	3.8	4.2
59. Allied Health, Other	43	4.7	4.7	4.7	4.6	4.6	4.0	4.6
62. Cosmetology	33	3.8	3.6	4.5	4.2	3.3	3.3	3.6
TOTAL SAMPLE	2,063	4.1	4.0	4.5	5.1	4.2	5.3	4.1

Note. Stanines range from 1-9. The mean is 5 and standard deviation is 2 for a nationally representative sample of 12th graders. Vocational programs are grouped according to CPP Job Cluster. Project ID numbers precede program titles.

[a]Abbreviations are as follows: Reading Skills (RS), Language Usage (LU), Clerical Skills (CS), Space Relations (SR), Numerical Skills (NS), and Mechanical Reasoning (MR), G is a composite of RS, LU, and NS.

[b]Sample sizes vary slightly from scale to scale. The smallest sample size is reported. Data are not shown for vocational programs with less than 20 students.

Table F6

Job Cluster Ability Scale Mean Stanines for Students Meeting Satisfaction/Success Screens

JOB CLUSTER and Vocational Program	N[b]	Job Cluster Ability Scale[a] BC (E)	BO (C)	TEC (R)	SCI (I)	ART (A)	SOC (S)
BUSINESS CONTACT (BC)	105	5.1	5.1	4.8	4.8	4.9	4.9
31. Marketing & Distrib. Ed.	101	5.1	5.0	4.6	4.7	4.8	4.9
BUSINESS OPERATIONS (BO)	265	4.9	5.2	4.4	4.8	5.0	5.4
20. Accounting & Bookkeeping	40	5.9	6.0	4.9	5.3	5.1	5.7
24. Data Processing & Related	47	4.9	5.2	4.9	5.2	4.9	5.7
25. Secretarial & Related	51	4.6	5.3	4.4	4.6	5.1	5.4
27. Typing & General Office	64	4.6	4.8	3.8	4.2	5.1	5.3
30. Business & Office Ed.	47	4.9	5.2	4.1	5.0	4.9	5.4
TECHNICAL (TEC)	838	4.1	3.7	5.7	3.9	4.1	3.7
10. Agribusiness/Prod. Miscl.	25	4.9	4.7	5.9	4.8	4.7	4.3
44. Food Production & Mgmt.	22	3.9	3.3	3.4	3.3	4.4	4.3
68. Carpentry	123	4.0	3.4	5.5	3.6	4.3	3.6
70. Electrician Services	17	4.5	3.9	5.6	4.1	4.5	4.0
73. Electrical Equip. Repair	21	5.6	5.0	6.6	5.2	4.7	5.2
77. Heating, A.C., & Refrig.	65	4.3	4.1	5.8	4.3	4.0	4.0
81. Aircraft Mechanics	50	5.6	5.1	6.9	5.5	4.9	4.8
82. Auto Body Repair	145	3.9	3.6	5.7	3.5	4.2	3.3
83. Auto Mechanics	190	4.1	3.6	5.9	3.8	3.9	3.7
90. Machine Tool/Shop	50	3.8	4.0	5.7	4.0	3.8	3.2
92. Welding & Soldering	55	3.5	3.0	5.3	3.3	3.9	3.3
SCIENCE (SCI)	152	5.0	4.9	6.3	5.4	5.2	4.5
64. Electronic Technology	66	5.3	5.4	6.8	5.8	5.1	4.8
87. Drafting	51	4.6	4.7	6.1	5.0	5.4	4.1
ARTS (ART)	65	4.3	4.5	4.3	4.5	5.3	4.7
88. Graphic & Printing Comm.	58	4.4	4.7	4.4	4.6	5.4	4.9
SOCIAL SERVICE (SOC)	187	4.2	4.5	4.2	4.5	4.7	5.1
56. Practical Nursing	36	5.0	5.8	5.6	5.8	4.9	5.7
57. Nursing Related Services	61	3.7	4.0	3.6	4.2	4.5	4.7
59. Allied Health, Other	42	4.4	4.4	4.2	4.8	4.6	5.6
62. Cosmetology	32	4.2	4.0	3.6	3.5	5.0	4.4
TOTAL SAMPLE	1,972	4.3	4.1	5.1	4.2	4.4	4.3

Note. Stanines range from 1-9. The mean is 5 and standard deviation is 2 for a nationally representative sample of 12th graders. Vocational programs are grouped according to CPP Job Cluster. Project ID numbers precede program titles.

[a]Related Holland types are shown in parentheses.

[b]Sample sizes vary slightly from scale to scale. The smallest sample size is reported. Data are not shown for vocational programs with less than 20 students.

APPENDIX G

Supplementary Figures

Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens

Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens

Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens

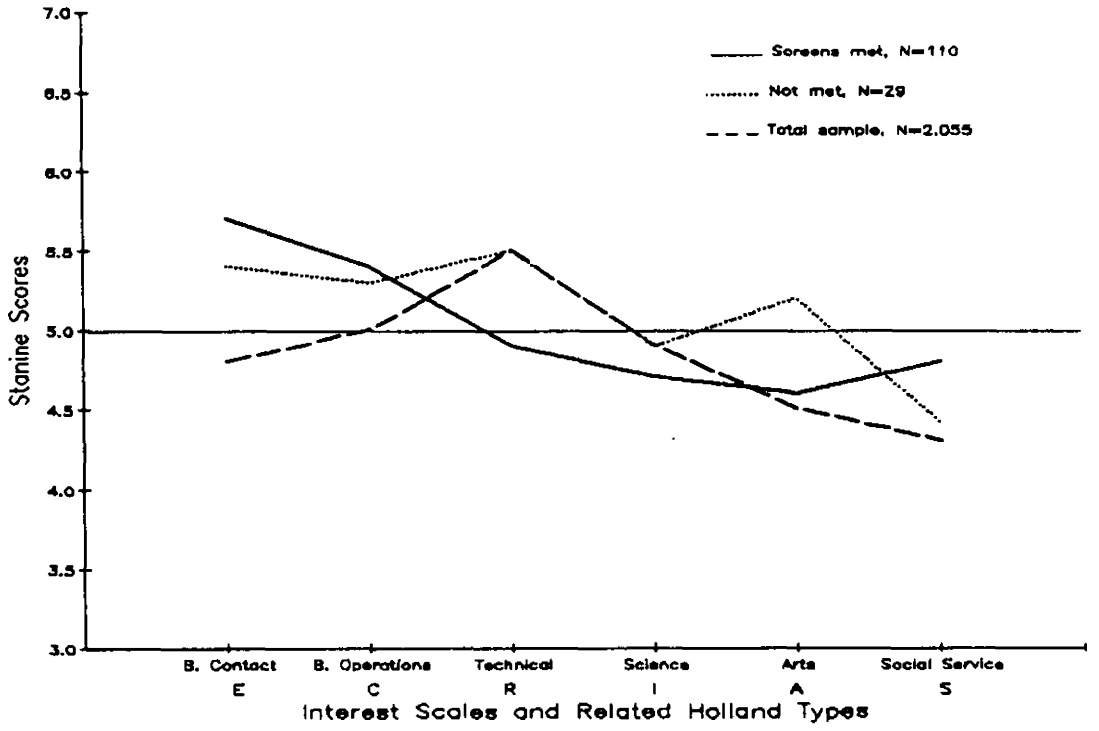


Figure G1. Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Business Contact Job Cluster.

