ACT RESEARCH REPORT

No. 67

67

December 1974

ASSESSING THE CAREER INTERESTS OF COLLEGE YOUTH: SUMMARY OF RESEARCH AND APPLICATIONS

G. R. Hanson

PUBLISHED BY THE RESEARCH AND DEVELOPMENT DIVISION

THE AMERICAN COLLEGE TESTING PROGRAM

P. O. BOX 168, IOWA CITY, IOWA 52240

ASSESSING THE CAREER INTERESTS OF COLLEGE YOUTH: SUMMARY OF RESEARCH AND APPLICATIONS

ABSTRACT

This report describes the rationale, development, technical characteristics, and use of the ACT Interest Inventory, which provides both descriptive information about an individual's interests and information to facilitate focused exploration of educational and career alternatives. The report begins with consideration of the question, "What are interests and why do we measure them?" It concludes with a discussion of the ways information about group differences in educational and vocational behavior can be used to help individuals make satisfying and rewarding career choices.

The results of extensive item analyses indicated that the scales of the ACT Interest Inventory measure six basic dimensions of interest with sufficient consistency and accuracy for individual counseling with students. Group differences in item responses suggested that separate scaling and norming procedures were needed for men and women, but that whites and nonwhites did not require separate norms. Validity evidence supporting the descriptive use of the ACT Interest Inventory included correlational information showing that the six scales are relatively independent, are interrelated in the expected circular fashion, are highly related to Strong Vocational Interest Blank scales measuring the same dimensions, and are unrelated to ACT ability measures. Evidence supporting the use of the ACT Interest Inventory to facilitate focused exploration of possible educational programs of study included analyses of institutional differences, sex differences, and educational programs of study. Results from multiple discriminant analyses showed that people in the same major attending different institutions had similar interest profiles, that men and women in the same educational major had highly similar interests patterns when scores were scaled separately by sex, and that people in different educational majors had quite different interest profiles. Similar educational major differences were found for a cross-validation sample and support the generalizability of these data to other samples. Results of these analyses were used to construct a Map of College Majors which summarizes the group differences among college majors and can be used with individuals to show the similarity of their interests to the interests of successful and satisfied college seniors in a variety of majors. A second reporting procedure, the World-of-Work Map, was developed to show the similarity of an individual's work activity preferences to the work tasks and activities which characterize groups or families of occupations. These work activity preferences are best described in terms of two bi-polar dimensions—a data/ideas dimension and a people/things dimension. The application of these two reporting procedures in career counseling situations are discussed.

TABLE OF CONTENTS

A Rationale for the ACT Interest Inventory 1
What Are Interests? 2
Why Measure the Interests of College Youth? 5
Communicating the Results of Interest Measurement 6

Development of the ACT Interest Inventory 8
Background Development 8
Scale Development of the ACT Interest Inventory 8
Item Homogeneity 9
Group Differences in Item Responses 10
Reliability of the ACT Interest Inventory Scales 13

Norming the ACT Interest Inventory 15
The Norm Group Sample 15
Scaling the ACT Interest Inventory 18
Reporting Normative Information for the ACT Interest Inventory 19

Validation of the ACT Interest Inventory 20
Data Related to the Descriptive Use of the ACT Interest Inventory 20
—relationships among scales 20
—correlations of the ACT Interest Inventory with the Strong Vocational Interest Blank 22
—relationship of ACT Interest Inventory Scales to academic ability and achievement variables 22
Data Related to the Use of the ACT Interest Inventory for Focused Exploration 25
—data collection 26
—institutional differences 29
—sex differences 32
—educational major differences 43
—cross-validation of educational major differences 45
Future Research Directions 52

Application of ACT Interest Inventory Research to Interpretation of Scores 54
Relating Student Interests to Educational majors 54
Relating Student Interests to the World of Work 55

Appendix 1—Development of the ACT Occupational Classification System and the World-of-Work Map 59

Appendix 2—Vocational Interest Profile 66

Appendix 3—Raw Score to Standard Score to Percentile Rank Conversion Tables 68

Appendix 4—Item Content of ACT Interest Inventory Scales 70

References 71

ASSESSING THE CAREER INTERESTS OF COLLEGE YOUTH: SUMMARY OF RESEARCH AND APPLICATIONS

Gary R. Hanson[1]

The focus of this report is on the assessment of interests of college-age youth. To begin, we must ask: What are interests? Why do we measure them? In the end we must try to answer: What do interests tell us about the educational and vocational behavior of various groups of people? How can we use that information to help individuals make satisfying and rewarding career choices? The purpose of this report is to present a rationale for measuring interests, to illustrate how that rationale was applied in the construction of the ACT Interest Inventory, and to report the initial steps in validating the expected uses of the ACT Interest Inventory. In the process, perhaps partial answers may be found to these important questions about interest measurement.

A Rationale for the ACT Interest Inventory

The rationale for any assessment device reflects the particular values and professional biases of the developer. The rationale generally includes a clear statement of what is to be measured and why, and of the implications of the measurement for its intended uses. It also provides guidelines for the development and construction of the assessment instrument. Decisions regarding item construction, scoring, scaling, norming, validation, and reporting procedures are directly influenced by the rationale for the instrument.

The rationale for the ACT Interest Inventory described below includes a working definition of *interests,* an examination of why interests are measured, and how results may be reported to students and counselors. The discussion of these topics illustrates the values which guided, and the goals which were inherent in, the development of the ACT Interest Inventory.

[1]The author wishes to thank Dr. Dale Prediger and Dr. Nancy Cole, both of ACT, and Dr. Fred Borgen, Iowa State University, for their critical review and helpful suggestions which greatly improved the manuscript. Dr. Prediger also made a major contribution of text related to the ACT Occupational Classification System discussed in Appendix I and to the World-of-Work Map discussed on pages 55, 63. Thanks also are due Dr. Robert Fenske for assisting in the sampling design and data collection phase of the project, and Dr. Richard Lamb for coordinating the data collection and data analyses. The contributions of Mr. John Poyzer and Mrs. Marcia Kennedy to the data collection and analyses are greatly appreciated as is the work of Ms. Jane Bock who typed and proofed numerous drafts of the report.

What Are Interests?

William James (1890), one of the first psychologists to deal with the concept of interest, suggested:

> Only those items which I notice shape my mind—without selective interest, experience is an utter chaos. Interest alone gives accent and emphasis, light and shade, background and foreground—intelligible perspective, in a word [p. 403].

James considered interests to be a cognitive function of the mind, instrumental in selecting and organizing an individual's experience.

Kitson (1925) perceived the concept of interest in terms of the psychological constructs of "identification" and "self." For Kitson, "to be interested in a thing is to endeavor to identify one's self with it [p. 141]."

In a classic review of interest measurement, Fryer (1931) distinguished between "subjective" and "objective" interests. He defined subjective interests as *feelings* of pleasantness and unpleasantness toward certain experiences, and objective interests as observable *reactions* to such experiences, and viewed both as acceptance-rejection activities.

W. V. Bingham (1937), head of a group of industrial psychologists at the Carnegie Institute of Technology, defined an interest as a tendency to become absorbed in an experience and to continue in it.

> We therefore define interest not only in terms of the objects and activities which get attention and yield satisfaction, but also in terms of the strength of the tendencies to give attention to and seek satisfaction in these competing objects of interest [p. 62].

Strong's early conception of interests revolved around an empirical definition based on the differentiation of men in various occupations by the Strong Vocational Interest Blank. In the introductory chapter of *The Vocational Interests of Men and Women,* Strong (1943) noted that interests "point to what the individual wants to do, they are reflections of what he considers satisfying [p. 19]."

In more recent works, Strong has written:

> What are interests? . . . They remind me of tropisms. We go toward liked activities, go away from disliked activities [1960, p. 12].

> Interest scores measure a complex of liked and disliked activities selected so as to differentiate members of an occupation from nonmembers. Such a complex is equivalent to a "condition which supplies stimulation for a particular type of behavior," i.e., toward or away from participation in the activities characteristic of a given occupation. Interest scores are consequently measures of drives [1955b, p. 142].

The concept of interest was further refined by Carter (1944), who extended it to include the ideas of "developmental growth," the "self concept," and "identification," and suggested that:

> The individual derives satisfaction from the identification of himself with some respected group; by this method he seizes some sort of status. This identification leads to an interest in restricted activities and experiences; to the extent that this is true the person learns about the vocation and the vocational group [p. 185].

Darley (1941) suggested that interest types represented outgrowths of personality development and that occupational selection and elimination were functions of personality type as well as of abilities and/or aptitudes. He concluded that "occupational interest types grow out of the development of the individual's personality [p. 65]."

The concept of interest type was further elaborated by Bordin (1943) in terms of self-concept and identification. Bordin maintained that in answering an interest inventory, an individual expresses his acceptance (or rejection) of a particular view or concept of himself in terms of his occupational stereotypes. Interests encompass certain patterns of likes and dislikes that are expressions of personality; as the self-concept fluctuates and changes, so too will the pattern of likes and dislikes.

A somewhat different approach to the concept of interest has been taken by Berdie (1944).

> When interests are considered as expressions of liking and disliking, attention can be paid to the objects liked or disliked. These objects form constellations; they have characteristics in common that enable us to place them in classes [p. 153].

Berdie maintained that preferences for such constellations of objects were relatively constant and reflected fundamental aspects of personality. The specific objects involved in the constellations could change, and learning and emotional experiences could affect them, but the constellations themselves were not so susceptible to experience and were probably determined by constitutional and early social factors.

Super (1949) formulated a conceptual definition much like Bordin's.

> Interests are the product of interaction between inherited aptitudes and endocrine factors on the one hand, and opportunity and social evaluation on the other. Some of the things a person does well bring him the satisfaction of mastery or the approval of his companions, and result in interests. Some of the

things his associates do appeal to him and, through identification, he patterns his actions and interests after them; if he fits the pattern reasonably well he remains in it, but if not he must seek another identification and develop another self-concept and interest pattern [p. 406].

Holland's view of interests has been expressed in his recent book (1973).

In short, what we have called "vocational interests" are simply another aspect of personality [p. 7].

Just as we are more comfortable among friends whose tastes, talents, and values are similar to our own, so we are more likely to perform well at a vocation in which we "fit" psychologically. . . . In the present theory, the congruence of a person and his environment is defined in terms of the structure of personality types and environmental models [p. 9].

What, then, are interests? Clearly, there is no consensus. One theme common among these conceptions of interests, however, is that interests are a constellation of relatively discrete likes and dislikes (covertly experienced and/or overtly demonstrated) which lead to consistent patterns of behavior. As such, the concept of *interests* is a useful tool for understanding the vocational and educational behavior of people. That interests are viewed as a constellation of likes and dislikes suggests that interests can be classified and organized into meaningful categories, classes, or dimensions.

Identifying major interest dimensions. Two general approaches have been taken to identify and organize the basic dimensions of vocational interests. In one approach, scale scores or items from well-known interest inventories have been factor analyzed in order to identify a common structure. The second approach has used occupational classification systems based on the interest profiles of people in similar jobs to illustrate that the world of work can be organized into a relatively few categories. A brief review of major studies in this area illustrates the basic dimensions and structure of vocational interests.

Super and Crites (1962) pointed out that progress in the measurement of interests was first made possible by a shotgun approach—an approach less concerned with the nature of interests than with the fact that they could be measured at all. Only after scales had been developed for the measurement of the interests of men in a variety of occupations did factor analysis and item analysis reveal the nature of the interests.

The first major attempt to identify interest dimensions was that made by Thurstone (1931) who factor-analyzed 18 occupational scales of the early Strong Vocational Interest Blank and identified four major factors: Science, People, Language, and Business. Ten years later, using a larger number of scales from the SVIB, Darley (1941) identified six factors which he called Technical, Verbal, Business Contact, Welfare, Business Detail, and Certified Public Accountant (CPA). Strong (1943) reported the results of seven different factor analyses of the SVIB using different samples and differing numbers of occupational scales. He found surprising consistency in the dimensions or factors, which he labeled Science, People, Business System, Business Contact, Language, Things vs. People. In a later factor analytic study, Cottle (1950) identified two major bipolar interest factors. The first he called People-Things, and the second Data (Business Detail)-Ideas.

Perhaps the most comprehensive study of interest factors was conducted by Guilford and his associates (1954). Brief 10-item interest scales were developed to measure 33 hypothesized interest factors. These scales were then administered to large samples of Air Force personnel. Results from the factor analysis identified 24 factors. Eight of these were clearly interest factors; the others were more appropriately assigned to personality dimensions of adjustment or temperament. Guilford's factors were labeled Scientific, Social-Welfare, Mechanical, Outdoor, Clerical, Business, Aesthetic-Expression, and Aesthetic-Appreciation.

Super and Crites (1962) reviewed the major attempts to identify interest factors and showed that nearly all of the studies could be synthesized to suggest the following major interest dimensions:

- Scientific — an interest in knowing the why and how of things
- Social Welfare — an interest in the welfare of people or an interest in people for their own sake
- Literary — an interest in the use of words and in the manipulation of verbal concepts
- Material — an interest in working with tangibles; also called a People-Things dimension

- Systematic — an interest in record keeping and clerical activities
- Contact — an interest in business and economic areas as well as in meeting and dealing with people
- Aesthetic — an interest in artistic expression and appreciation

The consistency with which these same few factors continue to appear suggests that they represent basic dimensions of vocational interest. Recent factor analytic studies using the SVIB and the Kuder (Harrington, Lynch, & O'Shea, 1971; King & Norrell, 1964; Navran & Posthuma, 1970; Schutz & Baker, 1962; Terwilliger, 1963) have typically identified from four to seven factors which correspond to those of Super and Crites (1962). These data taken together provide considerable supporting evidence that interests can be described in terms of a relatively few basic dimensions.

Yet another approach has been taken to identify the major dimensions of interest. Strong (1943) found that occupations could be grouped together on the basis of the similarity of the interests of those in the occupations. Strong correlated the occupational interest scales and grouped those scales which intercorrelated .60 or higher. The 36 occupational scales were combined into the 11 groupings below.

I. Artist, psychologist, architect, physician, dentist
II. Mathematician, physicist, engineer, chemist
III. Production manager
IV. Aviator, farmer, carpenter, mathematics-physical science teacher, printer, policeman, forest service man
V. YMCA secretary, YMCA physical director, personnel manager, city school superintendent, minister, social science teacher
VI. Musician
VII. Certified public accountant
VIII. Purchasing agent, office worker, accountant, banker
IX. Real estate salesman, life insurance salesman, sales manager
X. Lawyer, author-journalist, advertising man
XI. President of manufacturing concern

The scales of the Strong Vocational Interest Blank were also grouped into families by Darley and Hagenah (1955), who obtained results similar to Strong's. Using Darley's terminology, Super and Crites (1962) characterized these same groups as:

Biological Science
Physical Science
Technical
Social Welfare
Business Detail
Business Contact
Linguistic

The similarity of these groupings of occupations to the interest factors derived from factor analysis is striking. Other classifications of occupations have derived similar groupings. For example, Roe (1956), Super (1957), and Holland (1966) classified occupations into groups according to the following categories:

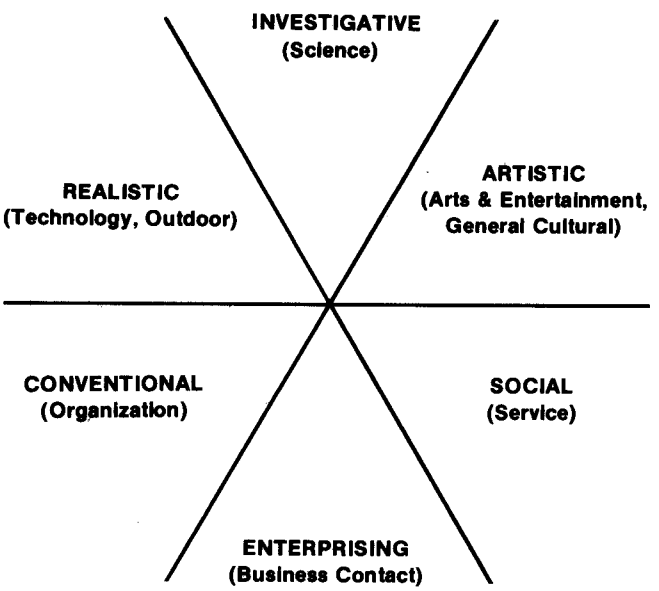
Roe
Technology
Outdoor
Science
General Cultural
Arts and Entertainment
Service
Business Contact
Organization

Super
Technical or Material
Scientific
Literary
Musical or Artistic
Humanistic or Social Welfare
Business Contact
Business Detail

Holland
Realistic
Investigative
Artistic
Social
Enterprising
Conventional

These similar classes of occupations and occupational interests suggested by various writers had been used primarily as discrete and independent

categories. However, Roe (1956) noted that adjacent categories in her ordered list were related; Roe and Klos (1969) formalized this suggestion by describing the interest categories as a circular ordering in which classes adjacent in the circle were most closely related, while those most widely separated were the least related. In the ordering of the Roe groups listed above, the circle is completed by placing the last group, Organization, adjacent to the first, Technology. The corresponding categories of Holland are related to the circular configuration suggested by Roe in Figure 1.



