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ABSTRACT

This study was designed to determine the accuracy with which high school students estimate their cognitive abilities as measured by the Armed Services Vocational Aptitude Battery (ASVAB). In addition, the study was designed to determine whether participation in vocational counseling activities through the ASVAB program or through Florida CHOICES/View is related to scores on a measure of career development. Subjects were 1,105 10th-, 11th-, and 12th-graders from 10 high schools in Florida. They were participants in a larger study involving 9,000 students. Major instruments used included the ASVAB and the Career Development Inventory (CDI). The CDI contains a slightly revised 52-item version of the Career Exploration Survey and other items dealing with students' career intentions and activities. The CDI was administered in the fall of 1986 and in the late spring of 1987. The ASVAB was administered between the two CDI administrations. Results indicate that: (1) students are not good estimators of their abilities; (2) males and females have different estimation patterns, with females showing more variability in inaccurate estimation; (3) accuracy of estimation is not related to ability level; and (4) underestimation of ability could impede proper career development choices. Twenty-three data tables are included, and sample first- and second-order factor scales of the Career Exploration Inventory (CEI) are appended. (TJH)

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EVALUATION OF THE ASVAB CAREER DEVELOPMENT PROGRAM

FLORIDA DEPARTMENT OF EDUCATION

JUNE, 1988

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FINAL REPORT

EVALUATION OF THE ASVAB CAREER DEVELOPMENT PROGRAM

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THE FLORIDA STATE DEPARTMENT OF EDUCATION

JUNE 1988

Executive Summary

Self Estimates of Cognitive Aptitudes
Their Accuracy and Implications for Career Counseling

Purpose: The two purposes of this study were (1) to determine the accuracy with which high school students estimate their cognitive abilities as measured by the Armed Services Vocational Aptitude Battery (ASVAB) and (2) to determine whether participation in vocational counseling activities through the ASVAB program or through Florida CHOICES/View is related to scores on a measure of career development.

Rationale: A recent meta-analysis of the accuracy of self estimates of ability (Mabe and West, 1982) summarized 55 studies which included, among other subjects, elementary, high school, and college students and concluded that the average correlation between estimated and measured abilities was .29. The Florida State Career Information Delivery System (CHOICES) requires students to furnish or estimate their cognitive aptitudes before assisting them in the exploration of various career options. If students supply inaccurate estimates of their aptitudes, the careers presented by CHOICES to them for consideration may not be the most appropriate ones.

Data Source: Subjects for this study were 1105 tenth, eleventh, and twelfth grade students from ten high schools in Florida. They were participants in a larger study which originally involved over 9000 students.

Methodology: The major instruments used in this study were the Armed Services Vocational Aptitude Battery (ASVAB) and an instrument entitled the Career Development Inventory (CDI). The latter instrument contained a slightly revised 52 item version of the Career Exploration Survey developed and validated by Stumpf, Colarelli, and Hartman (1983) and other items dealing with students' career intentions and activities. Of greatest relevance for this paper were items that asked whether students had used CHOICES or Florida View and had participated in various ASVAB counseling activities and that asked them to estimate their levels on seven abilities that are measured by the ASVAB. The stimulus materials and items that require estimation are shown below:

> Questions 10-16 contain seven specific areas of aptitude. These aptitudes are indications of a person's ability to learn different skills. For each of these aptitudes, mark your answer sheet to show your estimate of your aptitude compared to your classmates. For each of these seven aptitude areas, give yourself a rating from 1 to 5 on the statements below, using the following responses:
>
> (A) Top 10 percent (High)
> (B) Top 1/3 (Above average)
> (C) Middle 1/3 (Average)
> (D) Lower 1/3 (Below average)
> (E) Bottom 10 percent (Low)
>
> 10. ACADEMIC APTITUDE (My potential for further formal education).
>
> 11. VERBAL APTITUDE (My potential for verbal activities at grade level).

12. MATHEMATICAL APTITUDE (My potential for mathematical activities at grade level).

13. MECHANICAL AND CRAFTS APTITUDE (My potential for performance in the following sample occupational groupings: Machinist, Auto Mechanic, Sheet Metal Worker).

14. BUSINESS AND CLERICAL APTITUDE (My potential for performance in the following sample occupational groupings: Clerk Typist, Personnel Clerk, Transportation Agent, Data Entry Operator, Paralegal Assistant).

15. ELECTRONICS AND ELECTRICAL APTITUDE (My potential for performance in the following sample occupational groupings: TV and Radio Repair, Instrument Mechanic, Auto Electrician, Automatic Equipment Technician).

16. HEALTH, SOCIAL AND TECHNOLOGY APTITUDE (My potential for performance in the following sample occupational groupings: Medical Service Technician, Dental Assistant, Cook, Police Officer).

The CDI was administered by high school personnel in the fall of 1986 and in the late spring of 1987. The ASVAB was administered by U.S. Department of Defense (DOD) personnel between the two CDI administrators. ASVAB counseling activities were conducted by representatives of DOD and by high school counselors and occupational specialists. The specific activities were as follows: (1) district level workshops for counselors conducted by DOD, (2) distribution to students by DOD of a booklet entitled Your Career Starts Here, (3) orientation of students to the ASVAB by school personnel, (4) a video tape on interpreting the ASVAB in a follow up session for students conducted by DOD, (5) distribution of the Military Career Guide to students and group instruction on how to use it by DOD, and (6) individual follow up sessions with high school counselors/occupational specialists to assist students interpreting their ASVAB profiles.

Students' grade percentile scores on the ASVAB were combined into the five ability categories listed above and cross tabulated with both fall and spring self-estimates of ASVAB composite abilities. Contingency coefficients of agreement between measured and estimated abilities were computed. Analysis of covariance was used to assess the effects of participation in CHOICES/View, participation in one or more of the ASVAB activities, and grade level on total scores of the spring 52 item CDI. The fall CDI score was used as the covariate. The revised Career Development Inventory (CDI) items were factor analyzed in an attempt to identify dimensions similar to those in Stumpf's Career Exploration Survey (CES).

Conclusions and Educational Implications: The conclusions that can be drawn from this study are tentative because of the demonstrated ASVAB mean score differences between the students for whom all data were presented and those for whom they were not. However, it is believed that the conclusions concerning whether participating in the ASVAB program leads to a more realistic or valid view of abilities and aptitude after the program than before are generally correct: (1) As a group, students are not good estimators of their abilities. Males and females have different estimation patterns with females showing more variability in inaccurate estimation, i.e., more overestimation in verbal ability, an area in which females are typically supposed to be stronger than males and more underestimation in mechanical and electronics abilities, presumably useful in

occupational areas which are traditionally not entered by females. Self-estimations of abilities are only slightly more realistic/valid after taking the ASVAB than before. (2) While the stability of self-estimates of abilities is low, improving their reliability would probably not make them highly accurate. (3) Accuracy of estimation is not related to ability level. The negative correlations observed between discrepancy scores and independent ability estimates are probably artifactual. (4) Underestimation of abilities could lead students not to consider occupations in which they could probably succeed. Overestimation could result in a confusing array of occupations for students to consider, many of which might require ability levels not possessed by the student.

The assumption that lower ability students are less likely to volunteer to take the ASVAB appears to have been verified. These students are probably the ones most likely to be in need of counseling, to drop out before completing high school, and to be unemployed after leaving school (Rumberger, 1987; McDill, Natriello, and Pallas, 1985). It seems possible that encouraging or requiring them to undergo some combination of ASVAB testing and interpretation and counseling with CHOICES could result in their staying in school longer and/or result in a reduction of the high unemployment of students after they drop out. Minority students appear to be underrepresented in the final sample of 1081 students. Whether they tend to avoid the ASVAB program more than white students is an important question for further study.