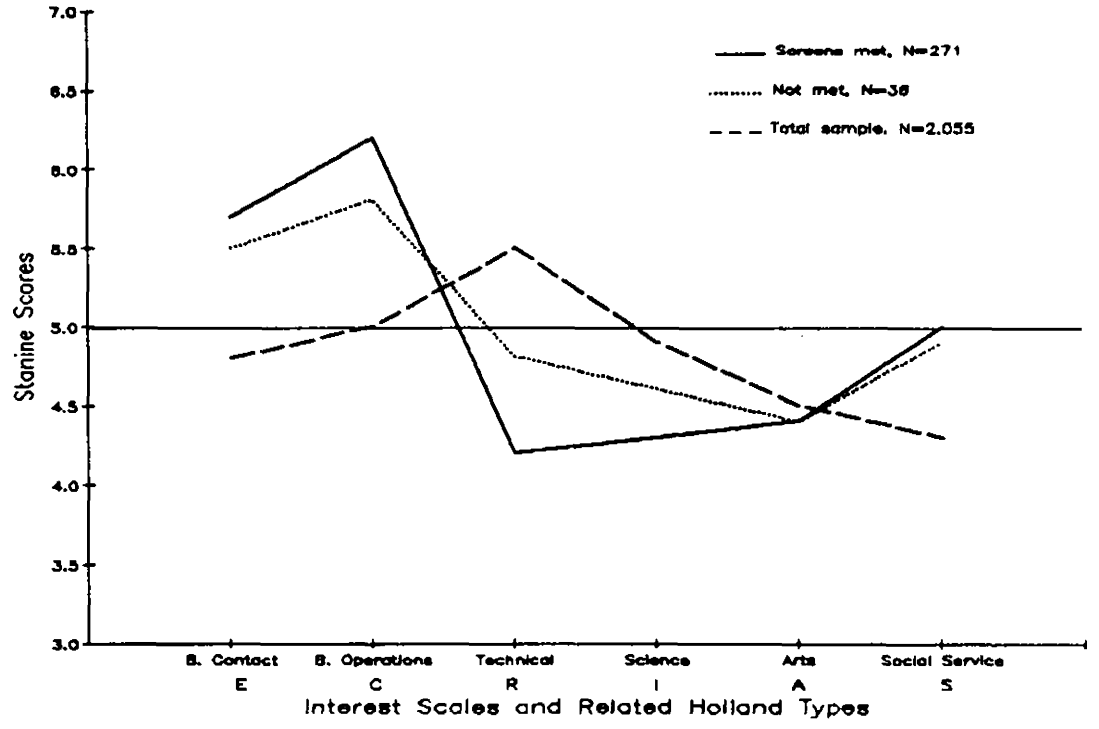


Figure G2. Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Business Operations Job Cluster.

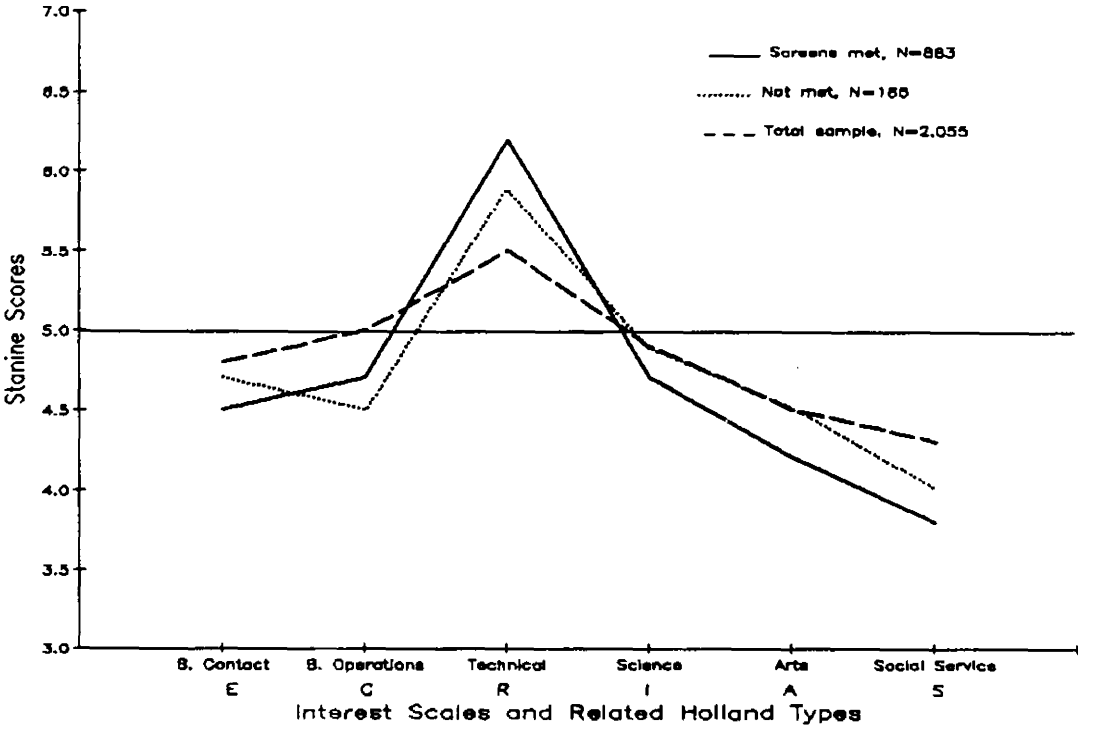


Figure G3. Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Technical Job Cluster.