NOTE.—Holland's categories are shown in capital letters.

Fig. 1. Circular ordering of Holland and Roe Categories.

Drawing on this background of research, Holland and his colleagues (Holland, Whitney, Cole, & Richards, 1969) reexamined the six scales from the Vocational Preference Inventory for evidence of a similar circular arrangement. The hypothesized circular (or hexagonal) configuration was found, and possible uses of organizing occupations for counseling and exploration were noted. The generalizability of the circular structure of the interests of men was documented by Cole and Hanson (1971). Examination of several well known and widely used interest inventories (SVIB, Kuder, Minnesota Vocational Interest Inventory, etc.) revealed that the circular arrangement of scales was supported in every instance. Later, Cole (1973) expanded the analyses of circular interest structure to women. The results identified the same circular configuration of interests for women. In addition, when the interest profiles of women in various occupations were projected on the circular configuration, the resultant occupational map was very similar to that of men, indicating the possible usefulness of the circular interest structure for exploration by women of the full spectrum of occupations.

The evidence cited here suggests that the interest dimensions proposed by Holland (1966) and others provide a simple skeletal framework for describing the nature and structure of interests. The nearly universal finding that these basic interest dimensions are arranged in a circular fashion provides a definite structure for use in developing a new interest inventory.

The *what* of interest measurement has been examined and the evidence suggests that a relatively few basic interest dimensions adequately describe an individual's interests. Two other factors influenced the development of the ACT Interest Inventory. One factor concerns *why* we measure interests; the other concerns *how* to report interest inventory results.

Why Measure the Interests of College Youth?

From its beginnings, the goal of interest measurement has been clear. That goal has been to help people identify careers in which they would be satisfied. For college youth in particular, the transition from secondary education to college and eventually to the world of work involves numerous and complex career decisions. Katz (1966), for example, has suggested that although vocational development is a continuous process, it is enacted through a sequence of choices. Each choice involves a preparatory stage which ideally includes a period of exploration and information gathering, as a prelude to the decision (Prediger, 1974). One critical choice college students must eventually make is the selection of a major. This choice, though reversible, influences subsequent choices related to career entry.

That career decision making for college youth includes a period of exploration has important implications for the development and subsequent use of an interest inventory. The role of an interest inventory in career decision making is twofold. First, the results of an interest inventory provide a *description* of the individual's interests; this facilitates self-exploration. Descriptive information

may be used to help people understand themselves, to organize information about themselves and the world of work, and later to examine changes in their interests over time. But as Cronbach (1971) stated, "a description is more than an adjectival phrase; it pulls behind it a whole train of implications [p. 448]." To say an individual has high Artistic interests is to call up a great number of expectations which will bear on future decisions. We measure the interests of college youth to provide descriptions that have real-world implications with respect to educational and vocational planning. This suggests that the second major role of interest inventories in educational and career decision making is to facilitate *focused exploration* of the world of work (Prediger, 1974). Focused exploration does not single out the "correct" college major or career choice for a person, but rather points to general areas for consideration. Because college youth cannot afford to explore and to keep all available options open forever, a major task confronting counselors is to help students identify and explore personally relevant options, rather than make decisions by default. Thus, a second major reason why we measure the interests of college youth is to assist them in the focusing process of exploration.

A final consideration in the rationale for the ACT Interest Inventory was the concern with *how* to communicate the results of an interest inventory to people. The next section outlines the problems and recommends a possible solution.

Communicating the Results of Interest Measurement

The rationale underlying the use of interest inventories is central to the meaningful communication of interest inventory results. The two major uses of interest inventories discussed previously imply that different reporting procedures may be needed. Information describing an individual's interests may best be communicated using normative information. That is, people generally like to know how their interests compare with the interests of their peer group. However, as Goldman (1971) suggested, while normative information provides an indication of relative standing within a group, it does not communicate the implications of that standing. A second reporting procedure which relates an individual's interest profile to the interest profiles of successful and satisfied criterion group members provides a more direct link between a person's interests and the implications of those interests for subsequent behavior. If individuals are aware of the relative similarity of their interests to those of various criterion groups, they may further explore those groups to which they are most similar. The communication of interest inventory results, based on the *similarity* of interests, for the purpose of facilitating exploration is based on a number of assumptions which require explanation.

Nearly all interest measurement reporting procedures assume that counselors may help people find satisfying and fulfilling careers by showing them the similarity of their interests to the interests of satisfied people employed in various jobs. That is, if an individual has the same characteristics as people who have entered a job and found it satisfying, it is likely that the individual will find that type of work environment satisfying as well. Logically, this element of job satisfaction is based on sharing common interests with one's co-workers.

The assessment of a person's similarity to various groups is not a new technique in counseling; it typically involves comparing an individual's profile on various measures with the profiles of particular criterion groups. The problems of profile comparison have long been recognized (Tiedeman, 1954). Prediger (1971) outlined some of the major questions associated with similarity matching. They include: Do the criterion groups actually score differently on the measures involved? Are the differences meaningful and in the expected direction? What are the most important measures? How much weight should be assigned to each? As Prediger (1971) and others (French, 1956) have pointed out, a measure of similarity can be obtained from totally irrelevant variables. To overcome these problems, Prediger (1971), drawing on the work of Tiedeman (1954) and others (Tiedeman, Rulon, & Bryan, 1951), suggested a data-conversion technique utilizing the statistical procedure of discriminant analysis to develop similarity scores. This procedure determines whether the criterion groups are differentiated by a particular set of variables. If so, the variables can be weighted and combined into independent factors (discriminant functions) that maximize the differences among the criterion groups. Experience has shown that two such "factors" typically account for the majority of the discriminating power of a set of variables (ACT, 1972; Borgen, 1972; Hanson & Prediger, 1973; Prediger, 1971; Pucel et al., 1972). Criterion group locations can be calculated from the discriminant function equations and these positions can in turn

be plotted on a coordinate grid on which the vertical and horizontal axes represent the two major factors. The nature of the obtained group differences can then be easily examined for psychological and practical meaningfulness.

An individual's factor scores can also be calculated and plotted on the same coordinate grid or "map." The individual's location can then be visually compared with the positions of the criterion groups. The potential use of this graphic representation of an individual's similarities and dissimilarities in counseling has been suggested by numerous investigators (Whitla, 1957; Dunn, 1959; Baggaley & Campbell, 1967; Cooley & Lohnes, 1968; Stahmann, 1969; Borgen, 1972), but the procedure has only recently been refined and field tested with students and counselors (Prediger, 1971). As described by Prediger (1974), similarity comparisons are especially helpful in career guidance uses of tests—primarily in facilitating career exploration. However, in clinical and personnel applications of tests, the goal is more likely to be maximizing the accuracy of predictions of group membership or success. Tatsuoka (1971) described procedures taking into account prior probabilities of group membership that are more appropriate to these latter applications. Rulon and his colleagues (1967) provided a detailed discussion of the rationale underlying discriminant analysis and similarity procedures, and Prediger (1971) illustrated its special applications to test interpretation.

Another important assumption underlying nearly all statistical reporting procedures, such as discriminant analysis, regression analysis, or the empirical scoring keys of the Strong Vocational Interest Blank, is that these procedures are based on past events and hence, reflect the status quo. That is, the relationship between what people have done in the past (e.g., choices made, grades earned, success on the job) and test scores is used in providing information about future behavior. As long as the nature of such a relationship remains viable and stable over time, the reporting procedures remain useful. Problems arise, however, when circumstances affecting the relationship between test scores and past behavior are rapidly changing, *or* if the reporting procedures reinforce certain undesirable aspects of the status quo. For example, a regression equation which assigned a large weight to measures of reading comprehension when predicting performance in a welding class might be seen as undesirable. As French (1956) noted nearly 20 years ago, undesirable aspects of the status quo may also be reinforced using discriminant analysis techniques. Hence, the nature of the relationship between test scores and the status quo should be studied and evaluated routinely to determine if the relationship continues to be viable and if any undesirable characteristics of groups or outcomes are being reinforced. If found, in the case of discriminant analysis, the criterion group could be redefined according to predetermined definitions of satisfactoriness, or an arbitrary assignment of group position on the test variables or discriminant factors could be made to relocate a criterion group in a more meaningful position (Prediger, 1971). The implications of this underlying procedure are discussed in subsequent sections dealing with the scaling and reporting of the ACT Interest Inventory scores.

Communicating interest inventory results via discriminant analysis and the similarity approach solves many of the profile matching problems and provides a reasonable foundation for reporting the ACT Interest Inventory results in a manner which facilitates exploration of educational majors and subsequent careers. In a subsequent section of this report, "Relating Interests to the World of Work," the similarity approach is extended to the basic work task dimensions characterizing occupations and human interests.

Summary

In the discussion of the development of the rationale for the ACT Interest Inventory, various conceptions of interests have been examined, the structure of interests has been discussed, a rationale for why we measure interests has been presented, and various reporting procedures have been suggested. A summary of the major points covered is presented below.

1. A common assumption in the definition of *interests* is that they represent constellations of likes and dislikes (preferences) which lead to consistent patterns of behavior.

2. The nature and structure of interests can be described in a relatively few basic interest dimensions.

3. These basic interest dimensions are related to each other in a particular circular manner.

4. The purpose of interest measurement is to help people identify and explore careers in which they would be satisfied.

5. More specifically, interest inventories may be used to *describe* an individual's interests in psychologically meaningful terms, and to facilitate *focused exploration* of various educational and career choices.

6. An emphasis on description and exploration suggests that the results of interest measurement should be reported to reflect relative standing within an appropriate peer group, and *similarity* of interests to those of appropriate criterion groups.

7. Finally, interest measurement is based on the assumption that if an individual's interests are similar to the interests of typical successful and satisfied criterion group members, the individual may find membership in that criterion group satisfying as well. Hence, the results of interest inventories tend to reflect the *current* status of educational or occupational criterion group members.

Development of the ACT Interest Inventory

The first section of this report reviewed various conceptions of interests, and described the rationale for the ACT Interest Inventory. This section describes the development of the ACT Interest Inventory and provides data concerning its reliability and related item characteristics.

Background Development

The ACT Interest Inventory is based on many years of research. Beginning with Holland's conceptual scheme for classifying occupations into six categories (Holland, 1964) and the development of an interest inventory using occupational titles (Holland, 1965), considerable empirical research has supported both the theoretical and practical usefulness of this approach and the generalizability of the conceptual framework to other interest inventories. For a review of this research, see *The Vocational Interests of Young Adults* (Hanson & Cole, 1973).

The immediate precursor of the ACT Interest Inventory was the Vocational Interest Profile (VIP), a 100-item, 8-scale interest inventory for use with vocational-technical and community college transfer students. Each VIP scale consisted of 10 items; students were asked to indicate, on a 5-point scale ranging from "dislike very much" to "like very much," the degree to which they would like doing a particular activity. Twenty experimental items were not scored on any scale. Revisions and adjustments in the item content were based on item-total correlations and the frequency distributions of item responses. The eight scales, Trades, Technical, Science, Health, Arts, Social Service, Business Contact, and Business Detail, were designed to conform to the circular configuration of interests proposed by Holland et al. (1969). Six of the eight scales correspond directly to Holland's six categories (Realistic, Investigative, Artistic, Social, Enterprising, and Conventional); the Technical and Health scales were added because of their special relevance to career-oriented educational programs. This form was normed in 1970 on a sample of 17,137 vocational-technical and community college students enrolled in career-oriented and transfer educational programs. Considerable criterion-related and construct validity, summarized in the *Handbook for the Career Planning Program* (ACT, 1972), was found for this form of the VIP. To summarize, the scales discriminated in the expected manner among successful and satisfied students enrolled in a variety of educational programs, showed a moderately high level of reliability, and conformed to the hypothesized circular configuration of interests (ACT, 1972; Hanson & Prediger, 1973).

Scale Development of the ACT Interest Inventory

Scale development began by assigning items from the VIP scales to the same-named scales of the ACT Interest Inventory. New items were written to

increase the length of the scales. Hence, a 6-scale, 120-item experimental form of the ACT Interest Inventory was used for final scale development.

Since the ACT Interest Inventory was designed for use with entering college students, final scale development was based on data for a large representative sample of students obtained by taking every 45th individual record from those of over 220,000 students who registered to take the ACT Assessment on the October 1972 national test date. The experimental form of the ACT Interest Inventory and a short biographical questionnaire were mailed to the home address of 4,819 students. Completed results were obtained from 4,077 students (approximately 85%). These records were then merged with the ACT Assessment results obtained from the October 1972 national test date. A total of 3,439 students (2,009 women and 1,430 men) completed both the ACT Assessment and the ACT Interest Inventory. Students who registered but did not take the ACT Assessment, and students who failed to grid their Social Security number correctly on both occasions were not included in the sample. Additional item analyses, raw score-to-standard score scaling, and norming were based on this sample. The background characteristics of this sample are described in the norming section.

Since the scales of the ACT Interest Inventory were designed to measure the six basic Holland-type interest dimensions, it was essential that the items of a scale indicate a high degree of homogeneity. Item-total score correlations, based on 20-item scales, were calculated for males, females, and the total sample. Items were retained on a scale if they met the following criteria:

1. Each item should correlate higher with its own scale than with any other scale.

2. Each item should correlate *at least* .45 with its total scale score.

3. Each item should correlate no higher than .50 with any other scale. (Note.—A few exceptions were made when an item correlated extremely high with its own scale [$>$ .75] and just slightly above .50 with a closely related scale.)

4. Items with a large proportion (40% or more) of students selecting the extreme response categories (e.g., like very much) were eliminated from a scale.

Items were first reviewed separately for each sex, and those not meeting the criteria for both sexes were omitted from a scale. Item-total correlations based on the total sample were then reviewed to determine if they met the item selection criteria. At least 15 of the 20 items for each scale met the criteria.

Six 15-item scales were then constructed for the reliability and additional item analysis studies. Scales having more than 15 items meeting the criteria were reduced to 15 items by deleting the items with the *lowest* item-total correlation. The resulting item composition for each scale is provided in Appendix 4.

Item Homogeneity

The relationships between the individual items and the 15-item scales of the ACT Interest Inventory were summarized by correlating each item with each total score. If the items comprising a scale are homogeneous, the correlation of those items with that total scale score should be higher, on the average, than with any other total score. The median item-total correlations for each set of items with each total score are presented in Table 1. The correlations of an item with its own scale are probably an overestimate because the item is part of the total score and contributes specific, error, and common factor variance to the correlation where only the latter is desired. When the scales are very short and the correlations are small, Guilford (1965) suggests correcting these correlations. However, with scales exceeding 20 items and having moderately large item-total correlations, correction formulas will not materially change the rank order of the correlations. A correction was not made, however, since the 15-item scales are moderately long and the *relative* size of the correlations across scales was of primary interest. Median correlations of a set of items with its own scale are also probably slight overestimates. The relative size is of primary importance, however.

For all scales, the median item-total correlations of a set of items with its total score are considerably higher than for any other total score. Hence, the items of each scale are more closely related to their own scale than to any other scale. The level of the median item-total correlations of each item set with its total score was .61 or higher. The next highest median correlations were in the low to mid-30s, and nearly always with an adjacent scale. For example, the median item-total correlation of the Social Service items with the Social Service total score is .69 and the next highest median correlations are

TABLE 1

Median Item-Total Correlations for Each Set of Items with Each ACT Interest Inventory Total Score

Item Sets (15 items/scale)	ACT Interest Inventory Scales					
	Science	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*
Science	.79	.08	.10	.03	.03	.32
Creative Arts	.10	.61	.27	.17	.02	.09
Social Service	.05	.31	.69	.27	.09	.06
Business Contact	.05	.17	.21	.61	.30	.17
Business Detail	.08	.05	.08	.35	.70	.18
Technical	.28	.07	.13	.14	.17	.66

Note.—Based on a college-bound sample of 2,009 women and 1,430 men.

with the Creative Arts (.31) and Business Contact (.27) total scores, adjacent scales on the circular continuum of interests. This same pattern of correlations generally holds for other sets of items as well. In general, each set of items correlate highly with their own scale and much lower with other scales, as prescribed by the item selection criteria. The relatively high level of correlation suggests that the goal of constructing highly homogeneous sets of items for each scale was met. Additional evidence concerning the homogeneity of the interest scales is provided by the internal estimates of reliability reported in a subsequent section of this paper.