Participation in ASVAB counseling activities produces small incremental changes in career development and awareness in students at three secondary-school grade levels. This effect might be greater when the ASVAB Workbook is available for use in counseling sessions. Analysis of the factor scores showed that only the second one, General Career Exploration (GCE), appeared to be influenced by participation in the ASVAB counseling program, Specific Career Exploration (SCE) was related only to grade level, and Satisfaction with Career Plans (SCP) was not related to either participation or grade level. This pattern of results strengthens the causal interpretation made for GCE since the ASVAB program would probably be less useful to students who were already exploring specific careers or who had made career decisions. Participation in the ASVAB program also appeared to increase accuracy in four of the ability estimates. This is an important finding if the causal interpretation is correct since Westbrook et al. (1988) indicated that self-knowledge is an important characteristic of career maturity.

As indicated above, all of the causal interpretations made in this study must be regarded as tentative. Future research on the effectiveness of the ASVAB program should be experimental in nature and the full program including use of the ASVAB Workbook should be carefully implemented. Such research could probably best be done in formal career guidance classes that are randomly assigned to various treatment conditions, i. e., various combinations of use of CHOICES and ASVAB programs.

INTRODUCTION

It is well recognized that an unacceptable number of students in the nation's high schools do not have specific, realistic post-secondary education/career plans and that many leave school without having made such plans. Increased awareness of the problems that arise for these students in terms of their financial independence and the quality of their lives has led to exploration of ways in which student access to both information and counseling related to decisions about post-secondary education and career choices might be improved.

This situation is considered to be a major problem by professionals at all levels of the Florida state educational system, and efforts have been made to remedy some of its aspects through programs such as Florida CHOICES, a computer delivery system that provides information about careers, schools and educational programs, and financial aid for post-secondary education. However, CHOICES requires students to furnish or estimate their cognitive aptitudes before assisting them in the exploration of various career options. If students supply inaccurate estimates of their aptitudes, the careers presented to them by CHOICES for consideration may not be the most appropriate ones. At present, there is no state-adopted career development instrument (aptitude test) for use in such programs, and few students ever take the General Aptitude Test Battery (GATB), the test to which CHOICES has been referenced.

This document is the final report to the State of Florida Department of Education on the activities and outcomes of a project undertaken to assist in the evaluation of the effectiveness of the Armed Services Vocational Aptitude Battery (ASVAB) as an instrument for providing information to Florida students and their counselors for use in making realistic plans for post-secondary education/employment. The ASVAB is appropriate for this purpose because it offers a comprehensive career exploration program and because the three most important ASVAB aptitude measures have now been referenced to CHOICES.

Beginning in October, 1987, students who have ASVAB Academic, Verbal, and Mathematical scores will be able to substitute them for GATB General Ability, Verbal, and Numerical scores (Wright,1986). Students will not be required to estimate their perceptual and psychomotor aptitudes as measured by the GATB. It is estimated that fewer than 30% of the occupations in CHOICES require above-average perceptual and/or psychomotor abilities (Wright,1986). Consequently, use of the three ASVAB measured abilities instead of estimates of the corresponding GATB abilities should result in improved matching of occupations with students even though measured scores for additional GATB abilities would not be available. In addition, students with high ASVAB measured abilities in Mechanical and Crafts, Business and Clerical, Electronics and Electrical, and Health, Social, and Technology will be able to identify possible occupations through the ASVAB counseling process and possibly to study them in more depth through CHOICES.

The CHOICES system delivers career information of several kinds. Access to career information is gained through use of any one or more of four routes, EXPLORE (lists occupations that meet user specified criteria), SPECIFIC (lists all information about a user specified occupation), COMPARE (lists simultaneously information about two or three user specified occupations), RELATED (lists jobs related to user specified topics). When any of these are used, occupations may be examined in terms of thirteen topics: Interests, Aptitudes, Temperaments, Education Level, Working Conditions, Future Outlook, Earnings, Hours of Work/Travel, Physical Demands, Physical Activities, Indoor/Outdoor, Career Fields, and Training Required.

A recent meta-analysis of the accuracy of self-estimates of ability (Mabe and West, 1982) summarized 55 studies which included, among other subjects, elementary, high school, and college students and concluded that the average correlation between estimated and measured abilities was 0.29. When this correlation was adjusted for sampling error and unreliability in the criterion, it became 0.36. Corrections for sampling error and unreliability in both predictor and criterion produced an estimate of 0.42. Average correlations (adjusted for sample size) between self-estimates and scholastic, clerical, mechanical, skilled technical, and intelligence criteria were 0.38, 0.45, 0.20, 0.31, and 0.34 respectively. The study reported that general support was found in the literature for associations between accuracy of self-evaluation and intelligence, achievement, and internal locus of control. It was also found that accuracy of self-estimates was associated with the following four conditions: "(a) expectation of self-evaluation validation, (b) self-evaluation instructions using social comparison terminology, (c) self-evaluation experience, and (d) instructions of anonymity."

More recently Westbrook, Sanford, Gilleland, Fleenor, and Merwin (1988) investigated the accuracy with which ninth grade students estimated their percentile scores on the Differential Aptitude Tests (DAT). They provided students with an explanation of what the DAT measures and a sample item for each of the nine tests. An explanation was also given of what percentiles are and how they are interpreted. Students were then given a blank DAT profile and asked to estimate their percentile scores to show how well they had done on each test (given approximately eight months earlier) in comparison with all other ninth graders in their county. Students were considered to be accurate estimators if their estimates fell within one standard error of measurement of their obtained scores. An Accuracy of Appraisal Hit score was computed for each score for each student. The score was 1 if the estimate was within one standard error of estimate of the obtained score and zero otherwise. The range of total Hit scores that could be obtained was 0 to 9. No significant differences in total Hit scores were found for males vs. females or white students vs. black students. Westbrook et al. (1988) also computed correlations between DAT obtained and estimated raw score equivalents to percentile scores and computed t-tests of differences between each pair of estimated and obtained scores. They found correlations that ranged from 0.23 to 0.64 and they found mean estimated scores to be significantly higher than mean obtained scores for every test. In addition, they computed the percentage of Hit scores for each test and found that they ranged from 0.30 to 0.52. Even though the correlations reported by Westbrook et al. (1988) tended to be higher than those reported in the meta-analysis by Mabe and West (1982), the two studies are in agreement that people in general and students in particular are not accurate estimators of their abilities.

RESEARCH QUESTIONS

The major research questions of concern in this project were as follows:

1. Do students in high schools that require their participation in the ASVAB program have a more realistic/valid view of their aptitudes as measured by the ASVAB after the program than before?

2. Do students in high schools that require their participation in the ASVAB program demonstrate a greater degree of career development and more accurate estimates of their abilities than students from high schools that have not adopted the ASVAB program?

3. Do high schools that require ASVAB testing and appropriate interpretation of its results have a smaller proportion of 1987 seniors who are uncertain of post-high school plans than schools in which these activities are not mandatory?

In addition to the major questions stated above, the answers to several additional questions were explored:

4. Do students who have used one or more of the options of CHOICES and also undergone ASVAB testing have greater degrees of career awareness and development than students who have experienced only CHOICES?

5. Do students who have participated in both the ASVAB program and CHOICES have greater degrees of career awareness and development than students who have participated in only the ASVAB program?

6. Do students who have participated in some combination of the ASVAB program and CHOICES or any one of them alone have a greater degree of career awareness and development than students who have participated in neither of them?

7. Does the overall ASVAB level of students modify the answers to any of the above questions? For example, is the relationship between participating in one or more of the programs and degree of career awareness and development the same for students of high ability and those of lower ability?

METHOD

Sample

From a pool of 22 districts who volunteered to participate, seven districts were selected to be included in the sample. Two high schools from each of six districts and one high school from each of two other districts were chosen. Each of the two-school districts provided a treatment and a control school; one single-school district contained a treatment school while the other had a control school. Treatment and control schools were selected to be as much alike as possible. For instance, these schools had similar percentages of students on free and reduced lunch programs, information that was used as a barometer of one aspect of socioeconomic status. Control schools administered the ASVAB on a voluntary basis to 10th, 11th, and 12th grade students; treatment schools required all students at these same grade levels to take the ASVAB. Counseling of students based on their own test results was provided for both kinds of high schools. A self-report pre- and post-measure of career awareness and development, the Career Exploration Inventory (CEI) was administered to all students in the participating high schools. Table 1 shows the numbers of students in each treatment and control school who took each test. It can be seen that many students did not take the post-CEI. The test was given late in the school year and in many schools the administration of the measure conflicted with other school activities.