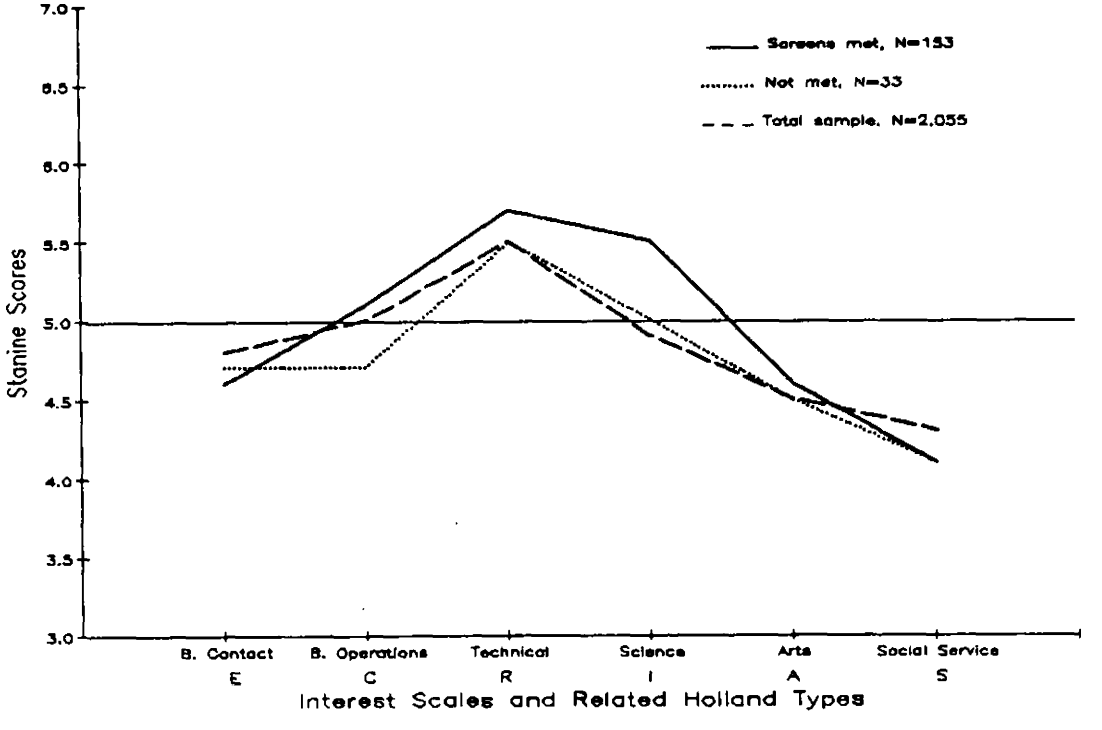


Figure G4. Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Science Job Cluster.

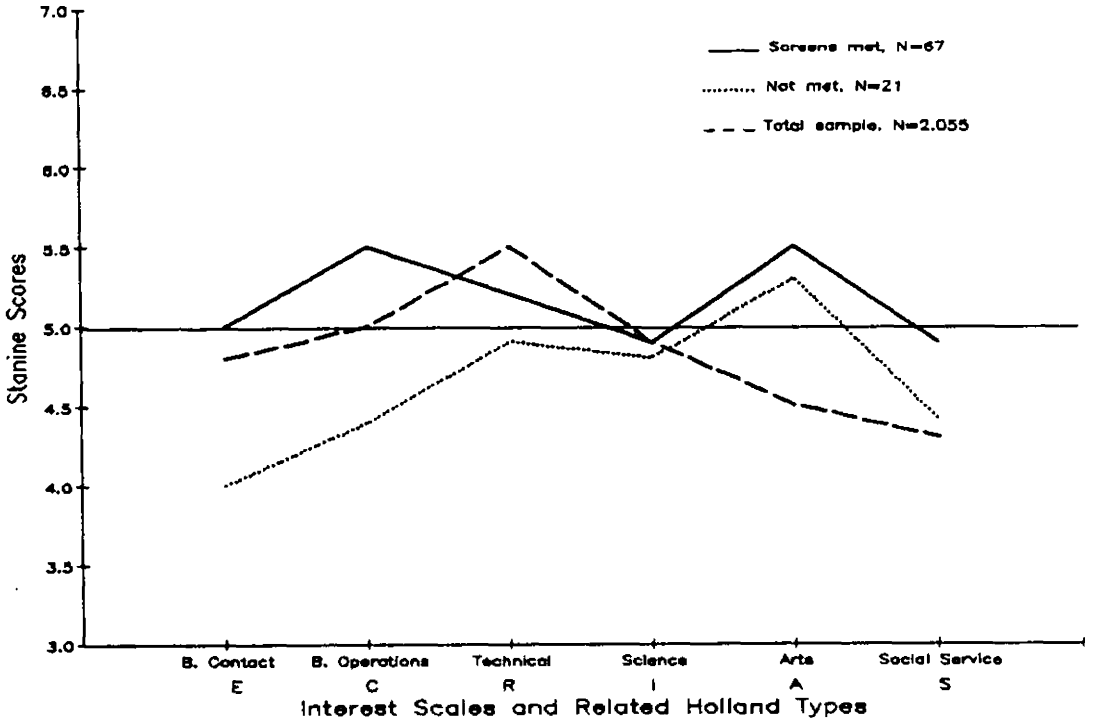


Figure G5. Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Arts Job Cluster.