Group Differences in Item Responses

The way in which different groups respond to the items of an interest inventory helps explain the nature of the scales and can have important implications for the way in which scores are reported and interpreted to students. At least some of the concern with possible bias in the use of interest inventories has focused on group differences in item responses, particularly sex differences (Harmon, 1973) and to a lesser degree racial ethnic differences (Gump & Rivers, 1974). For these reasons the ways in which men and women and the ways in which white and nonwhite students respond to the items were examined.

Sex differences. To determine if men and women differed in their responses to the ACT Interest Inventory items, the percentage of "like" responses for each item was calculated by summing the "like" and "like very much" categories. Table 2 presents the mean of the absolute difference between the percentage of "like" responses for men and women, the range of differences, and the classification of the items into one of three categories. The three categories are: (a) essentially *no difference* in the percentage of "like" responses, (b) a higher percentage of "like" responses for men, and (c) a higher percentage of "like" responses for women. A difference of 10% in the number of "like" responses was used to represent a "meaningful" difference between two item distributions. In applying the same analysis, Campbell (1974) used 15% to indicate a meaningful difference. If the difference in two item distributions was 10% or less, the two distributions were considered essentially the same for the two groups being compared.

The average difference (mean of the absolute difference) between men and women ranges from 8.7 for the Business Contact scale to 25.4 for the Social Service scale. Five of the six scales had an average difference greater than 10%. For the Technical (22.9) and Social Service (25.4) scales, the differences were large. Only 3 of the 15 items in the Technical scale showed less than a 10% difference between men and women, and only 1 of the 15 items in the Social Service scale showed a difference of 10% or less. As expected, the men had a higher percentage of "like" responses for 8 of the 15

items of the Science scale and for 12 of the 15 items of the Technical scale. Women had a higher percentage of "like" responses for 14 of 15 Social Service items and for 9 of 15 Creative Arts items. Overall, no differences were found between the responses of men and women for approximately 38% of the items; males had a higher percentage of "like" responses for about 25% of the items, and women had a higher percentage of "like" responses for about 37% of the items.

Although the ACT Interest Inventory shows considerable overall balance of items, men and women do respond differently to the ACT Interest Inventory items on specific scales. The directions of the differences are closely related to particular scales. Men say they like Science and Technical activities more often than women, and, conversely, women say they like Social Service and Creative Arts types of activities more frequently. These data parallel similar findings of sex differences in career choice and career-related experiences (Holland, 1973; Prediger, Roth, & Noeth, 1973).

Racial/ethnic differences. Since substantial sex differences were found for specific scales, the comparisons of item responses by racial/ethnic background were completed separately by sex. Because of the relatively small n-counts, data for various racial/ethnic groups (Afro-American/Black,

TABLE 2

Sex Differences on ACT Interest Inventory Item Responses for a Sample of 3,439 College-Bound Students

	ACT Interest Inventory Scales							
	Science	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*	**Total Number of Items in Each Category**	**Percentage of Total**
Average difference[a] between men and women in the percentage of "like" responses	13.1	15.7	25.4	8.7	11.4	22.9		
Range of differences	0-33	0-47	8-41	0-31	0-36	4-40		
The number of items showing a difference in the percentage of "like" responses of 10% or less	5	6	1	11	8	3	34	37.8
The number of items with men having a higher (>10%) percentage of "like" responses	8	0	0	1	2	12	23	25.6
The number of items with women having a higher (>10%) percentage of "like" responses	2	9	14	3	5	0	33	36.7

Note.—Sample based on 2,009 women and 1,430 men completing the six 15-item scales of the ACT Interest Inventory.

[a]Average difference—mean of the absolute difference between the percentage of "like" responses for men and the percentage of "like" responses for women.

Chicano, Oriental, American Indian) were combined into one category called nonwhite. Tables 3 and 4 present the results of these analyses. For both men and women, only two of the six scales showed an average difference of more than 10% in the percentage of "like" responses between whites and nonwhites. For men, the nonwhites had a higher percentage of "like" responses for 12 of 15 items on both the Social Service and Business Contact scales. For women, the nonwhites had a higher percentage of "like" responses on the Business Detail and Business Contact scales. Over the entire inventory, nearly 60% of the items showed no difference for men and about 75% of the items showed no difference for women. These percentages are relatively high when contrasted with the percentage of items (38%) showing no difference between men and women. Of those remaining items showing a difference, both nonwhite men and women indicated a higher percentage of "like" responses than white men and women. This evidence suggests that both white and nonwhite racial groups responded to the ACT Interest Inventory items in a similar fashion. Counselors may expect to find, however, that nonwhite males consistently obtain slightly higher scores on the Social Service and Business Contact scales. Nonwhite females may obtain slightly higher scores on the Business Detail scale and to a lesser extent on the Business Contact scale. These differences are not large enough to warrant separate norms and reporting procedures, however. That nonwhites typically responded with a larger percentage of "like" responses was also found by Strong (1952, 1955a) and that blacks expressed a stronger preference for social service types of

TABLE 3

Race Differences on Interest Inventory Item Responses for a Sample of Male College-Bound Students

	ACT Interest Inventory Scales							
	Science	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*	**Total Number of Items in Each Category**	**Percentage of Total**
Average difference between nonwhites and whites in the percentage of "like" responses	3.2	6.3	14.5	12.7	9.1	9.0		
Range of differences	0-12	0-23	5-26	4-25	2-20	3-18		
The number of items showing a difference in the percentage of "like" responses of 10% or less	14	14	3	3	9	11	54	60.0
The number of items with nonwhites having a higher percentage of "like" responses	0	1	12	12	6	3	34	37.8
The number of items with whites having a higher percentage of "like" responses	1	0	0	0	0	1	2	2.2

Note.—Sample based on 109 nonwhites and 1,321 whites.

occupations was found by Bayer and Boruch (1969), Hager and Elton (1971), and Kimball, Sedlacek, and Brooks (1971).

Reliability of the ACT Interest Inventory Scales

An important characteristic of any measure is its reliability, that is, its consistency and accuracy of measurement. Several different methods for determining reliability are available. Each method considers different sources of error in test scores such as (a) variation in the individual's responsiveness to items at a particular moment in time, (b) variation in the individual from time to time, and (c) variations in the samples of items chosen to represent an interest dimension. Internal estimates of reliability account for the first and third sources of error, while the test-retest correlations account for the first and second sources. Both types of reliability estimates are presented here for the sample of college-bound students comprising the norm group for the ACT Interest Inventory.

Internal estimates of reliability. The internal estimates of reliability for the six scales of the ACT Interest Inventory are presented in Table 5. Calculating internal estimates of reliability on the same sample used for final item selection and scale development may result in inflated estimates of reliability. Hence, the estimates presented in Table 5 should be contrasted with the results based on a totally different sample. For this reason, Cronbach alpha (Cronbach, 1951) estimates of reliability for a 10% representative sample of the college educational major criterion groups, described in the section on validity, are presented in Table 6.

TABLE 4

Race Differences on Interest Inventory Item Responses for a Sample of Female College-Bound Students

	ACT Interest Inventory Scales							
	Science	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*	**Total Number of Items in Each Category**	**Percentage of Total**
Average difference between nonwhites and whites in the percentage of "like" responses	2.0	4.3	6.7	11.8	13.9	4.5		
Range of differences	0-7	1-12	0-14	5-18	0-21	1-12		
The number of items showing a difference in the percentage of "like" responses of 10% or less	15	14	12	10	3	13	67	74.4
The number of items with nonwhites having a higher percentage of "like" responses	0	1	3	5	12	1	22	24.4
The number of items with whites having a higher percentage of "like" responses	0	0	0	0	0	1	1	1.1

Note.—Sample based on 182 nonwhites and 1,827 whites.

TABLE 5

Internal Estimates of Reliability for Six ACT Interest Inventory Scales on a College-Bound Student Sample

ACT Interest Inventory Scales	Men					Women				
	Mean	*S.D.*	*Split-half*	*Alpha*[a]	*S.E.M.*[b]	*Mean*	*S.D.*	*Split-half*	*Alpha*[a]	*S.E.M.*[b]
Science	2.94	0.95	.96	.94	.23	2.56	0.92	.95	.93	.24
Creative Arts	2.54	0.77	.89	.89	.26	3.02	0.78	.86	.87	.28
Social Service	3.13	0.74	.90	.91	.22	3.87	0.66	.89	.88	.23
Business Contact	2.76	0.70	.89	.89	.23	2.79	0.70	.88	.88	.24
Business Detail	2.59	0.73	.92	.91	.22	2.69	0.82	.92	.92	.23
Technical	2.92	0.69	.89	.88	.24	2.18	0.63	.89	.87	.23

Note.—Based on 1,233 men and 1,738 women with complete data (i.e., all 90-item responses and scale scores complete).

[a]Cronbach alpha coefficient.

[b]Standard Error of Measurement based on coefficient alpha estimate of reliability and reported in average item score units.

TABLE 6

Internal Estimates of Reliability for Six ACT Interest Inventory Scales for a Sample of College Seniors

ACT Interest Inventory Scales	Men					Women				
	Mean	*S.D.*	*Split-half*	*Alpha*[a]	*S.E.M.*[b]	*Mean*	*S.D.*	*Split-half*	*Alpha*[a]	*S.E.M.*[b]
Science	2.94	.92	.90	.94	.22	2.74	.92	.90	.93	.24
Creative Arts	2.87	.76	.91	.90	.24	3.31	.70	.87	.87	.25
Social Service	3.46	.68	.90	.91	.20	3.82	.66	.88	.89	.22
Business Contact	2.92	.76	.91	.91	.23	2.76	.71	.89	.89	.24
Business Detail	2.53	.73	.88	.91	.22	2.41	.80	.87	.92	.23
Technical	2.91	.69	.87	.89	.23	2.34	.66	.85	.88	.23

Note.—Based on 666 men and 552 women with complete data.

[a]Cronbach alpha coefficient.

[b]Standard Error of Measurement based on coefficient alpha estimate of reliability and reported in average item score units.

The coefficient alpha estimates of reliability shown in Table 5 ranged from .88 to .94 for men and from .87 to .93 for women, with a median of about .90 for men and .88 for women. The coefficient alpha estimates of reliability were used to calculate the standard error of measurement in average item score units. The average item score is a raw score obtained by calculating the mean item response (range 1.0 to 5.0) of each 15-item interest scale. The standard errors of measurement range from .22 to .26 for men and from .23 to .28 for women, representing approximately one-third standard deviation in average item score units. Data based on the college senior sample shown in Table 6 closely parallel data based on the high school college-bound sample.

The split-half estimates of reliability were calculated by correlating the score on the even numbered items with the score on the odd numbered items and then adjusted to reflect the full length scale using the Spearman-Brown formula. These correlations ranged from .89 to .96 for men and from .86 to .95 for women, with a median of about .89 for both sexes.

Test-retest correlations. The test-retest correlations for a group of 300 college-bound students who took the ACT Interest Inventory on two occasions separated by a 60-day interval are reported in Table 7. The correlations range from .80 to .89 with a median of approximately .85. As expected, the standard error of measurement based on the test-retest correlations, averaging approximately .30, was slightly larger than the standard error of measurement based on the internal estimates of reliability. The negligible change in mean score from one administration to the next for the six scales of the ACT Interest Inventory indicates there was no systematic change in the level of scores over this period of time for these students.

In summary, these data suggest rather high levels of reliability, considering the relatively short length (15 items) of each scale. Counselors may be confident that the scales of the ACT Interest Inventory measure six dimensions of interest with sufficient consistency and accuracy for individual counseling with students.

TABLE 7

Test-Retest Correlations for Six ACT Interest Inventory Scales for a 60-day Interval Based on a College-Bound Student Sample

ACT Interest Inventory Scale	1st Administration		2nd Administration		r	S.E.M.[a]
	Mean	*S.D.*	*Mean*	*S.D.*		
Science	2.86	.94	2.89	.97	.88	.32
Creative Arts	2.94	.77	3.05	.82	.86	.31
Social Service	3.59	.76	3.65	.81	.89	.27
Business Contact	2.83	.67	2.92	.68	.80	.30
Business Detail	2.70	.75	2.71	.79	.82	.34
Technical	2.58	.75	2.64	.75	.85	.29

Note.—Based on 300 college-bound students.

[a]S.E.M. = Standard Error of Measurement calculated with standard deviations from the first administration.

Norming the ACT Interest Inventory

This section describes the development of normative information for the ACT Interest Inventory, including the sampling procedures, the background characteristics of the norm group, the raw score-to-standard score scaling procedures, and the percentile rank reporting procedures.

The Norm Group Sample

The sampling procedures followed to obtain the 3,439 students constituting the norm group were described on page 9; this section provides a detailed description of the background characteristics of that norm group, including geographic location, level of education, racial ethnic background, father's occupation, and ACT ability level.

Table 8 shows the number and percentage of students in six geographic locations according to their component states. The norm group sample is typical of the ACT-tested student population in that the students from the Midwest (39%) are overrepresented, while students from the West (5%) and East (8%) are underrepresented. Nearly 95% of the sample were high school seniors, about 4% were

TABLE 8

Geographic Distribution of College-Bound Student Norm Group

Region	Component States	Regional N		Percent of Total	
		M	*F*	*M*	*F*
Western	Alaska, California, Hawaii, Idaho, Nevada, Oregon, Washington	70	99	4.9	4.9
Mountain/Plains	Colorado, Kansas, Montana, Nebraska, North Dakota, South Dakota, Utah, Wyoming	206	271	14.4	13.6
Southwestern	Arizona, Arkansas, New Mexico, Oklahoma, Texas	226	318	15.8	15.9
Midwestern	Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, Ohio, Wisconsin	542	780	37.9	39.0
Southeastern	Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia	279	358	19.5	17.9
Eastern	Connecticut, Delaware, District of Columbia, Maine, Maryland, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont, West Virginia	106	172	7.4	8.6
Data Missing for		1	11		
Total		1,430	2,009		

high school graduates, and only about 1% were high school juniors.

The racial ethnic background of the norm group sample is reported in Table 9. The norm group sample is predominantly White (92%); there are approximately 5% Blacks, about 2% Mexican/Spanish Americans, and only very small percentages of American Indians and Oriental Americans.

The distributions of the father's occupation shown in Table 10 provide an indication of the socioeconomic (SES) level of the norm group sample. Approximately 34% of the students had fathers in the managerial and professional level occupations, while about 19% had fathers in the semiskilled or unskilled occupations. About 12% of the students had fathers in the skilled trades and about 14% had fathers in the small business or farm owner occupations. The distribution of father's occupation represents a broad cross section of SES levels. As with the other background characteristics, there were no

TABLE 9

Distribution of Ethnic Background for College-Bound Norm Group

Student Response	Men (N=1,417)	Women (N=1,980)	Total (N=3,397)
Afro-American/Black	3.9%	5.8%	5.0%
American Indian	0.8	0.8	0.8
Caucasian American/White	92.2	91.0	91.5
Mexican/Spanish American	2.0	1.6	1.8
Oriental American	1.2	0.8	0.9

TABLE 10

Distribution of Father's Occupation for College-Bound Norm Group

Occupational Category	Men (N=1,378)	Women (N=1,874)	Total (N=3,252)
Managerial	17.0%	15.4%	16.1%
Professional	18.1	17.9	18.0
Sales	6.0	5.7	5.8
Semiprofessional or technical	5.1	5.7	5.4
Semiskilled	12.1	13.9	13.2
Skilled trades	13.1	11.8	12.4
Small business or farm owner	13.4	14.7	14.2
Supervisor or public official	8.9	8.5	8.7
Unskilled	6.1	6.5	6.3

sizable sex differences.

Table 11 presents the means and standard deviations of the four ACT ability measures and the ACT Composite score for the men and women in the norm group sample. Compared to a 3-year sample of ACT-tested students (ACT, 1973), the students comprising the norm group for the ACT Interest Inventory have slightly higher means for each of the ACT ability measures and the Composite score. For example, the norm group men have a mean Composite score of 21.4 and the women, a mean Composite score of 20.0, compared to a mean Composite score of 19.3 for men and 18.8 for women in the ACT Assessment sample.