Instruments

Instruments used in the study were the Armed Services Vocational Aptitude Battery (ASVAB) and the Career Exploration Inventory (CEI).

The ASVAB is an aptitude test published by the U.S. Department of Defense (DOD) that yields seven scores to be used in vocational counseling. It is accompanied by the Military Career Guide and the ASVAB Workbook (not available for this study) that are used

by students in making both military and non-military career decisions. DOD personnel administer the tests, provide scoring services, and conduct counselor workshops in interpretation of test scores and use of the associated materials with students.

Table 1

Number of Treatment and Control Students Who Took
The Pre-Post CEI and the ASVAB

School	CEI Pre	CEI Post	ASVAB
Treatment-1	454	248	533
Control-1	550	36	121
Treatment-2	549	444	527
Control-2	751	622	236
Treatment-3	388	340	344
Control-3	591	539	237
Treatment-4	1005	312	846
Control-4	375	427	68
Treatment-5*	1639	347	549
Control-5*	—	546	143
Treatment-6	681	—	325
Control-6	804	—	419
Treatment-7	419	—	142
Control-7	364	255	347

*The pretests for schools in district 5 were processed as one unit and are shown as such in the Treatment-5 row. Posttests were processed separately as treatment and control groups. Matched posttest records are shown appropriately above.

The Career Exploration Inventory (CEI) comprised three distinct parts, the results of which were used both separately and in combinations for the analyses reported here. The first part was an adaptation of the Career Exploration Survey (Stumpf, Colarelli, and Hartman, 1983), identified in this study as the Revised Career Exploration Survey (RCES). Revisions were made by the Florida Department of Education with permission of the authors. The second part was made up of student self-estimates of their levels of performance on the seven ASVAB aptitude measures. The last part included questions concerned with student background and career development. Additional items added for the spring administration asked questions directly related to current school year participation in ASVAB testing and counseling activities.

Procedures

STEP 1: DISTRICT LEVEL WORKSHOPS FOR COUNSELORS. ASVAB Test Specialists, employed by the Department of Defense, conducted a district level three hour workshop for the counselors in each participating district. Materials developed by the American Association of Counseling and Development were used for the workshops.

STEP 2: PRETEST CAREER EXPLORATION INVENTORY. The CEI was administered to treatment and control students in homerooms. Immediately following completion of the instrument, each student was given a copy of Your Career Starts Here and a brief (five-minute) orientation focusing on the purpose of the ASVAB and the benefits students receive from taking it.

STEP 3: THE ASVAB. The ASVAB was administered in homerooms, or whatever room(s) the principals of the schools designated, under the supervision of a teacher. The Department of Defense provided all testing materials and a test administrator for each session.

STEP 4: ASVAB RESULTS. ASVAB results were provided to schools within 14 days of testing. Following their return, one class period session was conducted as soon as possible thereafter to deliver results to students and conduct a group (no more than 50 students) interpretation utilizing the video tape "It's Your Future." Department of Defense Test Specialists conducted these test interpretation sessions.

STEP 5: SELF-EXPLORATION/INDIVIDUAL COUNSELING. During this phase, students had the Military Career Guide and Department of Labor publications available at the career center/library for individual exploration of careers. Counselors were available for those students requesting individual counseling.

STEP 6: POSTTEST CAREER EXPLORATION INVENTORY. The posttest CEI, modified to include five questions that evaluated the ASVAB counseling activities, was administered to students during April and May of 1987. The same procedures used for administering the pretest measures were followed.

Data Collection/Processing

DOD personnel scored the ASVAB and provided to participating schools data rosters containing an alphabetical list of students and their ASVAB scores by grades within schools. In addition, the DOD furnished a computer tape containing identifying information and ASVAB standard and percentile scores for each student to project personnel at the request of the participating schools. Machine scorable answer sheets containing students' responses to the pre- and post-CEI were electronically scanned, and computer files were prepared for them. The pre- and post-CEI files were merged and matched by student last name, birth year, and month. Records for which no match was obtained were then matched by last name and sex; and then by last name and grade if the former was unsuccessful. The matched records were then visually inspected and mismatching records were deleted. A final visual inspection was performed, and each matching pair of records was combined into one record. Records that contained more than two missing responses in either the pre- or post-CEI were deleted. The same procedure was used in matching the pre- post records with the ASVAB records. The final number of students for whom all matching records were available was 1105.

Data Analysis

The first major research question was partially answered by chi square analyses and their associated contingency coefficients that tested for agreement among estimated (pre- and post-) and actual ASVAB composite aptitude levels of students. The set of items used for student ability estimates and directions for responding to them are shown below:

> Questions 10-16 contain seven specific areas of aptitude. These aptitudes are indications of a person's ability to learn different skills. For each of these aptitudes, mark your answer sheet to show your estimate of your aptitude compared to your classmates. For each of these seven aptitude areas, give yourself a rating from 1 to 5 on the statements below, using the following responses:
>
> (A) Top 10 percent (High)
> (B) Top 1/3 (Above average)
> (C) Middle 1/3 (Average)
> (D) Lower 1/3 (Below average)
> (E) Bottom 10 percent (Low)

10. ACADEMIC APTITUDE (My potential for further formal education).

11. VERBAL APTITUDE (My potential for verbal activities at grade level).

12. MATHEMATICAL APTITUDE (My potential for mathematical activities at grade level).

13. MECHANICAL AND CRAFTS APTITUDE (My potential for performance in the following sample occupational groupings: Machinist, Auto Mechanic, Sheet Metal Worker).

14. BUSINESS AND CLERICAL APTITUDE (My potential for performance in the following sample occupational groupings: Clerk Typist, Personnel Clerk, Transportation Agent, Data Entry Operator, Paralegal Assistant).

15. ELECTRONICS AND ELECTRICAL APTITUDE (My potential for performance in the following sample occupational groupings: TV and Radio Repair, Instrument Mechanic, Auto Electrician, Automatic Equipment Technician).

16. HEALTH, SOCIAL AND TECHNOLOGY APTITUDE (My potential for performance in the following sample occupational groupings: Medical Service Technician, Dental Assistant, Cook, Police Officer).

The first four rating categories were identical to the ones provided in the CHOICES Guidebook, the fifth was added to produce additional range for the ratings. The fact that categories B and D did not contain the phrase, "Top (or Bottom) 1/3 excluding the Top (or Bottom) 10 percent," did not appear to be confusing to students since the qualifiers, "Above average" or "Below average" were also given.

Students' grade percentile scores on the ASVAB were combined into the five ability categories listed above and cross-tabulated with both fall and spring self-estimates of ASVAB composite abilities. Contingency coefficients of agreement between measured and estimated abilities were computed. In addition to studying the accuracy of students' estimates of their abilities by correlational means it was also of interest to determine

whether students tend to over- or underestimate them. Since it seemed possible that males and females might show different patterns of inaccuracy their data were analyzed separately. Also of interest was whether there were differences in over- and underestimations by members of different ethnic groups. Sex differences in accuracy were determined by computing seven discrepancy scores between estimated and measured abilities for each student and subjecting these scores to a multivariate analysis of variance. Since the multivariate tests were significant below the 0.05 level, univariate tests were performed to determine the individual abilities on which the sexes differed. No statistical analyses were made of ethnic differences in accuracy because the ethnic groups in the study differed so widely in measured ability.

The second major research question was answered through the use of the analysis of covariance with the pretest RCES serving as the covariate and posttest RCES as the dependent variable.

Stumpf et al. (1983) identified a number of dimensions (factors) in their version of the CES which were related to the career exploration process, reactions to career exploration, and beliefs regarding career exploration. Therefore, RCES items from the fall administration were factor analyzed in an attempt to identify these or similar dimensions.

The factor analysis of the RCES (reported below) yielded 12 first order and three second order oblique factors. Differences between the treatment groups on the three second order factor scores were determined with a multivariate analysis of covariance using pretest factor scores as covariates. Univariate analyses were done after the multivariate tests had been found to be statistically significant. In addition, a multivariate test of differences between treatment and control groups in accuracy of ability estimation was made and followed by univariate analyses of discrepancy scores.