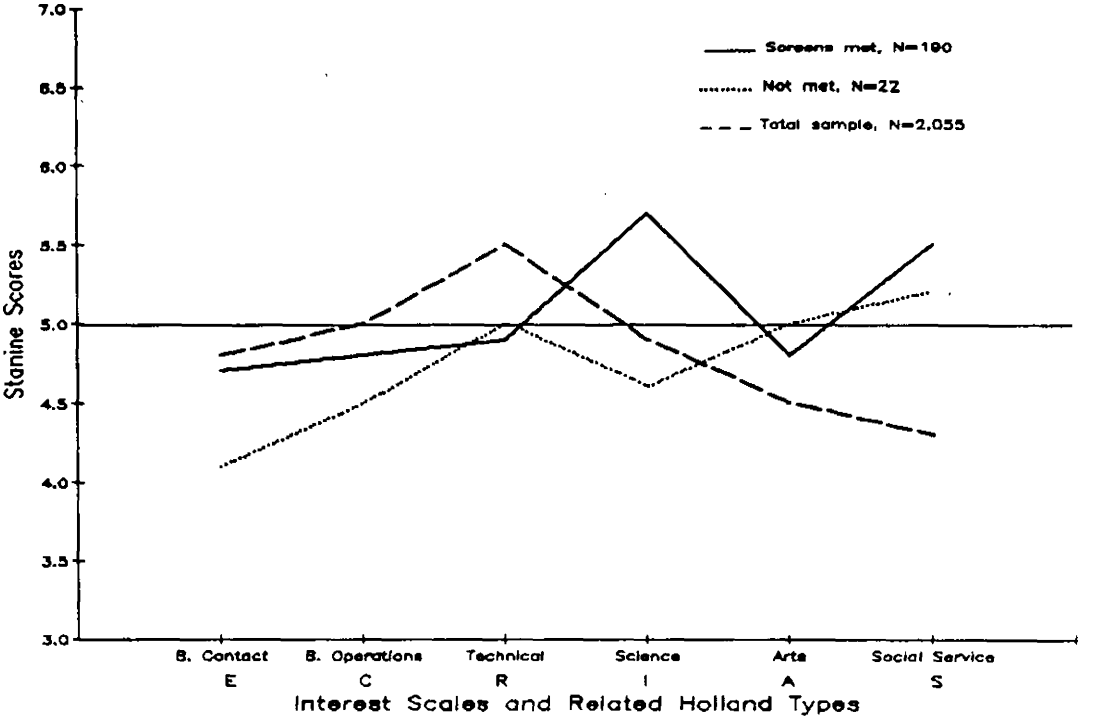


Figure G6. Interest Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Social Service Job Cluster.

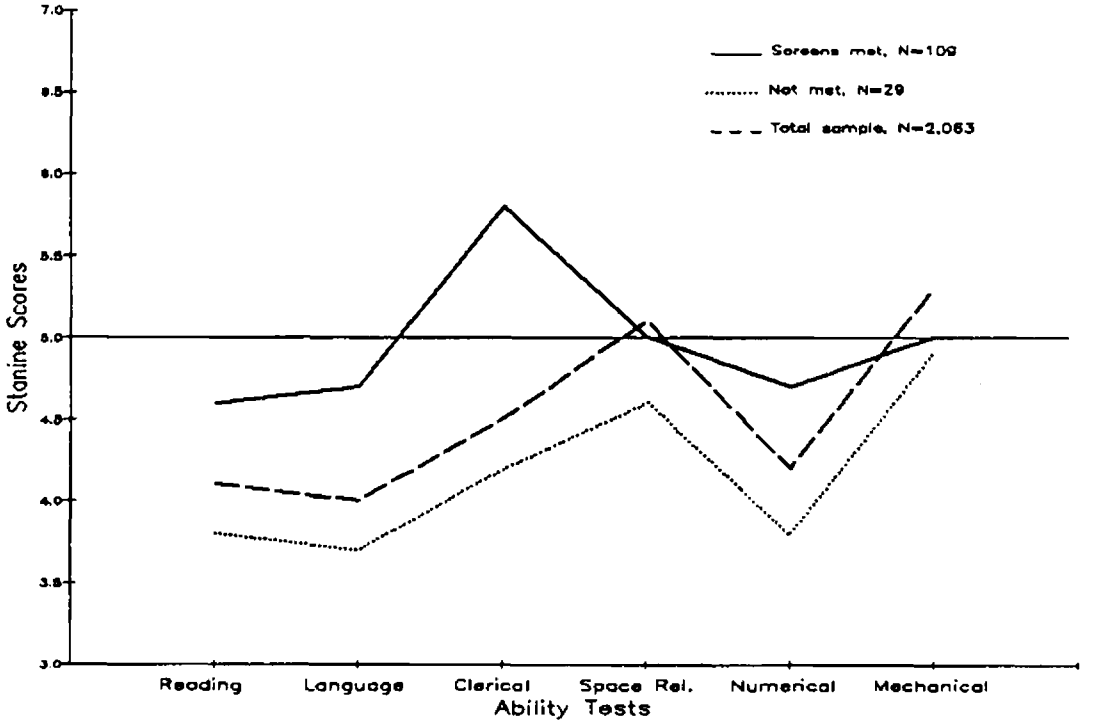


Figure G7. Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Business Contact Job Cluster.

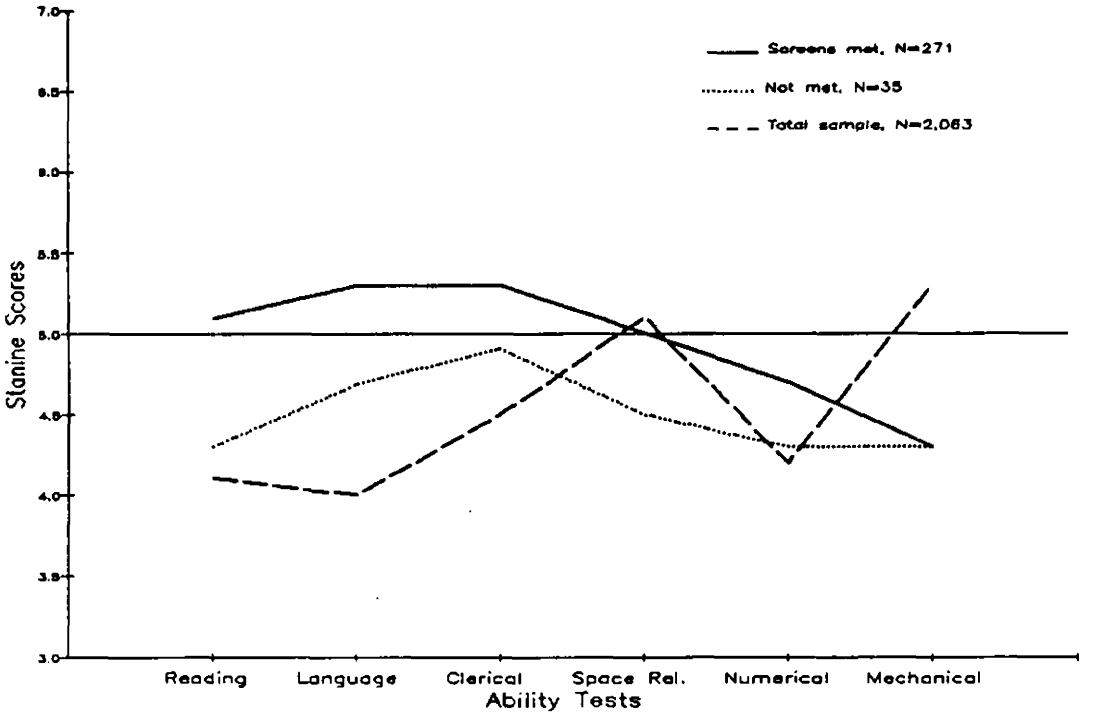


Figure G8. Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Business Operations Job Cluster.