TABLE 11

Means and Standard Deviations of ACT Ability Measures for the ACT Interest Inventory Norm Group Sample and the ACT Assessment Norm Group Sample

		ACT Ability Measures				
		English	*Mathematics*	*Social Studies*	*Natural Sciences*	*Composite*
ACT Interest Inventory Sample						
Men	$\overline{X}$	18.4	22.2	20.6	23.7	21.4
	S.D.	5.0	6.8	6.9	6.0	5.4
Women	$\overline{X}$	19.8	19.6	19.2	20.9	20.0
	S.D.	4.9	6.9	7.1	6.1	5.4
ACT Assessment Sample						
Men	$\overline{X}$	16.8	19.9	19.1	21.1	19.3
	S.D.	5.6	7.1	7.1	6.5	5.7
Women	$\overline{X}$	18.8	17.9	18.2	19.5	18.8
	S.D.	5.3	6.9	7.0	6.1	5.4

Note.—ACT Assessment sample is based on 2,724,342 college-bound students who took the ACT Assessment (1969-72).

The background characteristics of the norm group for the ACT Interest Inventory show this sample to be quite typical of most students who take the ACT Assessment. That is, the sample is predominately white, consists primarily of high school seniors, and has proportionately more students from the Midwest than from the East or far West. Counselors making interpretive statements based on the normative information should recognize that certain subgroups of students (e.g., adult students returning to college) are not well represented. Considerable counselor experience and clinical judgment is needed to provide sound interpretation for such special subgroups. Local normative information for the ACT Interest Inventory scales is provided as part of the High School Class Profile Report to help meet this need, however.

Scaling the ACT Interest Inventory

Data reported previously suggested that college-bound men and women respond to the ACT Interest Inventory items in distinctly different ways. The question faced in scaling the ACT Interest Inventory was how best to deal with such sex differences. The decision on handling sex differences was based on an explicit goal for the inventory reporting procedures. That goal was to report scores in a form which would suggest educational major or occupational options identically for both sexes. The aim was to avoid the designation of "male physics majors" and "female physics majors," for example, and to use instead simply "physics majors." Because this goal might have been accomplished in different ways, depending upon the empirical data, the task was to examine the possibilities and find the optimal one.

There are essentially two alternatives for scaling raw scores to standard scores (Cole & Hanson, in press). One is to combine both sexes into one reference group and the other is to scale raw scores to standard scores separately by sex. There are wide differences in the score distributions produced by the two procedures. In the first case (combined sex reference group), a larger percentage of men than women will receive high scores in the Technical and Science areas; more women than men will receive high scores in the Social Service and Creative Arts areas. The use of the second procedure (separate sex reference groups) results in approximately equal percentages of men and women in each category. This difference is documented in Table 12, where the percentages of students who obtained their highest score for each of the six Holland categories under the two procedures are reported. A

TABLE 12

Distribution of Percentages of Holland Codes for Women and Men for Different Types of Score Referencing[a]

	Codes Based on Raw Scores		Codes Based on Separate Sex Norms		Codes Based on Combined Sex Norms	
Holland Code	*W*	*M*	*W*	*M*	*W*	*M*
Social	67.3%	26.3%	17.9%	14.3%	28.8%	4.1%
Enterprising	3.1	9.6	13.6	13.3	11.1	14.0
Conventional	9.7	8.7	18.0	16.2	20.0	11.9
Realistic	0.2	18.9	14.4	19.4	2.8	35.8
Investigative	9.1	30.0	19.3	21.2	13.5	24.7
Artistic	10.8	6.4	16.7	15.3	24.1	9.4
Totals	100%	100%	100%	100%	100%	100%

Note.—Data obtained from Cole & Hanson (1974).

[a]Based on the scores of 3,439 college-bound high school students (2,009 women and 1,430 men) who took the ACT Interest Inventory in October 1972.

more complete discussion of the implications of these data is provided by Prediger and Hanson (1974).

Within each of the two procedures, there are two possibilities for the linkage of scores from the inventory to the score profiles of criterion groups. The mean profiles of each criterion group may be highly similar for the two sexes or quite different. If the profiles of criterion groups are similar for both sexes, one profile for each criterion group can be used in the reporting procedures. This was the desired goal and means that "physics majors," "engineering majors," "accounting majors" can be discussed without sex identification. If profiles differ by sex, the reporting procedures must take those differences into account and describe "male educational majors" and "female educational majors" differently.

TABLE 13

Possible Results of Different Scaling Procedures

Scaling Procedure	Criterion Group Profile Outcomes
Combined Sex Reference Group	1. Different by Sex (Undesirable)
	2. Similar by Sex (Desirable)
Separate Sex Reference Group	3. Different by Sex (Undesirable)
	4. Similar by Sex (Desirable)

Table 13 summarizes the two procedures and possible outcomes when scores are linked to criterion groups. The table shows the desirable outcomes of similar profiles by sex. The question remaining is which of the four possible outcomes are empirically demonstrated. The discussion in the later section on validity will show that if a combined sex reference group is used, the outcome will be different profiles by sex (outcome 1 in Table 13). This is an undesirable outcome according to the stated goal of treating the linkage of inventory scores to criterion groups identically by sex. However, if a separate sex reference group is used in the scaling procedure, the group profiles are highly similar by sex (outcome 4). Thus the desired goal of counseling with students considering various educational majors without reference to sex can be accomplished through the scaling of scores separately by sex. This then was the scaling procedure adopted for the ACT Interest Inventory.

The average item scores (the total scale score divided by the number of items) were scaled to a normalized T-score scale with a mean of 50 and a standard deviation of 10 separately within sex groups using an area transformation scaling procedure described by Guilford (1965, p. 521). An area tranformation, rather than a linear transformation, was used because the results produce standard scores which correspond to approximately the same percentile ranks across all scales. Hence, a standard score of 60 would have a percentile rank of approximately 84 for all scales.

The results of the scaling are shown in Appendix 3. Average item score to standard score to percentile rank conversions are shown for each raw score unit. Slight variations exist from scale to scale in the conversion tables because the scaling procedure involves fitting the empirical data to a normal curve.

Reporting Normative Information for the ACT Interest Inventory

Normative information for the ACT Interest Inventory is reported numerically and graphically. Figure 2 illustrates the section of the ACT Student Profile Report in which the percentile rank information is reported. The "x" represents the approximate percentile rank and the dashes represent an error band of approximately one standard error of measurement on each side of the reported score. Reporting the percentile ranks in this way emphasizes that the scores are only estimates and not precise values. This reporting procedure also shows the student's total profile compared to the profiles of other college bound students of the same sex. Scales with error bands which do not overlap usually indicate psychologically meaningful differences in interests.

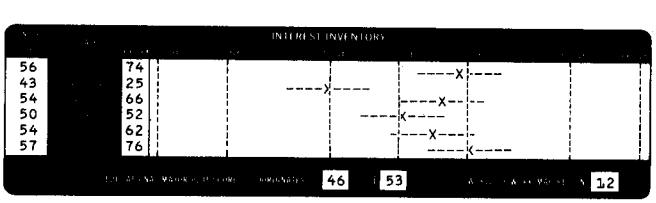


Fig. 2. ACT Interest Inventory Score Report.

Validation of the ACT Interest Inventory

Validation has been defined as a process of examining the justification for the various uses of an assessment (Cronbach, 1971). Viewed as a process, validation is never finished. As long as there are new students, a changing educational system, and a society with changing goals, the interpretations and uses of an educational assessment will also change. Hence, data reported and summarized in this report merely mark the beginning of the validation process for the ACT Interest Inventory. As additional data are analyzed, new information may suggest modification and change in the instrument and in its use.

To begin the validation process, however, data are presented which provide evidence supporting the two primary uses of the ACT Interest Inventory—*description* of people's interests in psychologically meaningful terms, and the identification of personally relevant educational and vocational options for purposes of *exploration.* Data relevant to educational criteria are presented in detail here. A summary of research relating the ACT Interest Inventory results to vocational criteria is presented in a later section, in conjunction with a description of the ACT Occupational Classification System. The rationale for these uses was provided in the first section of this report. Previous research with highly similar interest inventories developed for the Career Planning Program, 12-13 and the Career Planning Program, 8-11 provides considerable evidence of the content, concurrent, and construct validity of the ACT Interest Inventory (ACT, 1972; ACT, 1974). The item characteristics, as described in an earlier section of this report, provided preliminary evidence concerning the descriptive nature of the six scales. The following sections of this report will provide additional data supporting the two primary uses of the ACT Interest Inventory.

Data Related to the Descriptive Use of the ACT Interest Inventory

The ACT Interest Inventory is used to provide a description of a student's interests in psychologically meaningful terms. Data are reported in this section which further define the characteristics of the six scales by showing the interrelationships among the scales and the relationships of the scales with other variables such as ability measures, achievement measures, other interest inventories, and various measures of life experiences. These data provide evidence bearing on the construct validity of the scales.

Relationships among scales. The ACT Interest Inventory was designed to measure six important interest dimensions identified in the research literature. These six dimensions correspond to the six personal orientations proposed by Holland (1973) and should be related according to a hypothesized circular configuration (see page 5 for an example and related discussion). The intercorrelations of the six ACT Interest Inventory scales for the norm group sample of college-bound men and women are shown in Table 14. A graphic interpretation of these correlation matrices using a spatial configuration analysis (Cole & Cole, 1970) is presented in Figures 3 and 4. The spatial configuration analysis projects the vector points corresponding to the correlations among scales in p-dimensional space (six-space, in this case) into a smaller space. The resulting reduction in the number of dimensions needed to summarize the relationships between variables usually leads to a better understanding of the complex structure of the variables in a correlation matrix. Previous studies (Cole et al., 1971; Cole & Hanson, 1971; Cole, 1973) have shown that a two-dimensional space accounts for a majority of the variation of the vector points in p-dimensional space. Thus, the complex interrelationships between many variables may be better understood by examining the distances between variables on the two-dimensional plane. Variables showing a high degree of relationship fall close together on the plane, and variables with a low degree of relationship fall farther apart. This analysis was used to determine whether the ACT Interest Inventory scales used with college-bound students have the circular configuration proposed by Holland (1973).

For men the correlations between scales range from .03 to .54 with a median of .25; for women the correlations range from -.03 to .49 with a median correlation of .26. The six scales are relatively independent and generally appear related in the expected manner. The scales for both men and women shown in Figures 3 and 4 fall in the expected circular order from Science to Creative Arts to Social Service to Business Contact to Business

TABLE 14

Correlations between ACT Interest Inventory Scales

	ACT Interest Inventory Scales					
	Science	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*
Science	1.00	.21	.17	.01	.06	.43
Creative Arts	.27	1.00	.26	.31	-.03	.32
Social Service	.23	.52	1.00	.36	.06	.17
Business Contact	.03	.37	.45	1.00	.49	.33
Business Detail	.15	.11	.18	.54	1.00	.36
Technical	.34	.14	.16	.25	.31	1.00
Males						
Mean	50.0	50.0	50.0	50.0	50.0	50.0
S.D.	10.4	10.0	10.0	10.0	10.1	10.0
Females						
Mean	50.0	50.0	50.0	50.0	50.0	50.0
S.D.	10.3	10.0	10.0	10.0	10.0	10.4

Note.—Correlations are reported for 2,009 women above the diagonal and 1,430 men below the diagonal. Raw scores were converted to standard scores within sex group with a mean of 50 and a standard deviation of 10 based on these samples.

Detail to Technical and back to Science. Information from the correlation matrix and the spatial configuration analysis suggests that the ACT Interest Inventory scales measure six relatively independent interest dimensions which are related to each other according to theoretical expectations.

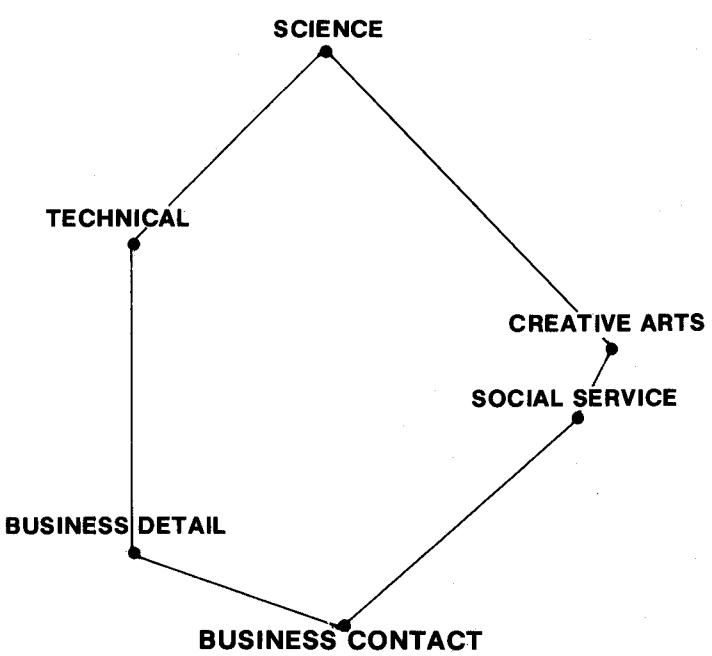


Fig. 3. Spatial configuration of ACT Interest Inventory scales for a sample of college-bound males.

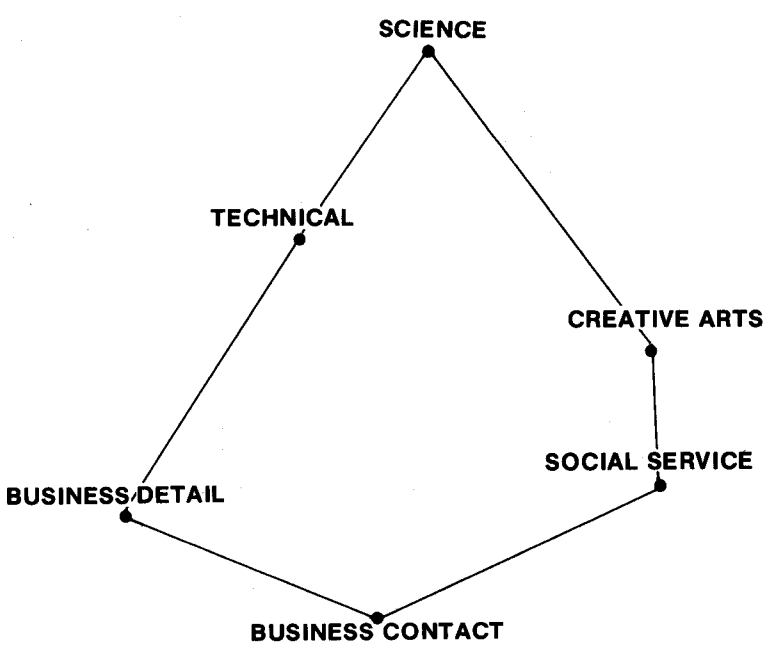


Fig. 4. Spatial configuration of ACT Interest Inventory scales for a sample of college-bound females.

Correlations of the ACT Interest Inventory with the Strong Vocational Interest Blank. Another way to determine what a particular set of scales measures is to correlate the scales with an instrument independently designed to measure the same constructs. High correlations between like-named scales provide evidence supporting the construct validity of both sets of scales.

To obtain this type of validity evidence, the Strong Vocational Interest Blank (SVIB) and the ACT Interest Inventory were mailed to 800 college seniors from four colleges. Answer sheets were returned by only 214 students, a meager 26.7% return rate. Of these, only 145 students completed sufficient items on both interest inventories so that usable scores could be obtained. Students who failed to provide identification sufficient to permit proper matching of the results from both interest inventories were also excluded from the sample. Because the return response rate was low and because the sample sizes are small, the results of this analysis should be interpreted with caution and considered only as preliminary. Additional data are needed to substantiate the results.

The SVIB-M and SVIB-W were scored on the new Strong-Holland scales, described by Campbell & Holland (1972) and Hansen & Johansson (1972), respectively. Both the SVIB and ACT Interest Inventory scores were converted to standard scores using the appropriate conversion tables supplied for each instrument. Zero-order correlations were then computed between the six Strong-Holland scales and the six ACT Interest Inventory scales. The results are presented in Table 15 for men and Table 16 for women, with the correlations for corresponding scales appearing along the diagonal. For men the correlations between like-named scales range from a high of .90 for the SVIB Artistic and the ACT Creative Arts scales, to .74 for the SVIB Social and Enterprising and the ACT Social Service and Business Contact scales. For women the correlations range from .87 for the SVIB Investigative and the ACT Science scales, to .62 for the SVIB Realistic and the ACT Technical scales. These correlations are high and approach the upper limit of correlation possible, given the reliabilities of the scales. Considerable supporting evidence of the concurrent and construct validity of these scales is provided by the data obtained from this limited sample. Replication of these results using larger samples is needed, however. Similar levels of correlation between the SVIB-W Strong-Holland scales and an earlier form of the ACT Interest Inventory was found by Hanson, Lamb, and English (1974). In addition, using redundancy analysis (Stewart & Love, 1968), Hanson (1973) showed that the SVIB-W and the earlier form of the ACT Interest Inventory shared a high degree of common variance (60%). Also, considerable convergent and divergent validity was evident when a different form of the ACT Interest Inventory was correlated with the Kuder General Interest Survey, Form E, the Ohio Vocational Interest Survey (OVIS), and the Vocational Preference Inventory (VPI), using samples of 9th and 11th grade high school students (ACT, 1974). In combination, these studies provide supporting evidence that the dimensions measured by the ACT Interest Inventory are highly related to other measures of the same constructs.