A chi square test of differences between proportions (converted to frequencies) was used to determine the answer to the third major research question.

Questions 4 through 7 were answered by a multivariate 2 by 2 factorial analysis of covariance. The three posttest second order factor scores were dependent variables; the three pretest factor scores and the ASVAB Academic Ability standard score served as covariates.

RESULTS

This section consists of three main parts: In the first, ASVAB composite scores for all students who took the test (total sample) are compared with the scores of students whose records could be matched (reduced sample). In the second, evidence of the construct (factorial) validity of the RCES for high school students is given. The third section details the results of analyses that attempt to answer the research questions stated above.

ASVAB Profiles of Total and Reduced Samples.

Table 2 shows the median grade level percentiles of the seven ASVAB composite scores for both total and reduced samples, and Table 3 gives standard score means and standard deviations for the same measures and groups.

The profiles show, in general, that treatment students have lower standard score means and lower percentile medians than control students.

Because treatment and control schools were selected to be as similar as possible, the lower treatment means appear to verify the assumption made by the investigators that less able students, who may be most in need of help with career development, tend not to avail themselves of the ASVAB when it is offered on a volunteer basis.

Table 2

Median Percentiles* of the Seven ASVAB Composite Scores
For Total and Reduced Samples

	Control		Treatment	
	Total	Reduced	Total	Reduced
Academic	61.81	64.45	58.19	60.96
Verbal	56.10	61.15	54.81	55.35
Mathematics	63.81	67.00	60.18	61.17
Mechanical	58.41	61.31	54.07	55.47
Business	64.45	68.42	64.08	66.63
Electrical	61.51	67.14	58.93	61.53
Health	59.79	64.13	55.02	58.23

*Based on 11th and 12th grade norms

Table 3

Means and Standard Deviations of Standard Scores* for Seven
Composite ASVAB Variables for Total and Reduced Samples

	Control				Treatment			
	Total		Reduced		Total		Reduced	
	M	SD	M	SD	M	SD	M	SD
Academic	49.18	8.09	51.05	7.54	47.71	8.24	47.83	7.65
Verbal	47.97	8.50	49.88	7.85	46.65	8.63	46.98	8.01
Mathematics	50.79	7.97	52.64	7.90	49.53	8.17	49.70	7.51
Mechanical	47.43	7.93	48.90	7.93	45.78	7.83	46.10	7.48
Business	50.55	7.44	52.30	6.40	49.42	7.96	49.80	7.47
Electrical	49.04	7.71	50.98	7.48	47.61	7.82	47.88	7.14
Health	48.55	8.18	50.28	7.87	47.01	8.24	47.33	7.74

*Based on the Youth Population (ages 17-23)

Tables 2 and 3 also show that students in the reduced sample tend to have higher standard score means and percentile medians than students in the total sample. These results call into question the representativeness of the reduced sample. Thus, the results of the analyses which investigate the research questions may not be completely generalizable to the total sample and the population from which it was drawn.

Construct Validity of the RCES

In constructing the CES, Stumpf et al. (1983) defined 16 theoretical dimensions of career exploration. Their final instrument successfully measured 12 of these factors in both undergraduate and graduate college students. Because the instrument was revised for the purposes of this study, and because it was administered to high school rather than college students, it was necessary to determine the extent to which the factor structure of the instrument could be reproduced.

A fifteen percent random sample of pre-RCES records was drawn from each of the schools that participated in the study. Of these 1368 records, 1195 were sufficiently complete to include in the analysis. Twelve principal axis factors were extracted from the intercorrelations of the 52 RCES items and were rotated in an attempt to achieve an oblique simple structure. Eleven of these factors were almost identical to those obtained by Stumpf et al. (1983) except that the original factors were orthogonal while the current ones were oblique. One possible explanation for this discrepancy is that the dimensions of career exploration or development in less mature high school students are not as completely differentiated as they are in undergraduate and graduate students.

A second order analysis was obtained by factor analyzing the intercorrelations of the first order factors. Three oblique second order factors were obtained. These in turn yielded a general career exploration or development factor. The names given to the three second order (A - C) and the twelve first order factors (I - XII) are shown below:

A. SPECIFIC CAREER EXPLORATION (SCE)

1. Amount of Information (I)
2. Environmental Exploration (X)

Students high in SCE report that they know a lot about job activities and opportunities in the specific career areas of interest to them. They report that during the past year they have actively engaged in acquiring information about specific jobs or companies.

B. GENERAL CAREER EXPLORATION (GCE)

3. Methods of Search (II)
4. Self-Exploration (IV)
5. Stress (V)
6. Internal Search (IX)
7. Worry (XI) - Not identified by Stumpf et al. (1983)
8. External Search (XII)

Students high in GCE are still engaged in general exploration and appear not yet to have developed specific career interests. They report that they have spent a great deal of time in self-exploration and appraisal, and in making plans for clarifying and reaching career goals. They report considerable stress related to selecting a specific career.

C. SATISFACTION WITH CAREER PLANS (SCP)

9. Importance of Obtaining Preferred Position (III)
10. Satisfaction (VI)
11. Focus (VII)
12. Employment Outlook (VIII)

Students high in SCP appear to have selected a specific career and report that they are satisfied with the amount of information they possess concerning it.

Results for the entire set of factor analyses are shown in Appendix A. These results are sufficiently similar to those of Stumpf et al. to constitute evidence of construct validity for the revised instrument when used with high school students. The presence of intercorrelated first and second order factors provides justification for using the total RCES score in addition to scores constructed from the three second order factors as indicators of general career development.

Additional evidence of construct validity for the RCES was obtained by analyzing both the total score and the three factor scores by grade level. If the RCES is a valid measure of career development, then its scores should increase with grade level. Table 4 shows the results of a one-way multivariate analysis of variance of the three pretest second order factor scores and a univariate test of the total score using grade level as the independent variable. Table 5 gives the results of the univariate analyses for the three factor scores separately and Table 6 shows the means and standard deviations of the dependent variables by grade level. Results of the analyses show significant grade differences for both the total RCES score and the first two factor scores (Specific Career Exploration and General Career Exploration).

Table 4

Multivariate and Univariate Analyses of Variance of
Pretest RCES Factor and Total Scores by Grade Level

Test	Value	Hypothesis *df*	Error *df*	F	P
Pillai	.03	6	1998	5.38	<.01
Hotelling	.03	6	1994	5.44	<.01
Wilks	.97	6	1996	5.41	<.01
Roy	.03				<.01
Univariate		2	1000	7.39	<.01

Table 5

Univariate Analyses of Variance of Pretest RCES Factor Scores by Grade Level

Variable	Hypothesis Mean Square	Error Mean Square	F	P
SCE	816.40	72.53	11.26	<.01
GCE	1074.06	209.12	5.14	<.01
SCP	56.89	81.01	.70	>.01

df = 2,1000

Table 6

Means and Standard Deviations of Pretest RCES Factor and Total Scores by Grade Level

Variable	Grade Level					
	10		11		12	
	M	SD	M	SD	M	SD
SCE	34.82	8.36	36.80	8.73	38.02	8.51
GCE	7[illegible].73	14.12	77.67	13.88	77.65	16.22
SCP	54.80	9.14	54.74	8.76	55.63	9.07
Total	164.35	23.54	169.20	23.58	171.30	24.84
N	472		341		190	

Follow up analyses indicated significant differences between grade 10 and grades 11 and 12 but no significant differences between grades 11 and 12. Failure to find grade level differences for the third factor score, Satisfaction With Career Plans, casts some doubt on its construct validity as a measure of career maturity. High scores on it may indicate premature closure in career selection.

Results Related to Question #1.

Accuracy of Estimation The first research question sought to determine the accuracy with which high school students estimate their cognitive abilities as measured by the ASVAB. Table 7 shows contingency coefficients of correlation and their associated chi square values between measured ASVAB aptitudes and fall and spring self-estimates of the ASVAB aptitudes.