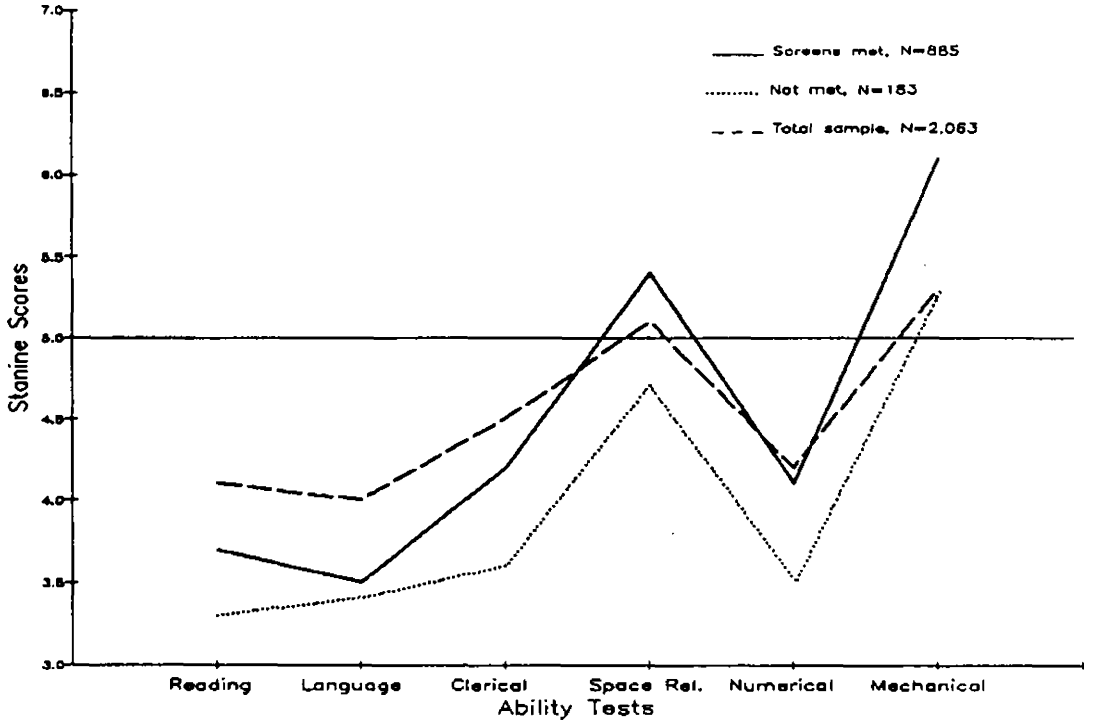


Figure G9. Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Technical Job Cluster.

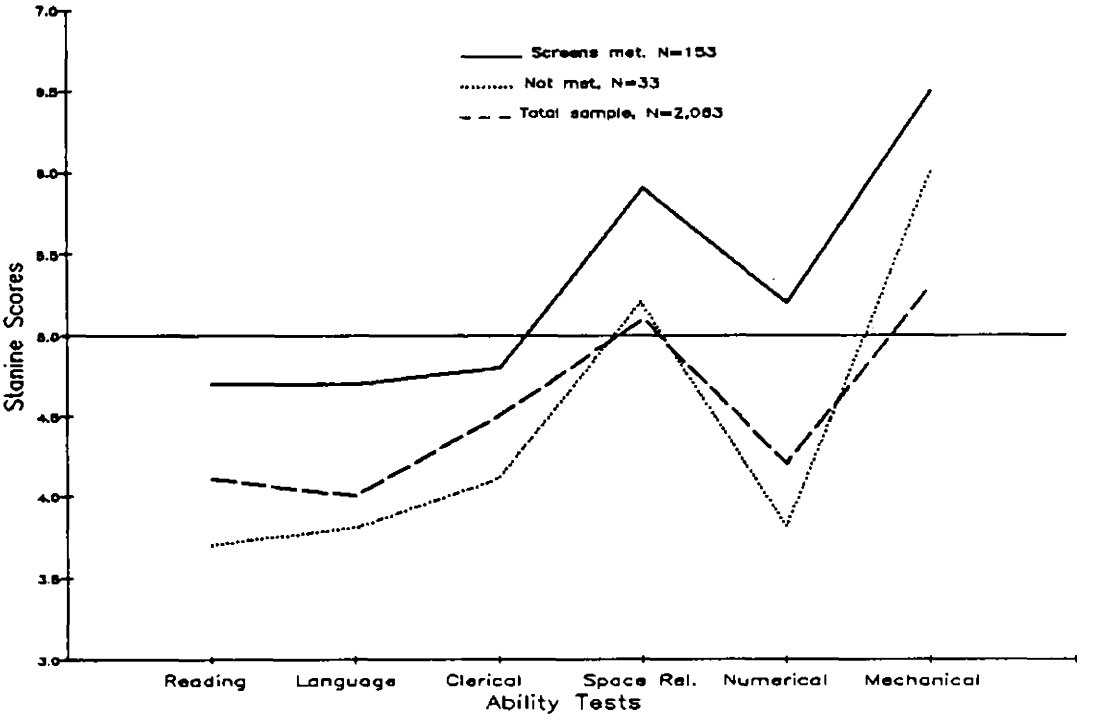


Figure G10. Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Science Job Cluster.