Relationship of ACT Interest Inventory Scales to academic ability and achievement variables. The relationship between interests and abilities has been reviewed and summarized in most texts on tests used in guidance (e.g., Super & Crites, 1962; Goldman, 1971; Anastasi, 1961). Because the degree of relationship between abilities and interests is generally low to moderate, the usual conclusion is that interests and abilities represent quite different characteristics. Similar results were obtained when the ACT Interest Inventory was correlated with several academic ability and achievement variables obtained from the ACT Assessment. Table 17 for men and Table 18 for women show the correlations between the six ACT Interest Inventory scales and student-reported high school grades in four subject areas, the five ACT test scores, and the nine Out-of-Class Accomplishment scores. Only the Science interest scale correlates consistently with high school grades and ACT test scores; these correlations are always below .40. The highest correlation of the Science scale with these variables is either with the Natural Science GPA or average GPA or with the ACT Natural Science or Composite score. The lowest correlation with the Science scale is for either the H.S. English GPA or the ACT English test score. The other ACT Interest Inventory scales correlate to a very low degree with the H.S. grades or the ACT scores. The correlations of the Out-of-Class Accomplishment scales with the ACT Interest Inventory scales are generally low (less than .40), but do show some convergent and divergent validity. The highest correlations are nearly always with the similarly named dimension. For example, for men the two Science scales

TABLE 15

Correlations between ACT Interest Inventory and Strong-Holland SVIB Scales for Male College Seniors

ACT Interest Inventory Scales	Strong-Holland Interest Scales					
	Investi-gative	*Artistic*	*Social*	*Enter-prising*	*Conven-tional*	*Realistic*
Science	.83	.23	.37	-.10	.20	.42
Creative Arts	.28	.90	.30	-.11	-.11	-.12
Social Service	.36	.36	.74	.09	.17	.28
Business Contact	-.26	-.15	.32	.74	.54	.08
Business Detail	.14	-.18	.12	.47	.78	.40
Technical	.57	.03	.26	.26	.45	.85
ACT Interest Inventory						
Mean	53.2	52.2	44.5	47.7	51.0	50.1
S.D.	11.7	10.4	10.6	9.5	11.3	11.4
N=62						
Strong-Holland Scales						
Mean	49.1	51.7	47.8	46.5	47.5	48.9
S.D.	10.9	9.7	9.0	9.3	10.8	11.8
N=62						

TABLE 16

Correlations between ACT Interest Inventory and Strong-Holland SVIB Scales for Female College Seniors

ACT Interest Inventory Scales	Strong-Holland Interest Scales					
	Investi-gative	*Artistic*	*Social*	*Enter-prising*	*Conven-tional*	*Realistic*
Science	.87	.46	.00	-.23	-.13	.52
Creative Arts	.34	.85	.26	.21	-.20	.19
Social Service	.07	.28	.77	.40	.14	.01
Business Contact	-.25	.01	.53	.78	.24	-.20
Business Detail	.09	-.02	.24	.41	.80	.29
Technical	.52	.39	.02	-.02	.03	.62
ACT Interest Inventory						
Mean	52.0	52.6	51.9	50.6	51.1	52.9
S.D.	10.9	10.3	10.1	11.1	10.9	10.7
N=83						
Strong-Holland Scales						
Mean	49.5	51.6	54.2	50.4	50.9	52.4
S.D.	10.4	9.9	9.3	8.4	10.1	10.2
N=83						

correlate .31, Practical Skills and Technical correlate .33, and the Writing, Speech, and Art scales correlate with the Creative Arts interest scale .36, .32, .26 respectively. The same general pattern is noted for women, although the general level of correlation is lower.

Summary. Data presented in this section suggest that the six scales of the ACT Interest Inventory are relatively independent, yet interrelated according to theoretical expectations. Relationships with ability measures, high school grades, and out-of-class accomplishments or experiences also conform to theoretical expectations. Finally, the six interest dimensions measured by the ACT Interest Inventory are highly related to the Strong Vocational Interest Blank scales independently constructed to measure the same dimensions. Correlations of a different form of the ACT Interest Inventory with three other interest inventories are also as expected. Taken together, this evidence supports the concurrent and construct validity of the scales and their use in describing human interests.

TABLE 17

Correlations of the ACT Interest Inventory Scales with H.S. Grades, ACT Test Scores, and Out-of-Class Accomplishment Scales for a Sample of College-Bound Men

			ACT Interest Inventory Scales					
Variables	**Mean**	**S.D.**	*Science*	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*
High School Grades								
H.S. English	2.9	0.8	.20	.15	.03	-.04	.02	-.08
H.S. Mathematics	2.6	1.0	.29	-.02	-.05	-.10	.11	.00
H.S. Social Studies	3.1	0.8	.21	.07	.03	-.01	.04	-.07
H.S. Natural Sciences	2.8	0.9	.33	.01	-.05	-.10	.01	-.02
H.S. Average GPA	2.8	0.7	.34	.06	-.02	-.09	.06	-.05
ACT Scores								
ACT English	18.4	5.0	.21	.15	-.04	-.13	-.01	-.13
ACT Mathematics	22.2	6.8	.36	.01	-.09	-.13	.12	-.02
ACT Social Studies	20.6	6.9	.26	.15	.00	-.05	-.01	-.12
ACT Natural Sciences	23.7	6.0	.38	.13	-.06	-.14	-.04	-.02
ACT Composite	21.4	5.4	.36	.12	-.05	-.12	.02	-.08
Out-of-Class Accomp.								
Athletics	3.1	1.9	.00	-.03	.14	.14	.04	.12
Work Experience	3.2	2.0	.02	.11	.09	.20	.04	.13
Practical Skills	2.8	1.6	.20	.16	.09	.14	.09	.33
Leadership	1.9	1.8	.14	.23	.30	.20	.03	-.01
Music	1.7	2.0	.12	.32	.10	.09	.04	-.02
Speech	0.9	1.3	.07	.32	.22	.20	.04	-.06
Art	0.7	1.2	.07	.26	.06	.02	-.06	.10
Writing	0.9	1.2	.14	.36	.22	.12	.00	-.09
Science	0.8	1.2	.31	.12	.04	-.01	.00	.08

Note.—Sample consists of 1,430 high school men.

Data Related to the Use of the ACT Interest Inventory for Focused Exploration

Use of the ACT Interest Inventory to facilitate focused exploration of educational options requires the presence of substantial and meaningful differences in scale scores among relevant criterion groups (e.g., college majors). If the patterns of scores for students in various educational majors do not differ in sensible ways, the ACT Interest Inventory would have little validity or practical value. Effective *use* of the inventory also involves communicating the above information to students in a way which helps them identify personally relevant educational and career options.

The purpose of this section is to examine *institutional* differences, *sex* differences, and *educational major* differences among college seniors in terms of their ACT Interest Inventory scores. That is, do students in the same educational major, but attending different institutions, have the same or different patterns of interest? Do men and women in the same college major have similar or different interests? Do students in various

TABLE 18

Correlations of the ACT Interest Inventory Scales with H.S. Grades, ACT Test Scores, and Out-of-Class Accomplishment Scales for a Sample of College-Bound Women

			ACT Interest Inventory Scales					
Variables	**Mean**	**S.D.**	*Science*	*Creative Arts*	*Social Service*	*Business Contact*	*Business Detail*	*Technical*
High School Grades								
H.S. English	3.2	0.8	.14	.10	-.03	-.03	-.02	.01
H.S. Mathematics	2.7	1.0	.16	-.06	-.08	-.05	.15	.03
H.S. Social Studies	3.2	0.8	.18	.08	.00	-.03	.00	.05
H.S. Natural Sciences	2.9	0.8	.24	.00	-.06	-.09	.03	.05
H.S. GPA	3.0	0.7	.23	.03	-.06	-.07	.06	.04
ACT Scores								
ACT English	19.8	4.9	.15	.20	-.09	-.12	-.08	.02
ACT Mathematics	19.6	6.9	.28	.08	-.10	-.10	.04	.09
ACT Social Studies	19.2	7.1	.25	.21	-.02	-.07	-.11	.07
ACT Natural Sciences	20.9	6.1	.28	.17	-.08	-.13	-.11	.09
ACT Composite	20.0	5.4	.29	.19	-.08	-.12	-.07	.08
Out-of-Class Accomp.								
Athletics	1.9	1.4	.06	.03	.10	.05	.00	.07
Work Experience	2.2	1.9	.03	.07	.11	.15	.08	.06
Practical Skills	3.1	1.2	.14	.18	.11	.14	.05	.12
Leadership	2.0	1.7	.15	.18	.16	.17	-.02	.03
Music	2.2	1.9	.03	.21	.00	-.03	-.05	-.02
Speech	1.0	1.3	.08	.25	.12	.16	-.04	.01
Art	0.9	1.2	.08	.31	.02	.03	-.07	.15
Writing	1.3	1.3	.09	.34	.11	.12	-.06	.01
Science	0.5	0.9	.23	.08	.05	.03	-.02	.08

Note.—Sample consists of 2,009 high school women.

educational majors have different patterns of interest? Answers to these questions provide evidence bearing on the criteria-related and construct validity of the scales. In addition, they have direct implications for the interpretation of the ACT Interest Inventory scores.

Examination of these group differences begins with a description of the data collection procedures and concludes with a description of the procedures developed to report scores to individuals.

Data collection. An interest inventory can facilitate exploration of educational programs of study by showing the similarity of an individual's interests to the interests of successful and satisfied college students in various educational majors. The value of using this similarity approach depends heavily on the relevance of the comparison groups. To obtain such groups, ACT sampled college seniors from a variety of educational majors and educational institutions. The purpose of the data collection was *not* to develop national norms but rather to insure a diverse sample of students in a sufficient number of different educational majors to provide an indication of the range of options available. The remainder of this section describes the data collection procedures and the resulting sample.

To determine which educational majors to use for criterion groups, the number of earned bachelor's degrees, by educational major, conferred in 1969-70 (National Center for Educational Statistics, 1970), was obtained. Eighteen general educational major areas accounted for a large percentage of the stu-

TABLE 19

Educational Institution Sampling Framework for Data Collection of ACT Interest Inventory from College Seniors

	Type of Control					
	Public			*Private*		
Geographical Region	(Size)[a] 1	2	3	(Size)[a] 1	2	3
Western	Eastern Oregon College	Univ. of Nevada-Reno	Sacramento State	Pasadena College	——	Univ. of S. Cal.
Mt./Plains	Adams State College	Univ. of N. Col.	——	Dana College	Creighton Univ.	Brigham Young Univ.
Southwestern	Arkansas Polytechnic	Arkansas State	Univ. of New Mexico	Bethany Nazarene Coll.	Baylor Univ.	——
Midwestern	Univ. of Wis.-Parkside[b]	Northeast Missouri State	Univ. of of Illinois	William Jewell College	Drake Univ.	St. Louis Univ.
Southeastern	Delta State	Murray State	Memphis State	Carson-Newman Coll.	Loyola Univ.-New Orleans	——
Eastern	North Adams State	Marshall Univ.	Univ. of Maryland	Colgate Univ.	Univ. of Baltimore	Long Island Univ.

[a]Size category indicators are: 1 = fewer than 3,000 enrolled students
2 = 3,000 to 10,000 enrolled students
3 = more than 10,000 enrolled students.

[b]Actual enrollment slightly larger than 3,000 but included as a replacement for small public midwestern institution.

dents. Three of the categories—Business, Education, and the Social Sciences—were large enough to suggest further breakdown. As a result of subdivision within these three categories, the 24 educational majors shown in Table 20 were used as a basis for sampling college seniors to establish meaningful criterion groups. Two other considerations, (1) the institutional size, location, and type of control, and (2) the sex distribution within educational majors, also directly influenced the sampling.

To insure a diverse sample of students, institutions were sampled from six geographical regions of the country, from three different size categories, and from both public and private types of control. Table 19 shows a 6 x 3 x 2 sampling framework, with the name of the institution chosen to represent each category. Colleges did not exist for four of the sample categories. The sampling framework was also influenced by the desirability of scoring and interpreting the ACT Interest Inventory so both men and women could explore the full range of educational programs. To accomplish this, adequate numbers of men and women from *all* 24 educational programs were needed. For certain educational majors adequate sample sizes were difficult to obtain because very few men or women entered or graduated from those majors. The goal, however, was to sample approximately equal numbers of men and women within each educational major area when possible. Again, the emphasis was on obtaining a diverse student sample rather than on trying to approximate the proportional representation of each sex in each program area.

Each college in the sample was asked to provide a roster containing name, mailing address, educational major, a college identification number, a sex indicator, cumulative grade point average, and ACT test scores, if available, for each second semester senior.

The educational majors coded by each college were reclassified into one of the 24 general educational major categories. Educational majors not easily classified into one of the 24 categories were assigned after study of detailed descriptions in the appropriate college catalogs.

To reduce the cost of the data collection, not all students from every college were included in the sample. Separate data files for each educational major were prepared for each sex group. A systematic random sample was selected from each major until *at least* 600 students were sampled. For majors with small n-counts, all available students were included in the sample. For example, the rosters of all 32 colleges in the sample yielded only 65 female engineering majors. All 65 students were subsequently included in the sample. Since not all rosters were available for sampling at the same time, this sampling procedure was conducted at three different times, as the rosters became available. This made it possible to distribute interest inventory materials without waiting for rosters from all colleges. Because of variations in the number of students per major in the three groups of colleges, a few of the larger educational majors were oversampled.

TABLE 20

Percentage Return Rates for 24 Educational Major Programs

	Percentage Return Rate	
Educational Major	*Men*	*Women*
No Major Indicated	41	33
Accounting	57	63
Agriculture[a]	59	——
Art (Fine & Applied)	51	55
Art Education[a]	——	56
Biological Sciences	60	70
Business, general	53	57
Business Education	50	68
Economics[a]	56	——
Elementary Education	51	58
Engineering[a]	62	——
English & Literature	45	60
Foreign Languages	59	60
Health Services	47	60
History	48	55
Home Economics[a]	——	64
Marketing[a]	49	——
Mathematical Sciences	64	77
Music Education	54	64
Philosophy & Religion[a]	50	——
Physical Science	60	63
Political Science	52	56
Psychology	54	63
Social Sciences, general	50	60
Sociology	48	63
Overall rate	54	61

[a]Percentages were not calculated for criterion groups with fewer than 100 students of a given sex.

The ACT Interest Inventory and a biographical questionnaire (see Appendix 2) were delivered to 25,308 college seniors (14,765 men and 10,543 women) during March and April 1973. One week after the first mailing, postcard reminders asking students to return the materials were mailed. Three weeks after the original materials were sent, a follow-up letter and a second set of materials were mailed. Students who still had not responded after 1 month were mailed a third follow-up reminder asking that the ACT Interest Inventory and questionnaire be returned. Approximately 12 weeks after the first mailing, 15,618 completed answer sheets had been returned, at an overall return response rate of 61.7%. Of these, 1,320 who had omitted the college identification number needed to merge their item responses with the information reported by the college, were subsequently assigned to a cross-validation sample, which is described in greater detail in a subsequent section of this report. Complete information was obtained from 14,298 college seniors, and the following data are presented to indicate the nature of this total sample.

Table 20 presents the response rates for each educational major reported separately by sex. For women, the response rates varied from a high of 70% for the Biological Sciences and Mathematical Sciences categories to a low of 55% for the Art and History categories. The mean percentage response rate for all women was 61%. For men, the response rates varied from a high of over 64% for the Mathematical Sciences to a low of 45% for the English and Literature category. The mean percentage response rate was approximately 54%. With the few exceptions noted, students from most educational majors returned usable answer sheets at about the same rate, although a larger percentage of women than men generally returned their material.