None of the contingency coefficients are high, and most of them are quite low. Students were best able to estimate their math, academic, and verbal abilities, but even these estimates were often quite inaccurate. Little improvement in agreement from fall to spring occurred. Many students did not avail themselves of the interpretation sessions, and simply taking the ASVAB was apparently not sufficient to alter estimates of ability. The meaning of these coefficients can be seen by examining crosstabulations in Table 8 that show the relationships between measured Academic and Electronics and Electrical abilities and fall estimates of them.

Table 7

Chi Squares and Contingency Coefficients of Correlation Between Measured ASVAB Aptitudes and Fall and Spring Self-Estimates of ASVAB Aptitudes (N=1081)

Aptitude	Fall		Spring	
	Chi Square	C	Chi Square*	C
Academic	228.11	.42	292.72	.46
Verbal	130.62	.33	215.28	.41
Mathematical	273.38	.45	321.64	.48
Mechanical and Crafts	139.74	.34	172.47	.37
Business and Clerical	39.46	.19	79.14	.26
Electronics and Electrical	76.07	.26	128.96	.33
Health, Social, and Technology	31.65	.17	47.63	.21

*All Chi Squares significant at less than .05

These results are in general agreement with those of Westbrook et al. (1988) except that the correlations found here are somewhat lower than they reported. This discrepancy is probably due to greater restrictions in range in the present study [i. e., the use of a five-category scale rather than the entire raw score range used by Westbrook et al. (1988)] and to the use of contingency coefficients rather than Pearson product-moment correlations. In addition, students in the present study did not know the kinds of items that were used to measure the abilities they were asked to estimate, especially those involved in the Mechanical, Business, Electronics, and Health, whereas Westbrook et al. (1988) gave students sample items from the DAT to help define the interest areas.

Reliability of Estimated Abilities

The results reported are in agreement with those of the previously cited meta-analysis of the accuracy of self-estimates of ability or achievement (Mabe and West, 1982). However, that study pointed out that these low coefficients could be due to unreliability of either the predictor (self-estimates) or the criterion (measured scores) as well as to the invalidity of the predictor because the theoretical upper limit of a validity coefficient is the square root of the product of the reliability coefficients of the two variables.

Table 8A

Crosstabulations of Estimated (Rows) and Measured (Columns)
ASVAB Aptitudes

		ACADEMIC Measured				
		Top 10% 1	Top 1/3 2	Middle 1/3 3	Lower 1/3 4	Bottom 10% 5
E	1 N	61	55	36	15	3
S	Pct	43.9	15.4	9.2	9.1	10.0
T	2 N	58	160	92	26	5
I	Pct	41.7	44.9	23.5	15.9	16.7
M	3 N	19	129	241	109	17
A	Pct	13.7	36.2	61.5	66.5	56.7
T	4 N	1	10	19	12	5
E	Pct	.7	2.8	4.8	7.3	16.5
D	5 N	0	2	4	2	0
	Pct	0	.6	1.0	1.2	0
Total	N	139	356	392	164	30
	Pct	12.4	32.9	36.3	15.2	2.8

Table 8B
Crosstabulations of Estimated (Rows) and Measured (Columns)
ASVAB Aptitudes

		ELECTRONICS AND ELECTRICAL Measured				
		Top 10% 1	Top 1/3 2	Middle 1/3 3	Lower 1/3 4	Bottom 10% 5
E	1 N	15	28	16	5	1
S	Pct	13.3	7.3	3.7	3.7	5.0
T	2 N	39	75	38	10	3
I	Pct	25.7	19.5	8.9	7.4	15.0
M	3 N	32	120	114	41	5
A	Pct	28.3	31.2	26.7	30.1	25.0
T	4 N	20	83	149	43	9
E	Pct	17.7	21.6	34.9	31.6	45.0
D	5 N	17	79	110	37	2
	Pct	15.0	20.5	25.8	27.2	10.0
Total	N	113	385	427	136	20
	Pct	10.5	35.6	39.5	12.6	1.9

Table 9 shows "test-retest" reliabilities of the self-estimates as indicated by Pearson product-moment (PPM) correlations between fall and spring measures, alternate form reliabilities of the measured ASVAB composite variables taken from the technical manual accompanying the counselors manual for the ASVAB, PPM correlations between estimated and actual composite scores for fall and spring, and theoretical upper limits for them. The results shown in Table 9 suggest that the validity coefficients between estimated and actual scores could be improved somewhat by increasing the reliability of the estimates. However, even if these theoretical limits could be approximated many students would continue to be inaccurate estimators.

Table 9

Estimated Reliability Coefficients of Self-Estimates and Actual ASVAB Composites and Upper Limits of Validity Coefficients*

Composite	r(SE)	r(AA)	r(SE,AA)		r(Max)
			Fall	Spring	
Academic	.54	.93	.37	44	.70
Verbal	.46	.93	.29	.38	.65
Mathematical	.53	.92	.42	.40	.70
Mechanical	.54	.89	.32	.34	.48
Business	.42	.94	.15	.22	.63
Electronics	.50	.93	.19	.28	.68
Health	.42	.94	.11	.17	.63

*r(SE) - reliability of estimated scores, r(AA) - reliability of measured scores, r(SE,AA) correlations between estimated and actual scores, r(MAX) - theoretical upper limit of correlation between estimated and actual scores.

Relationships of Accuracy of Estimation to Ability.

Discrepancy scores were computed for each student by subtracting each of the seven estimated aptitude levels obtained in the fall administration of the CEI from each appropriate ASVAB percentile category. Positive discrepancies indicate overestimates while negative ones are indicative of underestimates (for both estimated and measured abilities, 1 indicates high ability and 5 indicates low ability: thus a student whose measured score was 1 and who estimated an ability as 3 would be an underestimator with a score of -2). Ability estimates that were independent of the abilities that comprised a particular composite ASVAB score were generated by summing all ASVAB subtest scores that were not part of the composite. For example, the Electronics and Electrical composite score is a function of the general science, arithmetic reasoning, mathematics knowledge, and electronics information subtests. The six remaining subtests were summed to provide an ability estimate that was independent of it.

To replicate the findings of Mabe and West (1982), it would be necessary to demonstrate curvilinear relationships between the discrepancy scores and their associated independent ability estimates. That is, students with discrepancy scores of zero should have higher mean independent ability scores than students who were either under- or overestimators. No such relationships were found, as is shown in the example in Table 10. For all seven ASVAB composites, correlations between discrepancy scores and independent ability scores were negative, ranging from -.50 to -.33. Students who underestimated their abilities had higher independent ability scores than students who were overestimators. These relationships appear to be artifacts because students with high measured abilities cannot greatly overestimate them while the converse is true of students with low measured abilities. The general ability underlying all of the separate estimates then produces the negative correlations.

Table 10

Means and Standard Deviations of Independent Ability Scores for Electronics and Electrical Ability Discrepancy Scores

Discrepancy Score	Mean	SD	N
-4	54.93	2.45	17
-3	52.26	3.59	99
-2	49.87	4.78	225
-1	49.66	4.93	335
0	49.15	5.67	249
1	46.85	5.46	116
2	43.83	6.54	31
3	36.63	8.42	8
4	37.00	0	1

Over- and Underestimation of Abilities by Sex and Race

Under- and overestimation of ability patterns by males and females was studied by subjecting the seven pretest discrepancy scores as computed in the preceding section to a one-way multivariate analysis using sex as the independent variable. Because the multivariate tests were significant below the 0.05 level, univariate analyses of variance of the individual discrepancy scores were made. Table 11 shows the results of the univariate analyses of variance and Table 12 shows the means and standard deviations of the seven pretest scores by sex. As an aid to interpretation, Table 13 shows the percentages of males and females who were accurate estimators or who over- and underestimated their measured ASVAB abilities.

The results indicate that patterns of over- and underestimation are not the same for males and females. There were more females than males who overestimated their abilities in Academic, Verbal, Business and Health; there were more females than males who underestimated in Mechanical and Electronics.