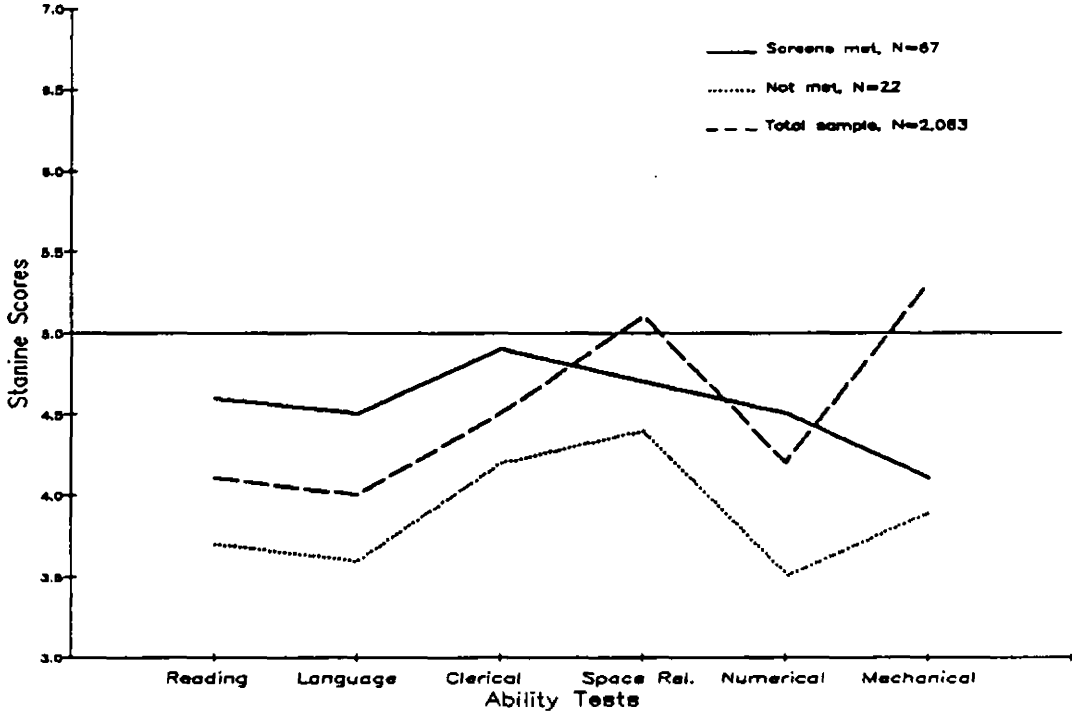


Figure G11. Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Arts Job Cluster.

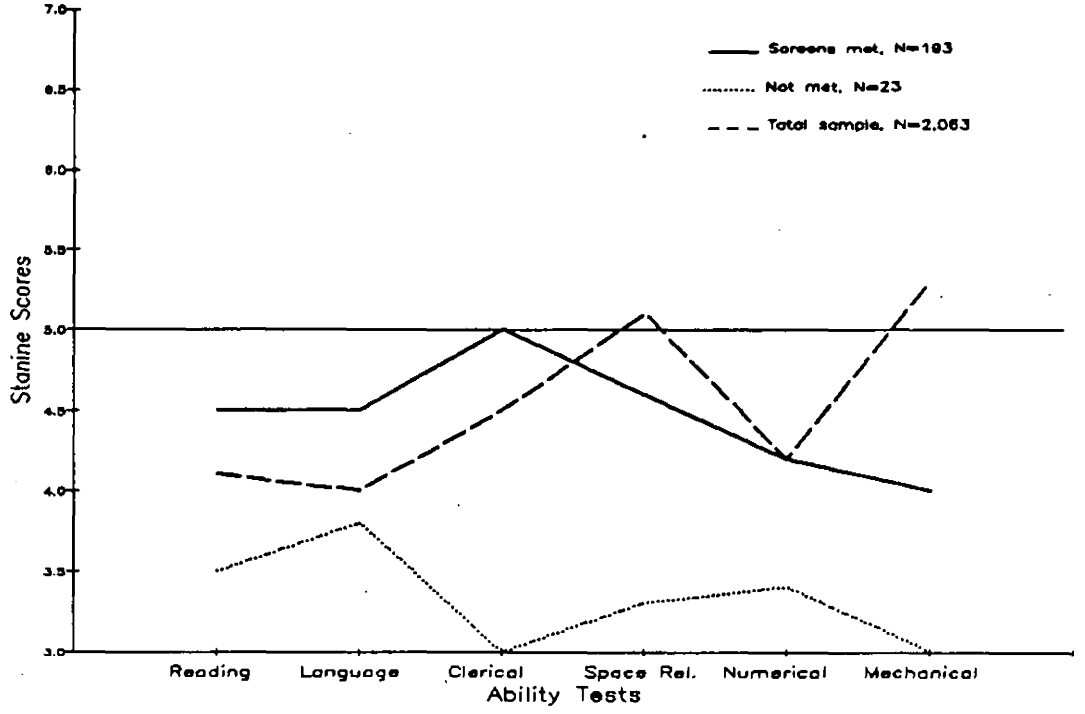


Figure G12. Ability Test Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Social Service Job Cluster.

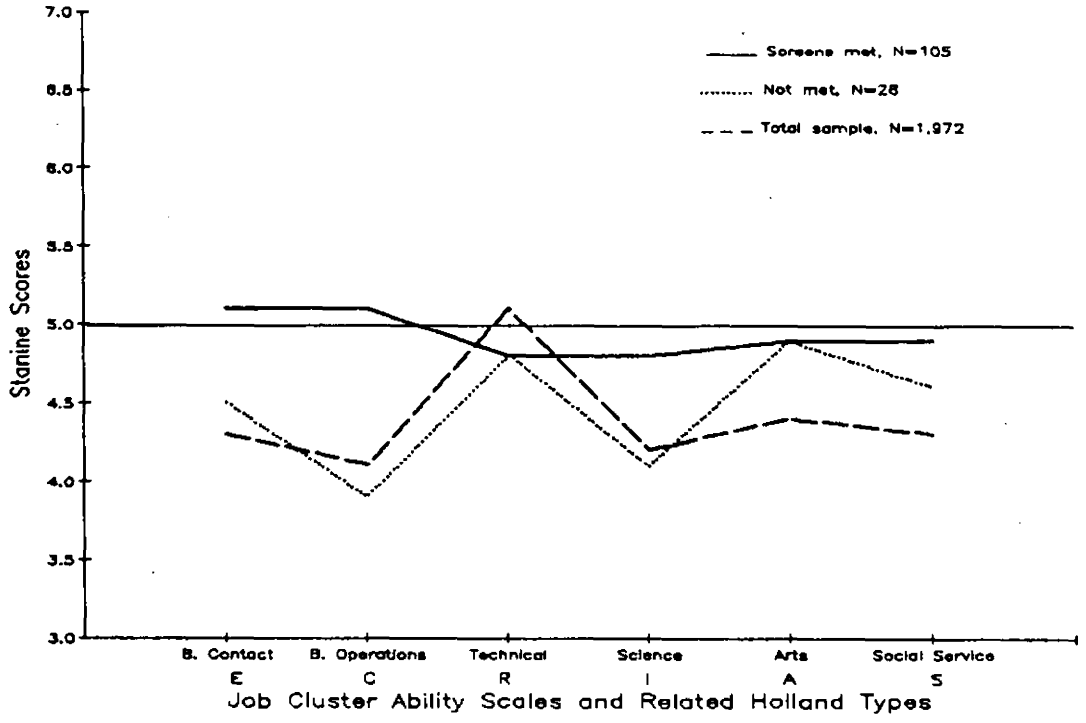


Figure G13. Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Business Contact Job Cluster.