The total percentage of students, by sex, from each sampling category is presented in Table 21. For both men and women, approximately 66% of the students came from public institutions and 33% from private institutions. That large private institutions were not included in the sample for two of the six geographical regions probably contributed to the relatively small total percentage of students from private institutions. All six geographic regions were well represented, with a slightly larger percentage of students from the Midwest (22%-men, 24%-women) and a slightly smaller percentage of students from the West (12.5%-men, 11.2%-women). In summary, data were obtained from a broad sample of college seniors in 24 educational majors from 32 different

TABLE 21

Percentage of College Seniors, by Sex, from Each Sampling Cell

Type of Institutional Control	Geographical Region																		Total Row Percent
	Western			*Mt./Plains*			*Southwestern*			*Midwestern*			*Southeastern*			*Eastern*			
Size[a]	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	1	2	3	
Public																			
Men	1.26	2.34	4.09	1.19	1.79	—	1.29	3.02	6.71	3.24	3.68	13.23	1.62	1.82	8.05	1.27	6.63	3.57	64.9
Women	1.15	1.90	3.60	0.42	3.32	—	0.85	2.01	6.95	2.49	4.63	13.70	2.20	2.89	7.79	1.79	8.93	3.34	68.1
Private																			
Men	0.50	—	4.31	0.27	1.03	14.89	1.29	4.69	—	0.17	1.43	0.19	1.35	1.43	—	1.41	0.41	1.59	35.1
Women	0.43	—	4.06	0.43	1.46	11.02	1.04	6.45	—	0.26	1.57	1.06	1.35	1.45	—	0.14	0.09	1.01	31.9
	Percentages by Geographical Region																		
Men	12.5			19.2			17.0			22.0			14.4			14.9			
Women	11.2			17.2			17.3			23.7			15.7			14.9			

[a]Size category indicators are: 1 = fewer than 3,000 enrolled students
2 = 3,000 to 10,000 enrolled students
3 = over 10,000 enrolled students.

colleges. A large percentage of the students came from public institutions, with approximately equal representation across the six geographic regions.

Institutional differences. Prior to conducting analyses to determine educational major differences across programs and sex differences within programs, it was important to determine whether students in the same major attending different institutions had similar interests. To use interest inventory results with a broadly based student population like those taking the ACT Assessment, a certain degree of homogeneity within a major across institutions should be evident. Without this degree of homogeneity, results could not be generalized from one institution to another, and serious questions regarding scale validity could be raised.

Since these analyses were conducted prior to examining sex differences, results are reported and summarized separately by sex. An institution was included in the analyses of institutional differences if ten or more people in a major were available from that institution. For men, 20 programs had five or more institutions enrolling 10 or more students. For women, there were 16 programs with five or more institutions having at least 10 students. Thus, there was a total of 36 analyses of educational program differences.

Because of the large volume of data resulting from these analyses, only a summary is presented here. Selected data are presented to represent the nature

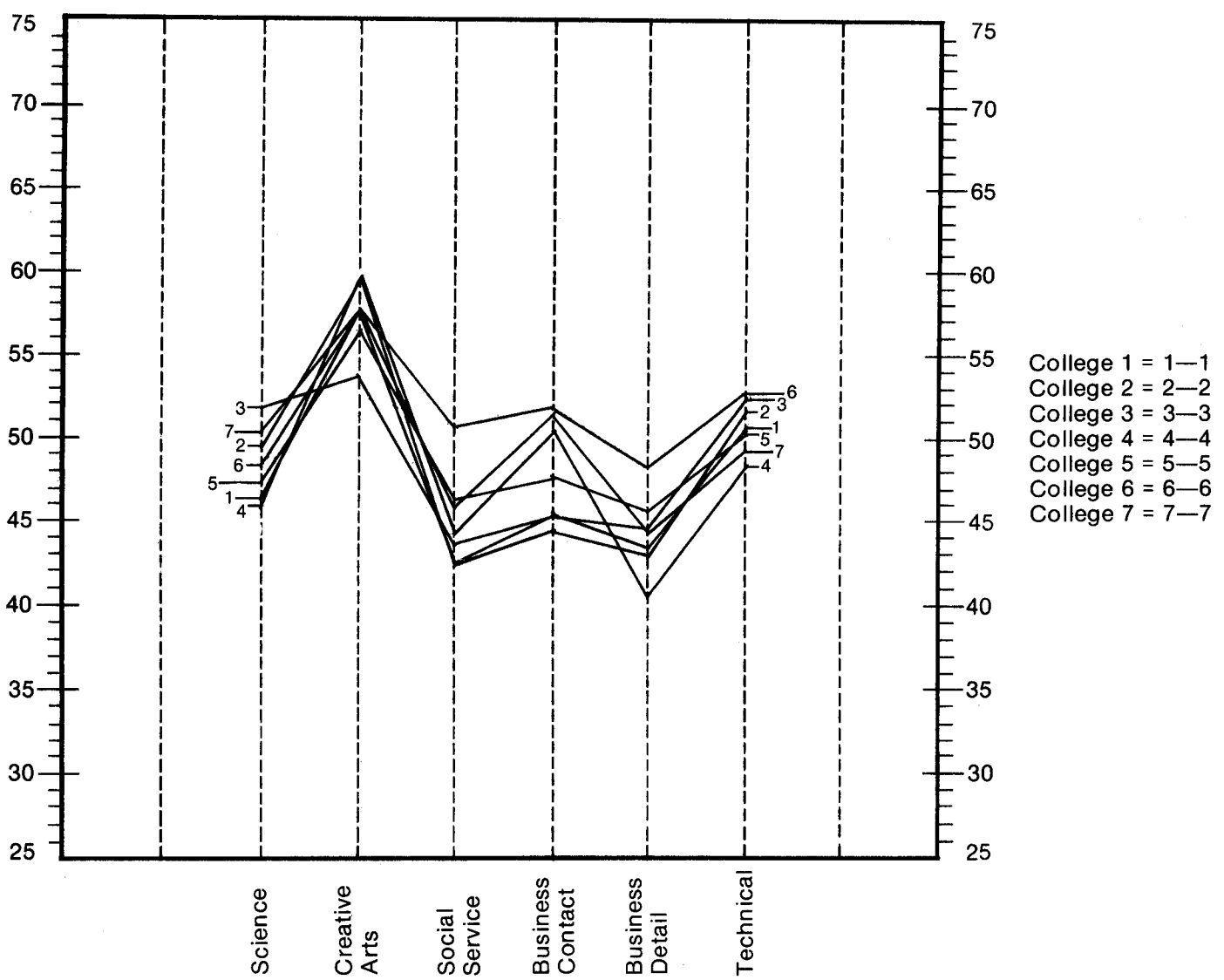


Fig. 5. Mean profiles for art majors from seven different institutions.

of the findings. For example, the mean institutional profiles of interests for students in one major are presented in Figure 5. The patterns of scores across institutions are remarkably similar. The female Art majors from all seven institutions consistently obtained their highest mean score on the Creative Arts scale and their lowest mean score on either the Social Service or Business Detail scale.

Institutional differences also were analyzed using discriminant analysis, a statistical technique for finding, from a set of variables, those combinations of variables which best differentiate among various groups. A detailed description of this procedure is found in Rulon, Tiedeman, Tatsuoka, and Langmuir (1967) and Cooley and Lohnes (1971). Discriminant analysis provides the opportunity to examine whether students in the *same* major attending *different* institutions can be differentiated by the six scales of the ACT Interest Inventory. If students in the same major across institutions have similar patterns of interest, Wilks' Lambda[2] coefficients will be relatively high. The median Wilks' Lambda coefficients were summarized to present the degree of differentiation among institutions for a given major. Finally, the associated F-values for Wilks' Lambda were summarized to indicate whether or not the educational major groups occupied the same multidimensional measurement space.

Table 22 shows the number of institutions, the

[2]Wilks' Lambda reflects the ratio of within-group "variation" to total-group "variation" where a low Lambda indicates greater group differentiation. That is, a low Lambda indicates less within-group variation and more among-group variation than a higher Lambda for the same groups.

TABLE 22

Summary of Discriminant Analyses across Institutions within Educational Programs

Educational Major	Men				Women			
	No. of Instit.	*No. of Students*	*Wilks' Lambda*	*Associated F-Values*	*No. of Instit.*	*No. of Students*	*Wilks' Lambda*	*Associated F-Values*
Accounting	11	305	.67	2.0**	5	68	.75	0.7
Agriculture	5	310	.80	2.8**	—	—	—	—
Art (Fine & Applied)	10	281	.64	2.3**	7	198	.70	1.9**
Art Education	—	—	—	—	—	—	—	—
Biological Sciences	20	531	.66	1.9**	13	351	.66	2.0**
Business, general	18	493	.65	2.1**	9	114	.50	1.6**
Business Education	—	—	—	—	11	204	.67	1.3
Economics	10	172	.69	1.1	—	—	—	—
Elementary Education	12	211	.73	0.9	19	792	.81	1.6**
Engineering	10	444	.86	1.2	—	—	—	—
English & Literature	10	139	.52	1.6**	16	364	.70	1.4*
Foreign Languages	—	—	—	—	7	196	.73	1.7**
Health Services	10	214	.57	2.2**	15	383	.64	2.0**
History	11	196	.64	1.4**	8	117	.64	1.2
Home Economics	—	—	—	—	11	272	.67	1.8**
Marketing	12	262	.72	1.2	—	—	—	—
Mathematical Sciences	12	207	.62	1.5**	9	139	.60	1.4
Music Education	7	116	.72	1.0	9	155	.68	1.2
Philosophy & Religion	6	101	.43	2.8**	—	—	—	—
Physical Sciences	15	385	.73	1.4*	—	—	—	—
Political Science	14	257	.66	1.3*	—	—	—	—
Psychology	13	264	.68	1.4*	14	294	.66	1.5*
Social Sciences	14	231	.52	1.9**	11	215	.53	2.2**
Sociology	12	214	.55	1.9**	14	257	.67	1.3*

* $p < .05$.
** $p < .01$.

number of students from those institutions, the Wilks' Lambda, and the associated F-value from each discriminant analysis. For both men and women, the F-values were significant at the 1% level for about one-half the educational programs. That is, for half the programs, the observed institutional differences were unlikely to be the result of chance alone. However, even for those programs for which statistically significant differences among group centroids were found, considerable institutional similarity, in terms of overlapping variance, was noted, as evidenced by the relatively high Wilks' Lambdas obtained. The median Wilks' Lambda for both men and women was approximately .66. As a point of reference, a Wilks' Lambda of 1.00 would indicate no program separation, or conversely, almost complete overlap, while a Wilks' Lambda of 0.0 would indicate complete separation or no overlap.

Another indication of the similarity among students at different institutions within a given educational major is provided in Figure 6, where seven institutional centroids with at least 10 female Art majors are plotted. This group was selected as an example because it represents a "typical" finding, in that a Wilks' Lambda of .70 was obtained. Ellipses including 50% of the students for each institution indicate the degree of overlap. All seven institutions fall within one-half standard deviation on either side of total sample centroids on the first two discriminant functions. These two functions account for 81% of the total variation among groups. The similarity of the mean profiles of these seven institutions is shown in Figure 5, p. 29.

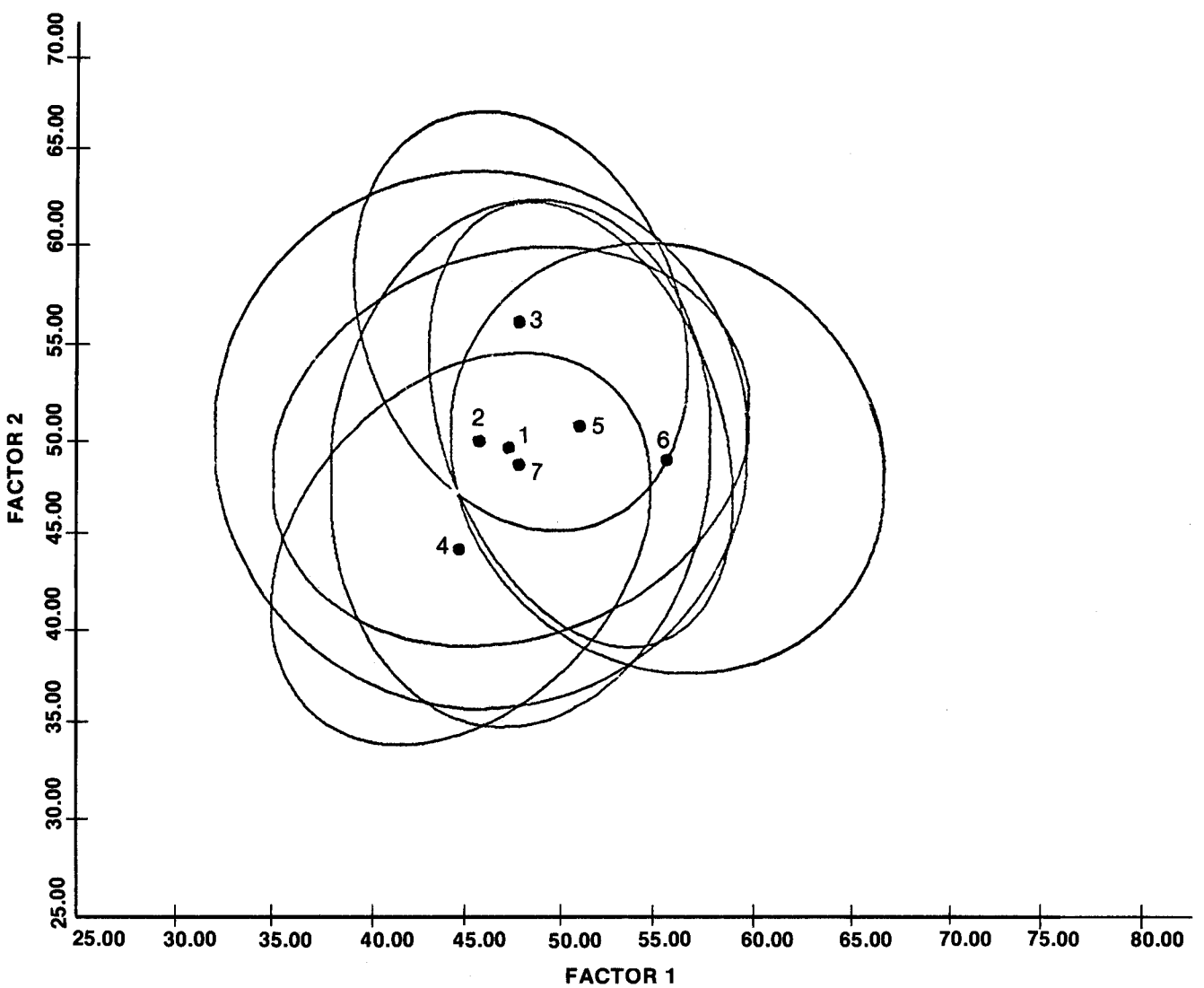


Fig. 6. Group centroids from seven institutions for female art majors.

In summary, students in the same educational major attending different institutions have similar interests. Students using the ACT Interest Inventory to explore possible educational majors can assume with a relatively high degree of confidence that the similarity of their interests to those of students in a particular educational major is generalizable from one institution to another. Comparable results were found when an earlier form of the ACT Interest Inventory was used with 2-year college students enrolled in various career-oriented educational majors at a variety of educational institutions (ACT, 1972). In addition, the similarity of interests across institutions for students in the same major provides supporting evidence of the construct validity of the ACT Interest Inventory. Clearly, the six scales measure interest dimensions which have a common meaning to students, as indicated by the similar pattern of interest scores for students in the same major at different institutions. Without this similarity, the underlying constructs or dimensions of the ACT Interest Inventory could be seriously questioned. Since the evidence supports the generalizability of the ACT Interest Inventory results for majors across institutions, the nature and extent of difference between men and women enrolled in the same educational program majors can be meaningfully examined.

Sex differences. An earlier section of this report discussed the rationale for scaling the ACT Interest Inventory separately by sex. The goal of this procedure was to report scores in a form which would provide a link between interests and educational majors identically for both sexes. The purpose of this section is to examine sex differences in the score distributions of men and women on the ACT Interest Inventory scales.

Two approaches were taken to analyze sex differences among the college seniors comprising the 24 educational major groups. First, a simple scale-by-scale comparison of mean standard scores, scaled separately by sex, for men and women in the same educational program was made. Mean profiles were used to show on which scales large differences existed. In the second approach, discriminant analysis was used to determine whether the interests of one sex in a given major are more similar to the interests of the same sex in another major, or whether they are more similar to the interests of the opposite sex in the same major. For example, if women are generally more like other women than men in their interests, one primary discriminant factor (function) would probably differentiate between men and women, and subsequent factors would then differentiate among various programs. If men and women in the same program have similar interests which are, in turn, different from the interests of the same sex in other programs, one would not expect to find a discriminant factor which differentiated men from women, but only factors which differentiated among educational programs.