Table 11

Univariate Analyses of Variance of Pretest Discrepancy Scores by Sex

Variable	Hypothesis Mean Squares	Error Mean Squares	F	P
Academic	19.68	1.03	19.17	<.01
Verbal	39.68	1.25	31.46	<.01
Mathematics	.32	.97	.33	>.05
Mechanical	19.00	1.65	11.54	<.01
Business	17.87	1.62	11.04	<.01
Electronics	107.00	1.63	65.73	<.01
Health	102.94	1.67	61.52	<.01

df=1,1032

Table 12

Means and Standard Deviations of Discrepancy Scores by Sex*

Variable	Male (N=482)		Female (N=552)	
	M	SD	M	SD
Academic	.033	1.029	.310	.999
Verbal	.029	1.235	.420	1.007
Mathematics	-.037	1.029	-.072	.948
Mechanical	-.600	1.366	-.871	1.206
Business	-.550	1.358	-.286	1.192
Electronics	-.554	1.349	-1.188	1.208
Health	-.373	1.341	.259	1.251

*Negative means indicate underestimation; positive ones show overestimation.

Table 13

Percentages of Males (N = 482) and Females (N = 552) Who Underestimated, Overestimated, or were Accurate Estimators of their Measured ASVAB Ability Scores

ASVAB Ability	Male			Female		
	Under	Accurate	Over	Under	Accurate	Over
Academic	28.7	43.8	27.5	17.7	44.9	37.3
Verbal	31.6	36.3	32.2	16.2	38.0	45.5
Mathematics	30.3	43.2	26.2	31.7	43.8	24.4
Mechanical	50.8	29.0	20.0	66.1	21.9	11.9
Business	50.8	29.5	19.8	42.4	33.5	23.3
Electronics	58.5	29.0	20.7	73.8	17.9	8.3
Health	48.3	28.8	22.9	25.2	34.2	39.7

Westbrook et al. (1988) failed to find sex differences in over-and underestimation of abilities; however, they combined each student's estimates into a Total Hit Score, which may have served to obscure sex-related patterns of over and underestimation.

Discrepancy scores were tabulated by race but no statistical tests of differences among them were made because of the considerable disparity in mean measured aptitudes. There were 978 white, 88 black, 5 Hispanic and 2 Asian-American students in the sample. Percentages of accurate estimator black students were considerably lower than percentages of accurate estimator white students on the ASVAB Academic, Verbal, and Mathematics aptitudes. Only small differences were obtained for the other aptitudes.

Consequences of Inaccurate Estimation

To investigate the impact of inaccurate estimation of abilities on the results of using the EXPLORE option of CHOICES, a series of simulated sessions was conducted. The five ASVAB ability levels were coded according to the rating system used by students for making self-estimates: a measured or estimated ability level in the top 10 percent was assigned a "1"; an ability level in the bottom 10 percent was given a "5." Intermediate levels were assigned "2," "3," and "4" in descending order. Thus, a set of measured or estimated ability levels with the first one in the top 10 percent, the second in the bottom 1/3, and the third in the top 1/3 would be coded (142). Three students who were inaccurate estimators were selected from the sample. One was high, one average, and one low in measured abilities. The high student's measured abilities were all in the top 10 percent (111). Self-estimates for this student for two abilities were in the top 1/3; the third ability estimate was in the middle 1/3 (223). Measured and estimated scores for the other two students were similarly coded.

The CHOICES Career Guidebook was used to construct profiles for the three students on the following EXPLORE topics: (1) Interests, (2) Aptitudes, (3) Temperaments, (4) Education level, (5) Working conditions, (6) Future outlook, (7) Earnings, (8) Hours/travel, (9) Physical demands, (10) Physical activities, (11) Indoor/outdoor, and (12) Career fields. The General Learning Ability (G), Verbal Aptitude (V), and Numerical Aptitude (N) scores in

the aptitude set were varied for each student in the simulation study to reflect his/her actual measured and estimated abilities. All other elements of the profiles were constant over students; abilities other than the three indicated above were entered as "3" (average).

The total number of occupations listed in CHOICES is 1223. The EXPLORE route lists them according to constraints imposed by information elicited by EXPLORE's topics and entered by the user. The first topic selected by the user is the most important one in determining which occupations are listed and which are not. For instance, if the CHOICES user's estimated ability levels are very low, occupations that require high ability levels for success (e.g., physician, attorney) will not be listed while those that require low ability levels (e.g., maintenance worker, cook's helper) will be listed. The second topic selected will further narrow the list of occupations, as will each successive topic used.

Table 14

Occupations Retained By EXPLORE As It Acquired Topic Information

Topic /Ability	Students					
	High		Average		Low	
	Meas.* (111)	Est.* (223)	Meas.* (213)	Est.* (233)	Meas.* (434)	Est.* (331)
General	1223	1108	1108	1108	392	837
Verbal	1223	1106	1108	1036	392	819
Numerical	1223	925	926	875	391	819
Other Abil.	566	519	520	503	215	466
Interests -1	399	28	28	22	4	17
Interests -2	26	21	21	--	--	--
Education	23	--	--	--	--	--

*Measured or estimated aptitude levels: Numbers in parentheses are ability level designations for the three students in the three abilities.

In this simulation, the order in which EXPLORE topics were used was Aptitudes, Interests, and Education. The first identifies occupations that are open to persons at or below given ability levels. The second identifies occupations that might be suitable for persons having certain interests or patterns of interests. The third selects occupations that have survived cuts made by the first two topics and that also require no education above the level (e. g., high school) entered by the user. Because EXPLORE discontinues its search when the list of occupations for a user has been narrowed to 25, the remaining topics (Temperaments, Working Conditions, etc.) were not used. Before or during use of the Education topic, the number of occupations listed for each simulation student had fallen to or below that number. Table 14 shows for each of the three students the number of occupations retained by EXPLORE as it acquired information.

Table 14 shows that inaccurate estimation of abilities could prevent the underestimating student from being informed about possibly suitable occupations. The Guidebook does warn students not to underestimate abilities and suggests entering the higher of two levels when the students can't decide between them because EXPLORE locates all occupations appropriate for the designated and all lower ability levels. This practice, however, could be confusing or misleading for underestimating students.

Results Related to Question #2

The second research question was concerned with whether students who participated in the ASVAB program demonstrated a greater degree of career awareness and development than students who did not. Two analyses of covariance (ANCOVA) were performed in attempting to answer this question. The first used as design variables the treatment condition and grade levels with the fall RCES score as the covariate. The dependent variable was the spring RCES score. No significant treatment effect was found. The second analysis used as design variables grade level and participation in one or more of the ASVAB counseling activities (i.e., students who had taken the ASVAB were divided into those who reported participation in one or more of the ASVAB counseling activities and those who reported no participation); fall RCES was the covariate. The same analysis was repeated using a multivariate analysis with the three fall factor scores as covariates and the three spring factor scores as dependent variables. Both the analyses of the total RCES scores and the multivariate analysis of factor scores showed significant grade, participation, and covariate effects. The results of the univariate ANCOVA are shown in Table 15; the raw fall and spring means and standard deviations are given in Table 16; and the adjusted spring means are given in Tables 17 and 18.

These results show that, as would be expected, RCES mean scores increase with increases in grade level, i.e., older students would be expected to have higher degrees of career development and awareness than younger students. Participation in one or more ASVAB counseling activities is also associated with increased career development and awareness when fall RCES is held constant. Univariate tests of the factor scores following the multivariate analysis show that grade level produced a significant effect only for the first factor score Specific Career Exploration (SCE) and that participation produced a significant effect only for the second one, General Career Exploration (GCE). The third score was not significantly related to either independent variable or to their interaction. Whether these associations are causal ones, however, cannot be determined from these data because students were not randomly assigned to the two participation conditions and it is well known (Cook and Campbell, 1979) that the two groups may differ on non-treatment variables that may also influence their RCES scores.