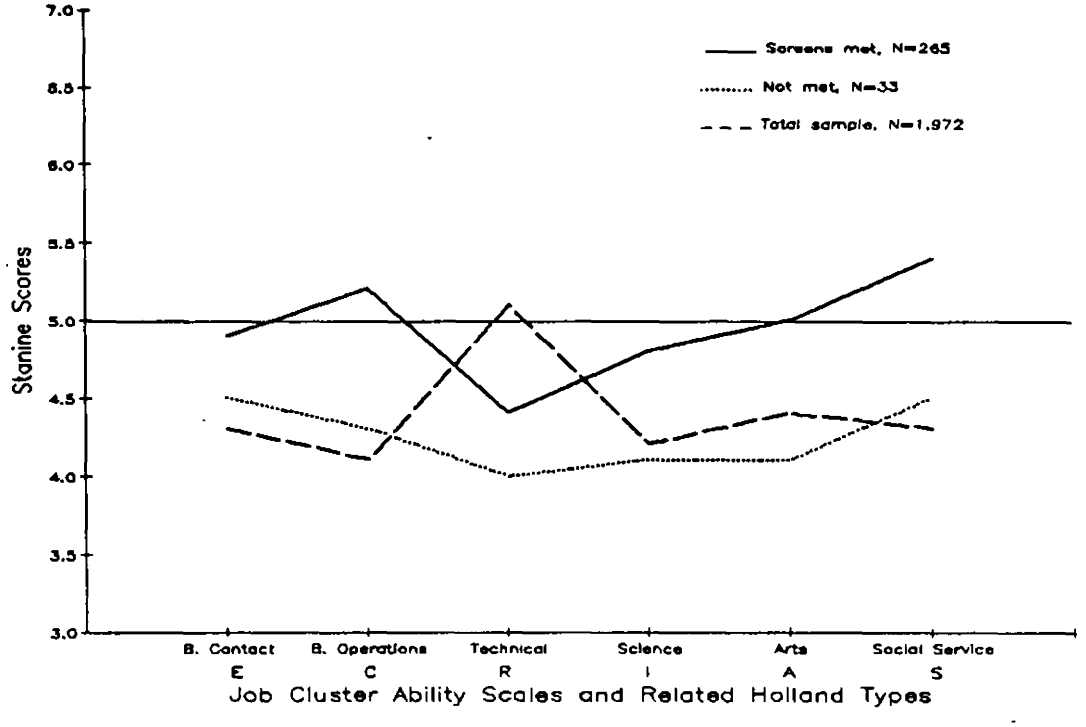


Figure G14. Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Business Operations Job Cluster.

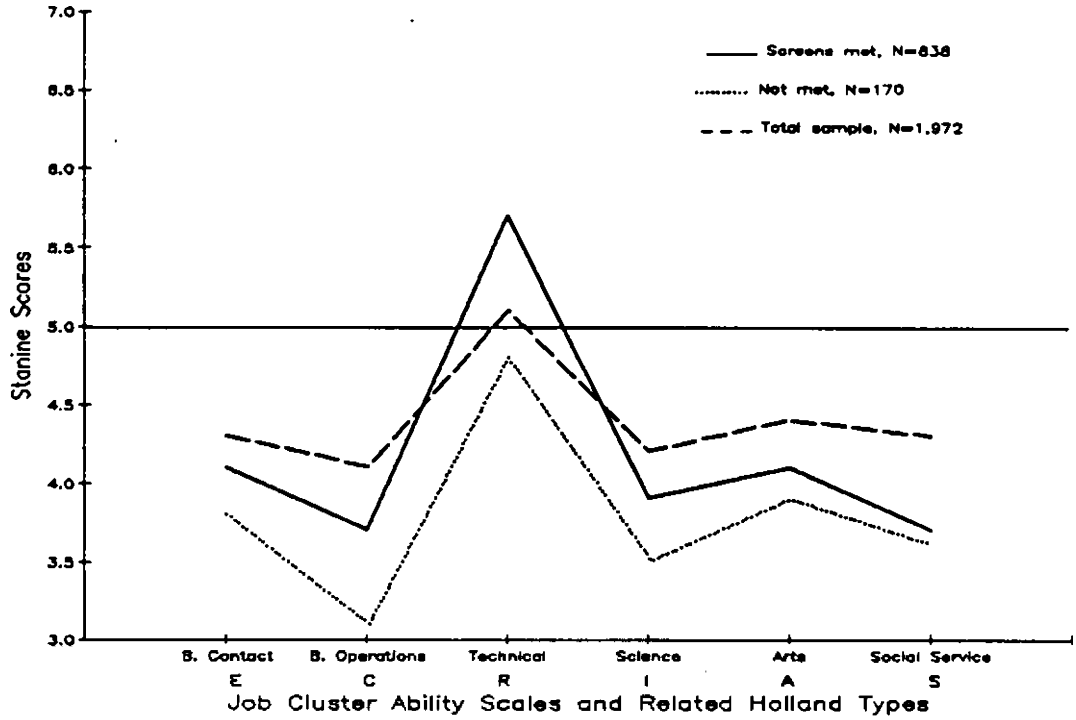


Figure G15. Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Technical Job Cluster.