TABLE 23

The Number of Men and Women Included in Each of the 24 Educational Major Criterion Groups

Educational Major	No. of Men	No. of Women	Total
Accounting	385	140	525
Agriculture	334	0	334
Art (Fine & Applied)	350	269	619
Art Education	0	122	122
Biological Sciences	588	424	1,012
Business, general	543	175	718
Business Education	113	238	351
Economics	214	0	214
Elementary Education	258	878	1,136
Engineering	468	0	468
English & Literature	188	407	595
Foreign Languages	140	266	406
Health Fields	272	437	709
History	260	185	445
Home Economics	0	304	304
Marketing	303	90	393
Mathematics	272	217	489
Music Education	195	225	420
Philosophy & Religion	149	0	149
Physical Science	454	102	556
Political Science	301	83	384
Psychology	317	348	665
Social Science, general	286	258	544
Sociology	292	319	611

Note.—N-counts include only those students who indicated overall satisfaction with their educational major.

Prior to these analyses, additional sampling from among the 14,298 available college seniors was conducted. Since the eventual criterion groups were intended to represent successful completion of the educational program (graduation) *and* overall satisfaction with the college major, students who indicated they were dissatisfied were eliminated from the sample. In addition, if fewer than 75 students of either sex were available, that sex group was not included in these analyses. A total of 12,169 students met all the sampling restrictions. Table 23 shows the number of men and women included in the groups used for these analyses. Because the discriminant analysis computer program was limited to 40 possible groups, 2 other sex groups were deleted. To reduce the total number of available groups to 40, males in the Business Education and Political Science groups were arbitrarily withheld from the analysis.

Raw scores were converted to standard scores (Mean = 50, SD = 10) separately by sex for all college seniors shown in Table 24, using the standard formula:

$$SS_1 = \frac{X - \overline{X}}{S.D.} \times 10 + 50$$

where $\overline{X}$ for each sex group was the mean of the 24 educational major group means for that sex, and S.D. was the square root of the mean of the 24 group variances. This procedure was used to reduce the effect of a few very large major groups on the total mean of each scale. Hence the standard scores reflect, for each sex group, approximately equal weight from each educational major. The means and standard deviations of the standard scores for the six ACT Interest scales for all groups are presented in Table 24. Examination of the mean profiles is facilitated by plotting them on a standard score profile shown in Figure 7. For those educational majors with sufficient data available for both men and women, the profiles are highly similar. The largest difference for any single scale is on the Business Detail scale for the Mathematical Sciences major, where women have a standard score about six points higher than men. This difference is about two-thirds of a standard deviation and represents a substantial difference in interests on that scale. Most differences are less than two points (or about .2 of a standard deviation) and probably represent sampling variation rather than actual differences.

A 40-group discriminant analysis was run using all educational program groups with sufficient numbers of both men and women. Single-sex criterion groups (e.g., Engineering, Agriculture, Home Economics) were included to insure that sex differences were interpreted in the context of the breadth and scope of educational program differences.

A summary of the discriminant analysis is provided in Figure 8. The mean group centroids for each criterion group were plotted on the two discriminant factors accounting for the majority (72.7%) of the discriminating power. A line connects the centroids for men and women in the same program. For those programs which are clearly differentiated from other programs, the men and women *within* a program are more similar to each other than to other students of the same sex in different majors. For example, the interests of men and women in such programs as Accounting, Business, Engineering, Mathematics, Physical Sciences, Biological Sciences, and Health Fields are more similar to each other than to those of members of the same sex in a different major. In most cases the centroids occupy nearly the same position when viewed in the context of the group dispersion or variation about the centroid. Ellipses including 50% of the males and females in the Health Fields have been included to indicate the degree of overlap between the men and women. The high degree of overlap is particularly impressive when the very purpose of discriminant analysis is to maximize group differences. The nature and extent of the overlap for other educational majors is about the same. In summary, the major source of variation on these two discriminant factors is based on educational major differences and not sex differences.

This data analysis suggests two important implications. First, since men and women in the same educational program have highly similar interests, it seems reasonable to combine them into a common criterion group and not to make a sex-based distinction when reporting scores. The results of this procedure will be described in the next section. The second important implication stems from the nearly unanimous finding that the interests of men and women in the same program were "highly similar." One could reasonably generalize this finding to groups for which sufficient data were not available for one sex or the other, and suggest that members of the group for which data were not available would *probably* have interests similar to the group for which data were available. Thus, even though insufficient numbers of female engineering majors were available, one could still reasonably suggest that women consider that major if their position on the first two discriminant functions was close to the engineering major centroid.

TABLE 24

Mean ACT Interest Inventory Standard Score Profiles for College Men and Women Graduating from 24 Educational Majors

	ACT Interest Inventory Scales											
	Science		*Creative Arts*		*Social Service*		*Business Contact*		*Business Detail*		*Technical*	
Educational Major	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.
Accounting												
Men (385)	47.2	9.1	42.5	10.0	44.5	9.5	53.1	8.3	65.7	7.5	50.7	9.2
Women (140)	46.9	10.6	41.7	11.0	42.3	10.9	51.6	9.3	67.0	7.7	49.5	10.1
Agriculture												
Men (334)	49.5	9.2	43.3	10.0	43.4	10.3	47.3	10.2	49.2	10.4	54.9	8.9
Women	n.a.											
Art (Fine & Applied)												
Men (350)	46.9	10.0	58.2	9.9	46.0	10.6	47.8	11.0	44.7	10.1	51.3	11.0
Women (269)	47.3	10.4	57.9	8.5	45.9	11.5	47.7	11.4	42.5	10.0	51.7	10.3
Art Education												
Men	n.a.											
Women (122)	49.6	10.4	58.3	7.5	52.5	8.7	47.9	9.8	43.0	9.3	54.8	9.5
Biological Sciences												
Men (588)	61.7	7.2	47.8	9.8	48.8	10.1	45.1	9.9	46.3	9.5	53.2	8.9
Women (424)	64.2	6.5	47.9	9.9	47.2	10.8	42.2	9.8	45.2	9.7	54.0	9.8
Business, general												
Men (543)	46.3	9.9	44.8	10.1	45.2	10.0	58.2	8.4	57.1	9.6	51.8	9.2
Women (175)	45.9	10.5	45.1	11.0	47.1	11.2	58.2	8.9	60.6	9.6	49.8	10.8
Business Education												
Men (113)	46.2	10.9	46.2	9.9	50.8	10.0	56.0	9.9	56.5	11.5	52.1	9.9
Women (238)	42.6	9.1	45.8	10.6	51.9	8.2	57.0	10.1	62.4	10.0	48.2	9.5
Economics												
Men (214)	50.9	9.1	48.9	9.8	47.2	9.8	53.5	10.0	54.0	9.9	50.2	9.5
Women	n.a.											
Elementary Education												
Men (258)	49.2	10.1	50.7	10.0	57.2	7.9	50.0	10.0	48.9	10.8	51.9	10.2
Women (878)	47.1	9.5	49.6	9.7	56.0	7.6	49.0	9.7	48.2	10.8	49.1	9.9
Engineering												
Men (468)	56.3	8.2	44.3	9.4	42.9	9.6	45.1	9.0	49.2	8.9	57.8	7.9
Women	n.a.											
English & Literature												
Men (188)	48.0	10.6	59.9	7.8	48.7	10.7	46.8	10.8	45.7	9.6	47.2	10.7
Women (407)	47.0	9.8	57.8	9.0	52.4	9.4	50.4	10.2	45.3	9.9	47.7	9.8
Foreign Languages												
Men (140)	48.8	10.3	53.7	10.7	51.2	11.2	48.5	10.5	46.9	9.9	49.9	11.7
Women (407)	49.6	10.3	53.4	10.0	49.6	10.0	48.2	10.2	47.7	9.8	48.9	9.7

Educational Major	ACT Interest Inventory Scales											
	Science		*Creative Arts*		*Social Service*		*Business Contact*		*Business Detail*		*Technical*	
	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.	$\overline{X}$	S.D.
Health Services												
Men (272)	52.3	10.8	46.0	10.9	54.1	9.4	48.7	10.4	47.6	10.3	52.3	9.7
Women (437)	55.6	9.1	46.4	10.0	54.2	8.0	45.5	8.9	45.4	10.3	50.9	10.1
History												
Men (260)	46.4	10.5	51.9	10.2	53.4	9.4	50.6	10.1	48.5	10.1	47.9	10.2
Women (185)	47.0	10.8	51.9	10.2	51.6	9.6	49.7	10.4	47.0	10.6	48.2	9.7
Home Economics												
Men	n.a.											
Women (304)	47.3	9.8	48.6	10.2	51.3	9.3	53.9	9.6	47.8	10.2	49.6	9.7
Marketing												
Men (303)	43.7	9.5	46.3	10.1	44.4	9.4	60.6	7.8	51.6	10.3	49.4	10.1
Women (90)	43.2	9.3	47.7	10.7	43.5	10.1	63.6	8.0	52.7	10.8	46.8	9.4
Mathematics												
Men (272)	57.8	8.9	44.8	10.2	44.7	11.0	42.2	9.5	52.4	10.2	51.2	9.6
Women (217)	58.6	9.4	43.1	10.1	47.1	10.1	45.3	9.5	58.5	9.2	52.6	9.3
Music Education												
Men (195)	47.2	11.1	57.4	8.6	51.3	10.3	46.1	10.1	46.8	10.6	48.0	11.0
Women (225)	47.1	10.4	55.9	9.5	51.6	9.7	45.9	10.2	46.5	10.5	47.6	10.3
Philosophy & Religion												
Men (149)	49.4	10.4	52.5	8.9	52.8	10.5	47.9	10.1	46.5	10.0	48.3	10.6
Women	n.a.											
Physical Sciences												
Men (454)	59.9	10.0	46.7	9.8	46.0	11.5	43.4	10.3	47.8	9.6	54.3	9.1
Women (102)	59.0	10.7	48.3	11.1	46.9	12.3	43.2	9.4	46.7	10.0	55.1	9.7
Political Science												
Men (310)	46.9	9.7	50.5	10.0	50.4	9.8	53.9	9.8	49.5	9.9	46.8	9.8
Women (83)	47.7	11.2	51.8	9.9	47.6	10.8	52.3	10.7	46.4	10.5	48.9	11.1
Psychology												
Men (317)	55.0	10.0	51.3	10.0	54.8	8.8	49.4	10.2	46.1	8.7	49.1	10.3
Women (348)	53.5	10.4	51.6	10.2	54.3	8.8	49.5	10.3	44.8	10.4	49.8	9.8
Social Science												
Men (286)	47.8	10.2	49.7	10.0	52.6	10.5	51.6	10.3	48.1	10.2	51.1	10.5
Women (258)	49.3	10.7	52.0	9.9	54.1	10.4	50.5	10.1	45.8	10.1	50.4	9.7
Sociology												
Men (292)	47.3	10.2	50.6	10.4	56.6	9.1	50.6	10.6	45.9	10.5	48.2	9.7
Women (319)	47.2	9.2	50.6	10.1	57.1	8.6	52.8	9.4	46.6	10.1	48.4	9.4

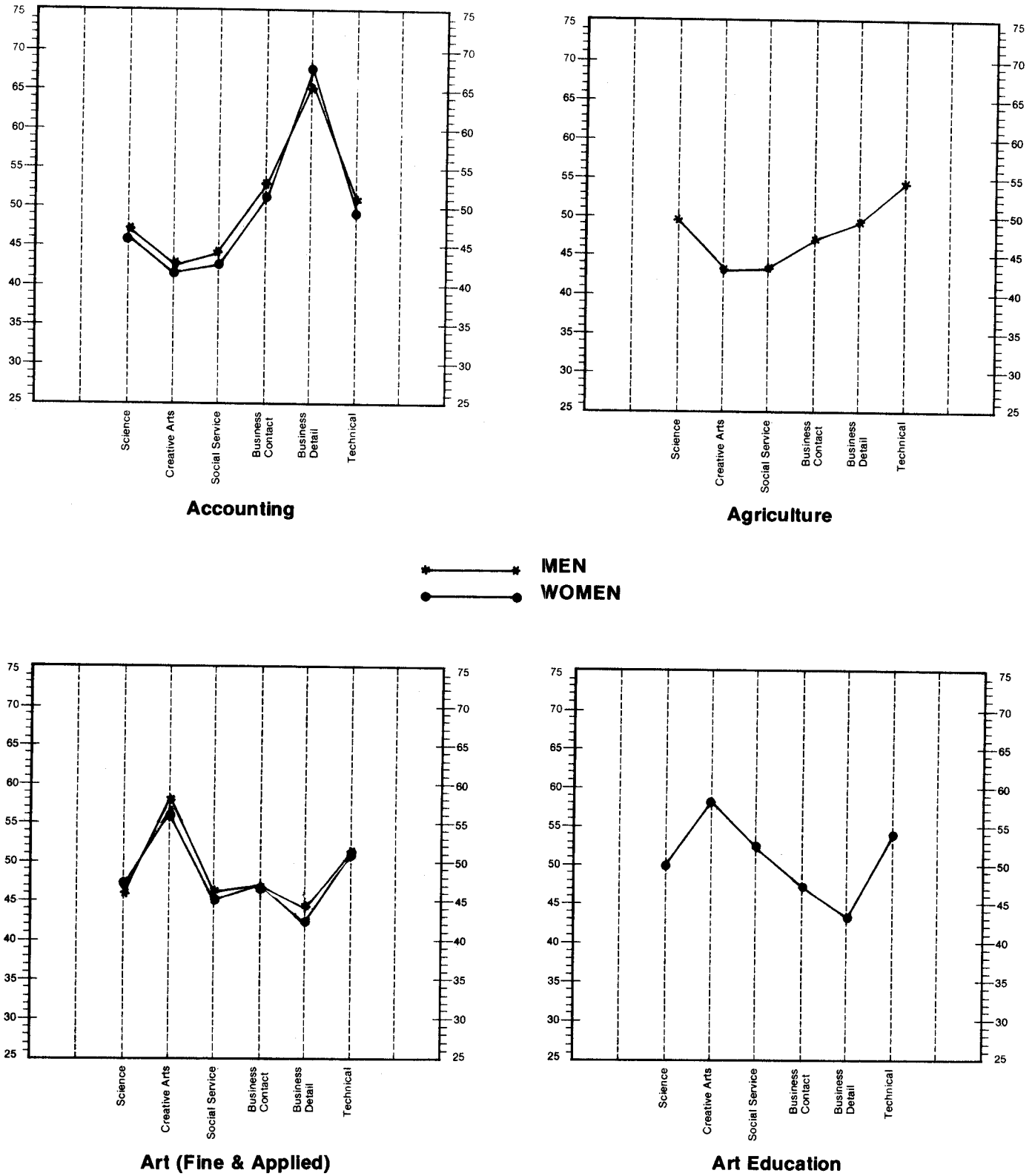
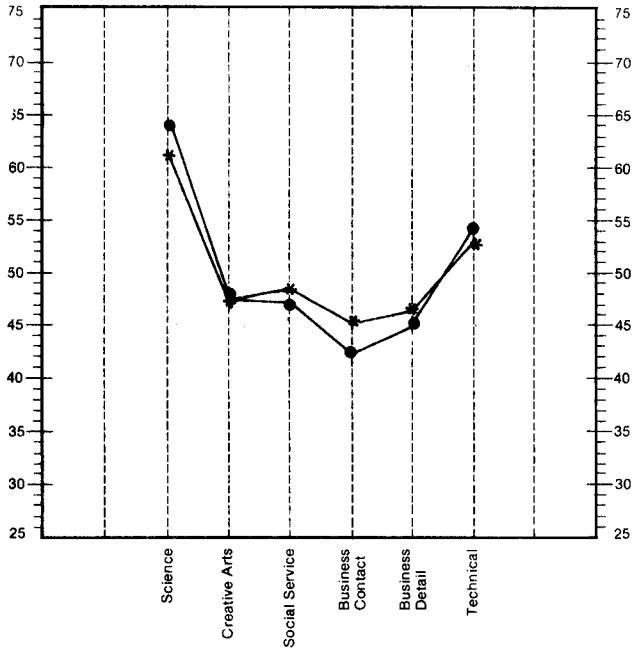
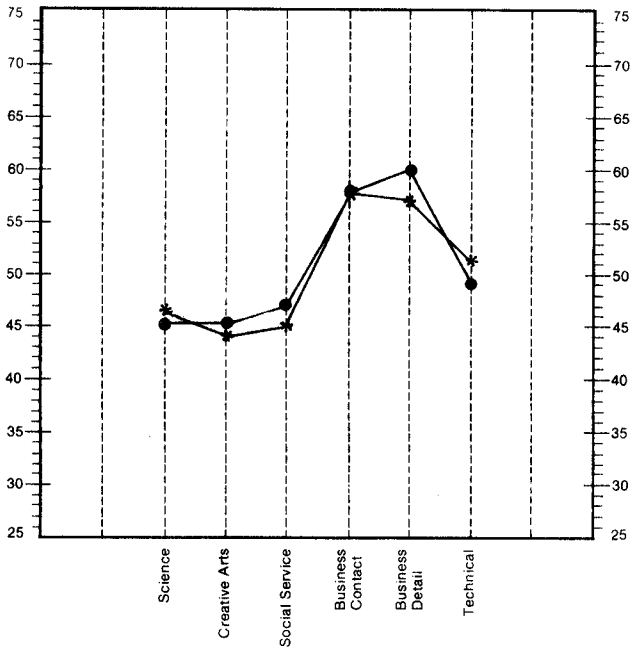


Fig. 7. Mean ACT Interest Inventory profiles for 24 educational majors.