Table 15

F-ratios for Univariate Analyses of Posttest RCES Factor and Total Scores by Participation and Grade Level with Pretest Factor and Total Scores as Covariates

Dependent Variable	Regression	Participation	Grade (G)	P X G
SCE	182.88*	.68	6.17*	2.69
GCE	119.14*	5.77*	.44	.40
SCP	118.45*	2.11	1.46	.01
Total RCES	437.08*	3.87*	4.51*	.37

* Significant at .05 or less

Table 16
Raw Fall and Spring RCES Means and Standard Deviations
by Grade and Participation

	No Participation		Participation	
Grade 10	**Fall**		**Fall**	
	M	**SD**	**M**	**SD**
SCE	35.64	8.53	34.44	8.26
GCE	74.17	14.33	75.00	14.03
SCP	54.94	9.35	54.74	9.06
Total	164.75	24.56	164.17	23.08
N	151		321	
	Spring		**Spring**	
SCE	36.38	9.02	34.67	8.61
GCE	72.14	16.10	74.83	15.07
SCP	52.80	10.18	53.34	9.54
Total	161.33	26.32	162.84	24.05
N	151		321	
Grade 11	**Fall**		**Fall**	
SCE	35.66	8.74	37.34	8.70
GCE	76.78	14.44	78.09	13.62
SCP	53.60	8.07	55.28	9.04
Total	166.04	24.09	170.71	23.24
N	110		231	
	Spring		**Spring**	
SCE	36.55	8.01	38.27	8.52
GCE	75.37	15.93	77.15	15.06
SCP	52.62	10.05	54.67	9.79
Total	164.04	26.39	170.10	23.30
N	110		231	
Grade 12	**Fall**		**Fall**	
SCE	39.86	7.49	37.06	8.91
GCE	77.14	14.58	77.92	17.06
SCP	56.37	7.60	55.25	9.75
Total	173.37	19.85	170.22	27.96
N	65		125	
	Spring		**Spring**	
SCE	39.74	9.07	39.78	8.88
GCE	73.88	14.26	77.30	16.46
SCP	55.46	9.40	55.26	10.29
Total	169.08	25.14	172.34	26.80
N	65		125	

Table 17

Adjusted Means for Factor Score I (SCE)
and Total RCES by Grade Level

	Grade		
	10	11	12
Factor I (SCE)	36.43	37.52	38.69
Total RCES	164.25	167.23	168.64
N	472	341	190

Table 18

Adjusted Means for Factor Score II (GCE)
and Total RCES by Participation Level

	No Participation	Participation
GCE	73.96	76.26
Total RCES	165.07	168.34
N	326	677

Participation Differences in Accuracy of Estimation. A multivariate analysis of variance was conducted to determine whether participation in one or more of the ASVAB counseling activities was related to acuracy of ability estimation. The seven posttest discrepancy scores were used as dependent variables. Pretest discrepancy scores were not used as covariates because the pre-post discrepancy scores were not experimentally independent. That is, they had in common the measured abilities. A separate analysis of the pretest discrepancy scores was conducted in order to determine whether differences that existed after participation also existed before it. None of the multivariate test criteria were significant in that analysis. The posttest discrepancy scores were analyzed with a 2 by 2 multivariate analysis of variance in which the independent variables were grade and participation levels. The multivariate tests for grade level and the interaction of participation by grade level were not significant but the participation effect was. Therefore, grade level was dropped from further consideration. Table 19 shows the results of the univariate analyses of the posttest discrepancy scores by participation level. Significant effects were found for the Verbal, Mechanical, Business, and Electronics scores. Table 20 shows the means and standard deviations of the discrepancy scores by participation level. Table 21 gives the percentages of overestimators, underestimators and accurate estimators by participation level as an aid to interpreting the analysis of variance results. It can be seen in Table 21 that percentages of accurate estimators of Verbal and Business scores are greater for participants than for nonparticipants. However differences between participation groups on Mechanical and Electronics discrepancies are apparently due to the presence of fewer underestimators and more overestimators in the participant group.

Table 19

Univariate Analyses of Variance of Posttest Disrepancy Scores by Participation Level in the ASVAB Career Development Program

Variable	Hypothesis Mean Square	Error Mean Square	F	P
Academic	.37	.99	.38	>.05
Verbal	4.64	1.11	4.17	<.05
Mathematics	.86	1.06	.82	>.05
Mechanical	5.99	1.62	3.70	<.05
Business	7.76	1.54	5.05	<.05
Electronics	7.48	1.55	4.81	<.05
Health	2.35	1.62	1.45	>.05

df=1,1079

Table 20

Means and Standard Deviations of Posttest Discrepancy Scores of Students Who Were Participants (N=708) or Nonparticipants (N=373) in the ASVAB Career Development Program*

Ability	Nonparticipants		Participants	
	Mean	SD	Mean	SD
Academic	.15	1.07	.19	.95
Verbal	.41	1.12	.27	1.02
Mathematics	-.10	1.05	-.04	1.02
Mechanical	-.64	1.23	-.48	1.29
Business	-.31	1.35	-.13	1.18
Electronics	-.77	1.30	-.59	1.22
Health	-.02	1.35	.08	1.23

*Negative means indicate underestimation; positive ones show overestimation.

Table 21
Percentages of Participants (N = 708) and Nonparticipants (N = 373) in the ASVAB Career Program Who Underestimated, Overestimated or Were Accurate Posttest Estimators of Their Measured ASVAB Ability Scores

Ability	Nonparticipants			Participants		
	Under	Accurate	Over	Under	Accurate	Over
Academic	26.8	38.1	35.1	20.8	46.8	32.5
Verbal	20.1	33.5	46.4	20.8	40.0	39.3
Mathematics	33.2	42.6	24.1	31.1	42.4	26.6
Mechancial	56.3	27.9	15.8	51.1	26.7	22.2
Business	44.2	30.6	25.2	36.0	37.7	26.3
Electronics	57.6	28.4	13.9	52.7	29.8	17.5
Health	34.6	30.6	34.9	33.3	31.1	35.6

Results Related to Question #3

The third research question asked whether high schools that require ASVAB testing and interpretation of its results have a smaller proportion of 1987 seniors who are uncertain of post-high school plans than schools in which these activities are not mandatory. The responses of students to two items on the CEI were used to investigate this question. The first (Item #2) asked "How certain are you of your career intention?" Student responses were (A) Very certain, (B) Certain, (C) Uncertain. The second (Item #9) required students to respond to the following statement "I need more information about careers before I make a career choice." Possible responses were (A) Strongly agree, (B) Agree, (C) Neither agree or disagree, (D) Disagree, and (E) Strongly disagree. Response categories A and B were combined as were categories C, D, and E for the analysis. Item responses were cross-tabulated by treatment condition for fall and spring separately. Chi squares were computed for each cross tabulation. The results of the analysis are shown in Tables 22 and 23. No significant treatment effects were found in any of the analyses. There was, however, an observed reduction in uncertainty (Item 2) from fall to spring for treatment students but not for control students. On the other hand, more students agreed with the statement in Item 9 in the spring than in the fall in both groups. This could, however, be interpreted positively as increased awareness of the availability of and need for career information.

Table 22
Cross Tabulation and Chi Squares for Fall and Spring
Analysis of Item 2 (Seniors Only),
"How certain are you of your career intentions?"

		Fall		Spring	
		Control	Treatment	Control	Treatment
Very Certain	N	21	32	23	45
	Pct	27.6	26.2	35.4	36.9
Certain	N	35	51	24	53
	Pct	46.1	41.8	36.9	43.4
Uncertain	N	20	39	18	24
	Pct	26.3	32.0	27.7	19.7

Chi square (2 *df*)=.73, p>.05 Chi square (2 *df*)=1.68, p>.05

Table 23

Cross Tabulations and Chi Squares for Fall and Spring
Analyses of Item 9 (Seniors Only),
"I need more information about careers before I make
a career choice."