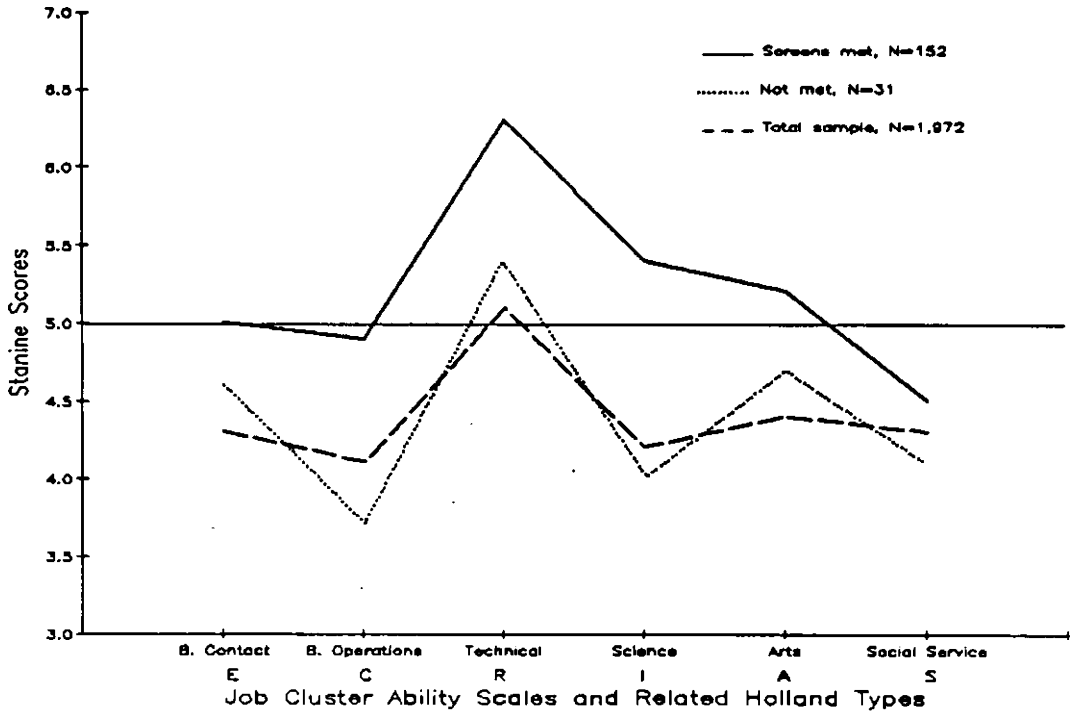


Figure G16. Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Science Job Cluster.

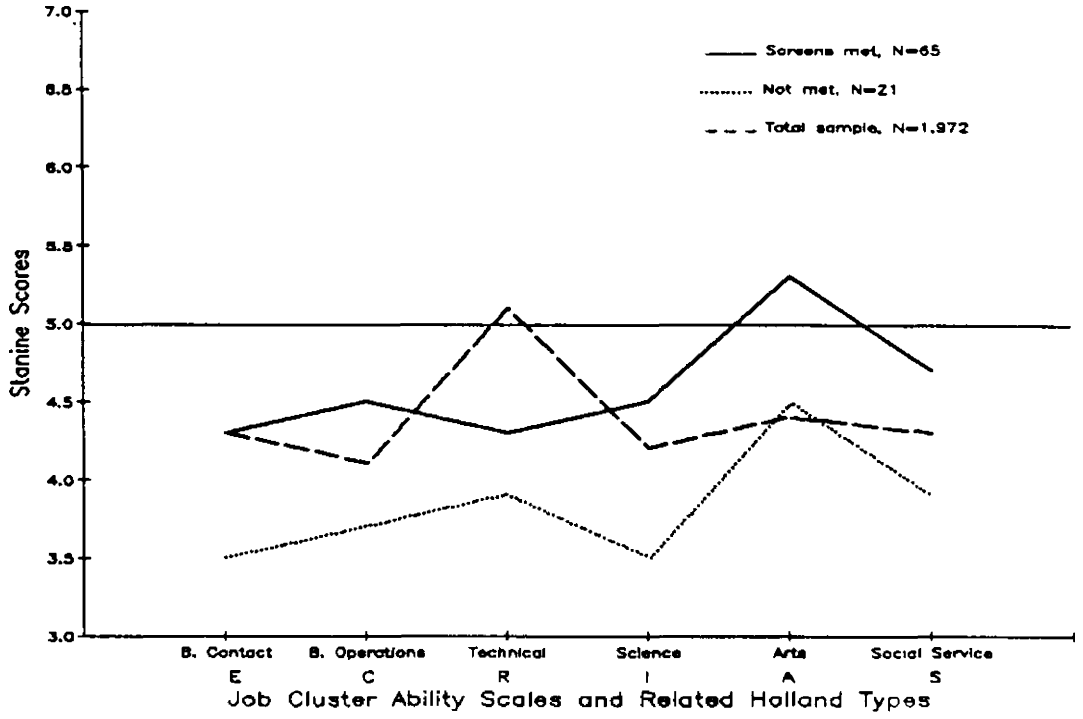


Figure G17. Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Arts Job Cluster.

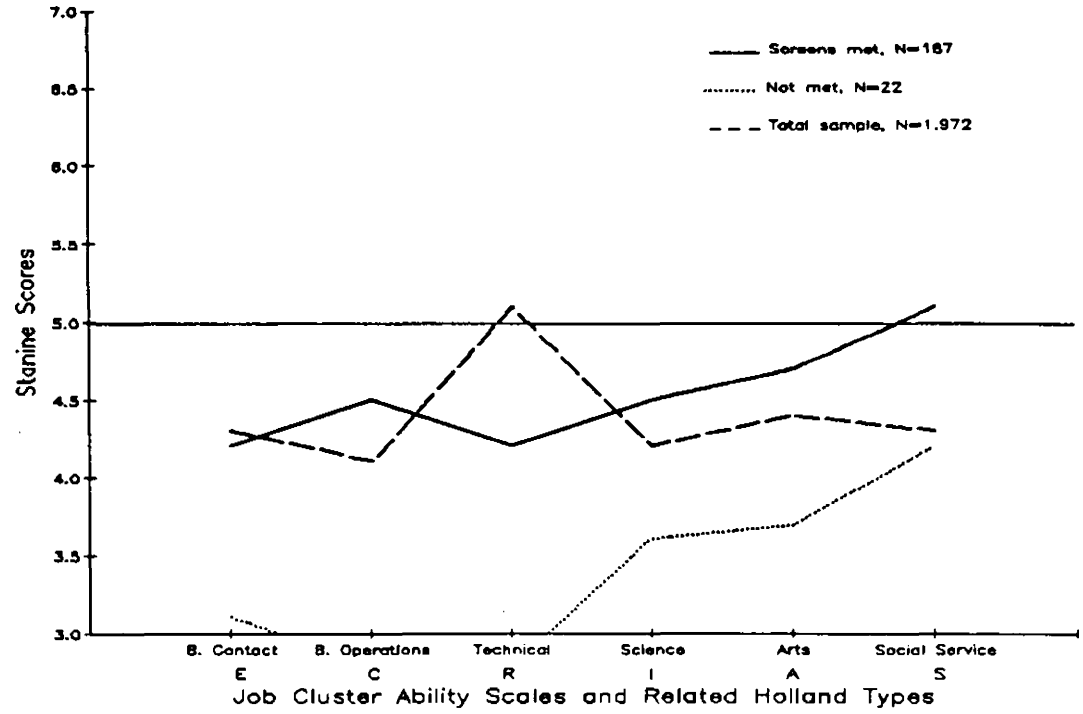


Figure G18. Job Cluster Ability Scale Profiles for Students Meeting and Not Meeting Satisfaction/Success Screens: Social Service Job Cluster.