		Fall		Spring	
		Control	Treatment	Control	Treatment
Agree	N	30	51	43	61
(A,B)	Pct	39.5	41.5	56.6	49.6
Disagree	N	46	72	33	62
(C,D,E)	Pct	60.5	58.5	43.4	50.4

Chi square (2 *df*) = .08, p>.05 Chi square (2 *df*) = .66, p>.05

Results Related to Questions #4 through #7

Questions 4 through 7 were concerned with the effects on students of having worked with CHOICES either by itself or in combination with having participated in some aspect of the ASVAB program. In addition, it was of interest to inquire whether the general ability of students would modify any of the main effects or interactions of the two variables. A single multivariate analysis of covariance was designed to answer all four questions using as dependent variables the three posttest RCES factor scores, and using participation in the

ASVAB program and/or CHOICES as independent variables with the three pretest factor scores and the ASVAB Academic score as covariates. The first multivariate effect to be investigated was a test of homogeneity of regression of the dependent variables on the covariates. That is, were the dependent variables related to the covariates in the same way in each of the treatment combinations? A nonsignificant effect gave an affirmative answer to question 7, and it was concluded that the relationship between participating in one or both of the programs and some aspect of the degree of career awareness and development was the same for students of high ability and those of lower ability. Nonsignificant results of multivariate tests made to answer the other three questions were also found. Therefore, no further tests on individual dependent variables were made for this set of questions. A possible reason for the negative results found for these questions is that few students used CHOICES during the time between the pretest and postest.

CONCLUSIONS

The conclusions that can be drawn from this study are tentative because of the demonstrated ASVAB mean score differences between the students for whom all data were present and those for whom they were not. However, it is believed that these conclusions concerning question 1 are generally correct: (1) As a group, students are not good estimators of their abilities. Males and females have different estimation patterns with females showing more variability in inaccurate estimation, i. e., more overestimation in verbal ability, an area in which females are typically supposed to be stronger than males and more underestimation in mechanical and electronics abilities, presumably useful in occupational areas which are traditionally not entered by females. Self-estimations of abilities are only slightly more realistic/valid after taking the ASVAB than before. (2) While the stability of self-estimates of abilities is low, improving their reliability would probably not make them highly accurate. (3) Accuracy of estimation is not related to ability level. The negative correlations observed between discrepancy scores and independent ability estimates are probably artifactual. (4) Underestimation of abilities could lead students not to consider occupations in which they could probably succeed. Overestimation could result in a confusing array of occupations for students to consider, many of which might require ability levels not possessed by the student. Students whose strongest abilities are indicated by one or more of the ASVAB areas Mechanical and Crafts; Business and Clerical; Electronic and Electrical; and Health, Social, and Technology scores could identify occupations to explore through use of the Military Career Guide or other sources and then investigate them more thoroughly through the SPECIFIC, COMPARE, and RELATED routes of CHOICES.

The assumption that lower ability students are less likely to volunteer to take the ASVAB appears to have been verified. These students are probably the ones most likely to be in need of counseling, to drop out before completing high school, and to be unemployed after leaving school (Rumberger, 1987; McDill, Natriello, and Pallas, 1985). It seems possible that encouraging or requiring them to undergo some combination of ASVAB testing and interpretation and counseling with CHOICES could result in their staying in school longer and/or result in a reduction of the high unemployment of students after they drop out. Minority students appear to be underrepresented in the final sample of 1081 students. Whether they tend to avoid the ASVAB program more than white students is an important question for further study.

A plausible conclusion with regard to question #2 is that participation in ASVAB counseling activities produces small incremental changes in career development and awareness in students at all three secondary school grade levels. This effect might be greater when the ASVAB Workbook is available for use in counseling sessions. Analysis of the RCES factor scores showed that only the second one, General Career Exploration

(GCE), appeared to be influenced by participation in the ASVAB counseling program, Specific Career Exploration (SCE) was related only to grade level, and Satisfaction with Career Plans (SCP) was not related to either participation or grade level. This pattern of results strengthens the causal interpretation made for GCE since the ASVAB program would probably be less useful to students who were already exploring specific careers or who had made career decisions. Participation in the ASVAB program also appeared to increase accuracy in four of the ability estimat s. This is an important finding if the causal interpretation is correct since Westbrook et al. (1988) indicated that self-knowledge is an important characteristic of career maturity.

Although there is some evidence pointing to a positive answer for question #3, no conclusion can be reached. Further research using more reliable indicators may yield more information concerning this question.

No conclusions concerning questions 4 through 7 can be reached at this time. The negative results obtained in this study may be due to the small number of students who worked with CHOICES during the period of time between the pre- and posttest RCES.

As indicated above, all of the causal interpretations made in this study must be regarded as tentative. Future research on the effectiveness of the ASVAB program should be experimental in nature and the full program including use of the ASVAB Workbook should be carefully implemented. Such research could probably best be done in formal career guidance classes that are randomly assigned to various treatment conditions, i. e., various combinations of use of CHOICES and ASVAB programs. Dependent variables in addition to the RCES should include actual career plans of students.

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APPENDIX A

FIRST AND SECOND ORDER FACTOR SCALES OF THE CEI

A. Objective Career Information: Current and Sought

AMOUNT OF INFORMATION I
For the career areas that interest you, how much do you know about...

31. what people actually do on the job?
32. the numbers and kinds of job opportunities?
33. organizations related to the career that are important?
34 this career area?
35. how to develop a plan to enter a specific career and become successful in it?

ENVIRONMENTAL EXPLORATION X
How often have you done the following in the last year?

19. Studied about possible careers.
20. Attended talks or other programs about career choices.
21. Obtained information on specific jobs or companies.
22. Talked to people who know a lot about careers in which you are interested.
23. Obtained information about job opportunities in career areas that interest you.
24. Looked for information about educational or other requirements for entering interesting career areas.
18. How many career areas have you explored and then decided they did not really interest you? (A - Not Sure, B - One or two, C - Several, D - Quite a few, E - Many)

B. Subjective Career Related Factors: Judgments and Concerns

METHOD OF SEARCH II
How much do you think the following activities will help you reach your career goals?

64. Making a detailed plan for meeting the educational requirements of the career you choose.
65. Planning a detailed job search.
66 Deciding exactly how to get information about firms you might like to work for.
67. Making a list of questions to ask at job interviews.
68. Checking out all of the major job markets in your chosen area.
57. Getting more information about the career area and the jobs that are available in it.

SELF-EXPLORATION IV
How often have you done the following in the last year?

25. Thought about things you have done in the past and how they fit in with your future career.
26. Thought about yourself as a person.
27. Thought about all you have done in the past.
28. Understood how your past can be important to your future career.

STRESS V
How much undesirable stress have you experienced that was related to each of the following?

52. Looking for a job.
53. Making decisions of almost any kind.
54. Deciding about a career to enter.
55. Deciding to try for a specific job.
56. Wondering whether you have all of the abilities necessary for success in the career areas that interest you.

INTERNAL SEARCH IX
How much do you think the following activities will help you reach your career goals?

60. Finding out more about yourself for the purpose of identifying the kind of job that will meet your individual needs.
61. Finding out more about all aspects of yourself.
62. Understanding how your past behavior is related to your future career.
63. Thinking seriously about yourself as a person.

WORRY XI
How often have you done the following in the last year?

29. Wondered whether there is any career in which you would really be happy.
30. Wondered whether you are mature enough to make a decision about the kind of career you will enter.

EXTERNAL SEARCH XII
How much do you think the following activities will help you reach your career goals?

58. Asking friends and relatives about careers.
59. Asking other students about their career explorations.

C. Projection of Future Career Related Activities

IMPORTANCE OF OBTAINING PREFERRED POSITION III
How important is each of the following to you at this time?

49. To enter the career area that you have chosen.
50. To work in a job that you want.
51. To be well established in an organization that you like.

SATISFACTION VI
How satisfied are you with the amount you know about each of the following?

40. The career areas in which you might like to work.
41. The specific job you think you might like.
42. The kind of organization in which you would like to work.
43. Career areas that fit in with your interests and abilities.
44. How up-to-date the career information you get is.
45. What will be likely to happen in the future in the career areas that interest you.

FOCUS VII

17. How many career areas are you interested in? (scale reversed)
36. Do you know what kind of job is best for you?
37. Do you know what kind of organization you want to work for?
38. Do you know exactly what occupation you want to enter?
39. Are you sure that you will enter the career area and/or the specific job that you now think you prefer?

EMPLOYMENT OUTLOOK VIII
How do employment possibilities look for:

46. The job(s) you prefer?
47. The organization(s) you prefer?
48. The overall occupational area(s) you prefer?

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