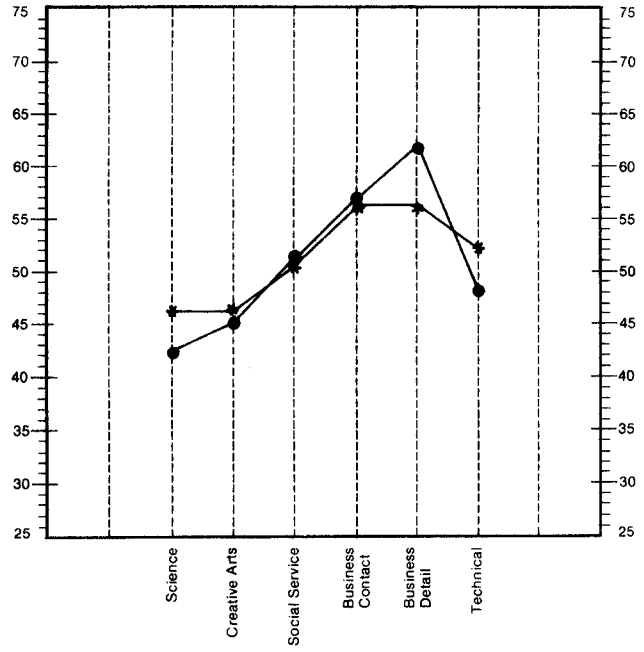
Biological Sciences



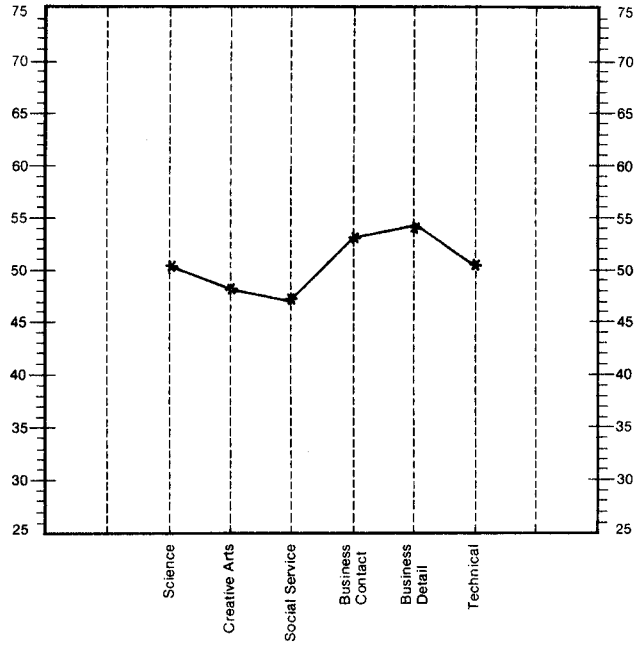
Business, general

MEN

WOMEN

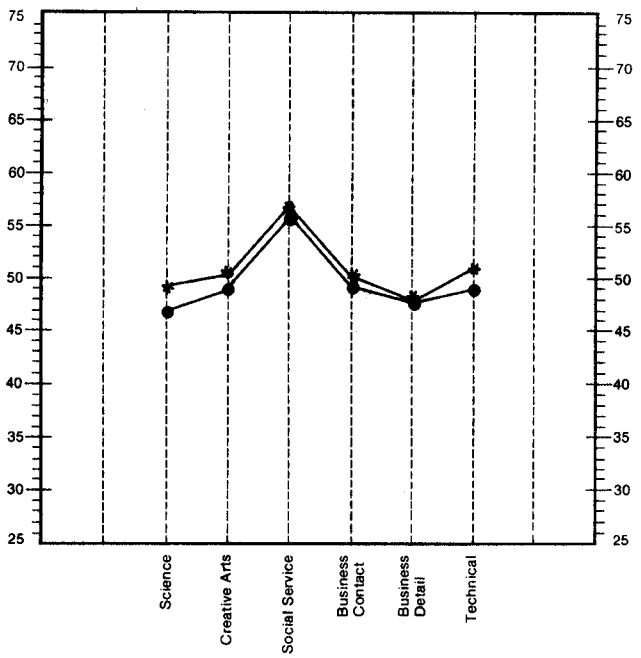


Business Education

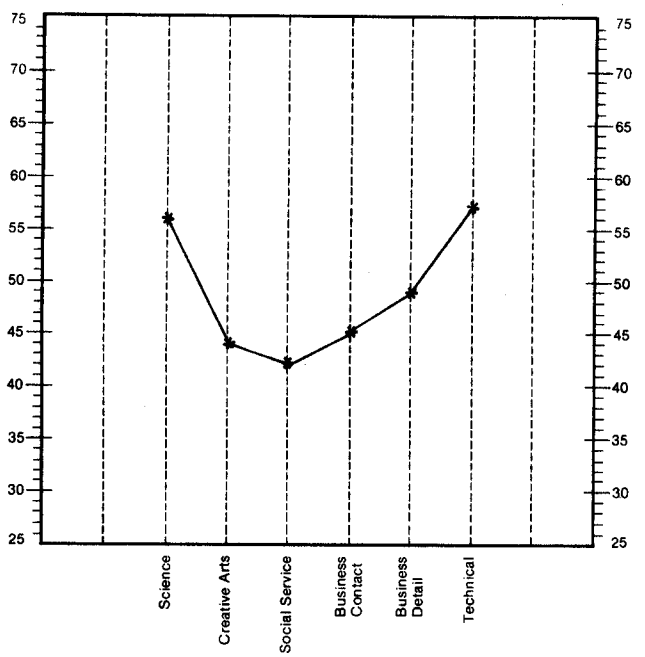


Economics

[*Continued*]

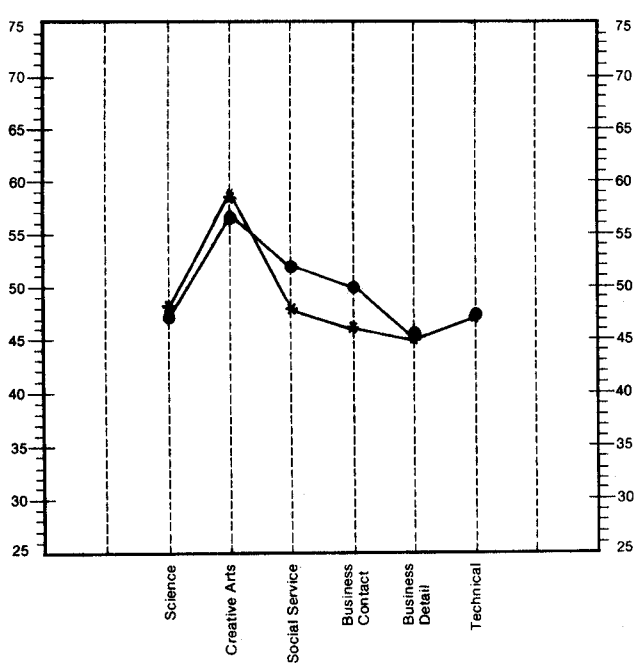


Elementary Education

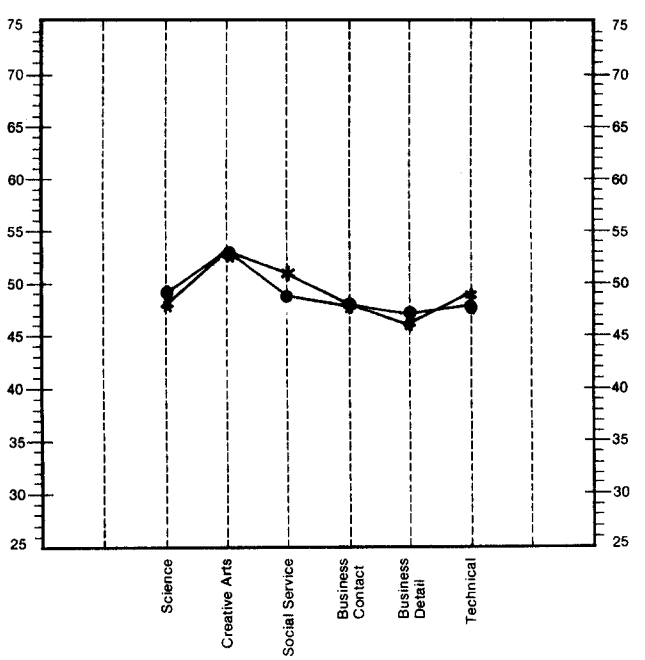


Engineering

MEN
WOMEN

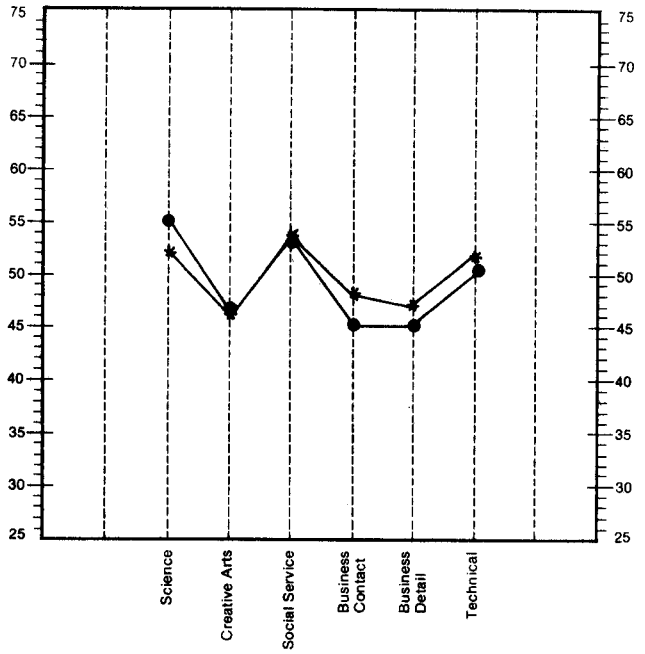


English & Literature

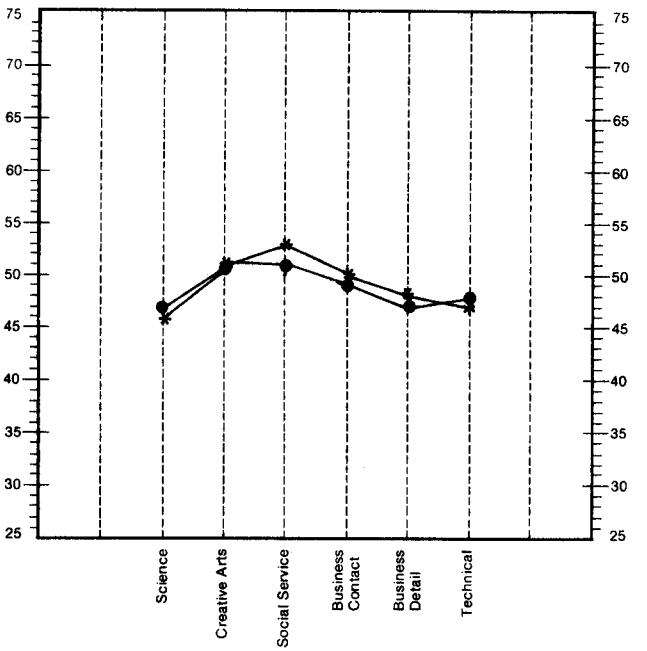


Foreign Languages

Fig. 7. [*Continued*]

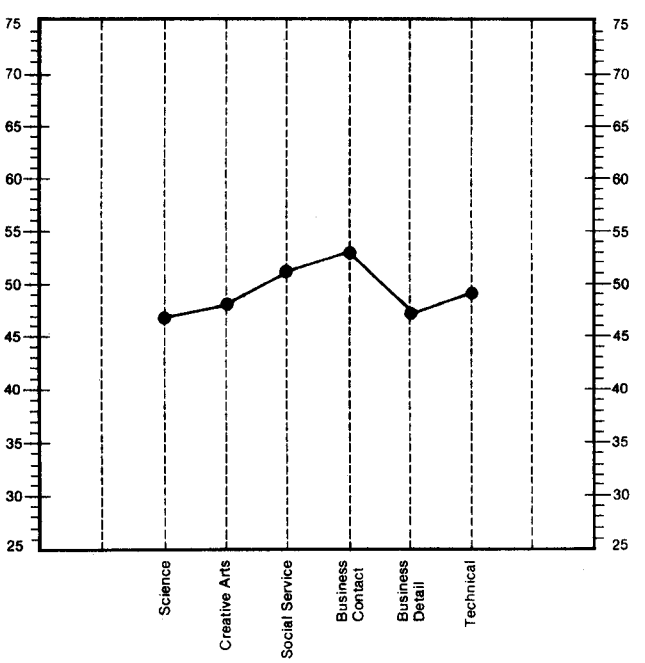


Health Services

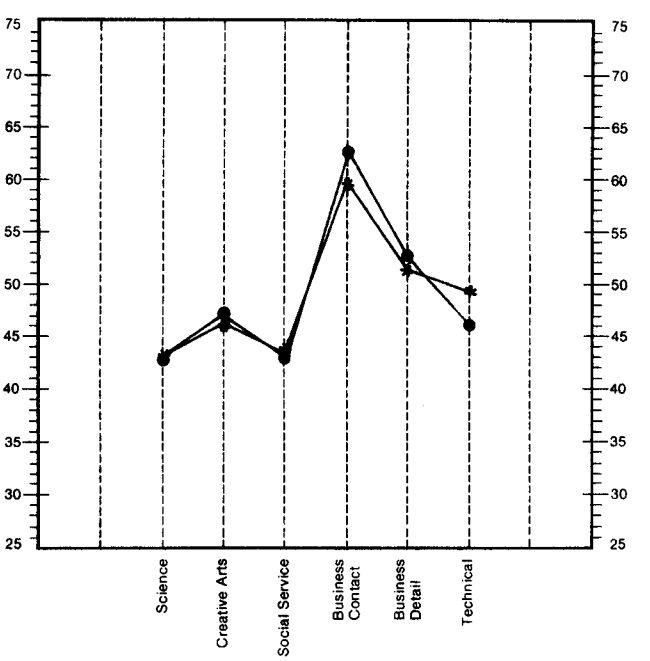


History

MEN
WOMEN

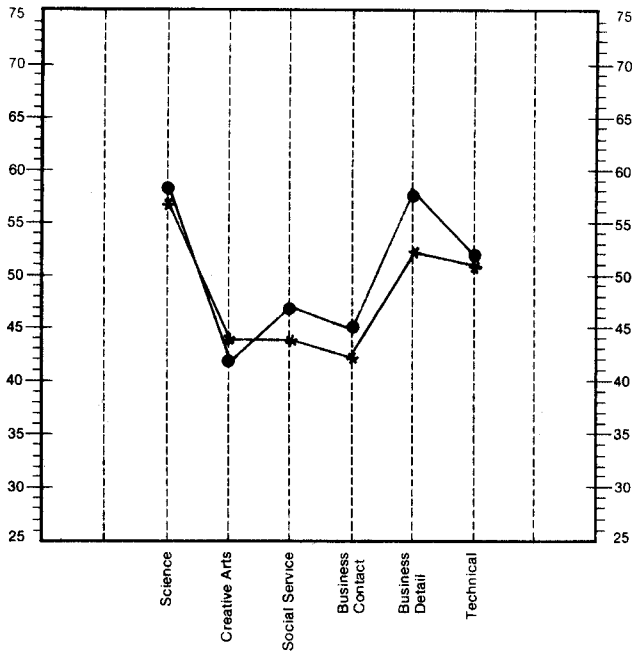


Home Economics

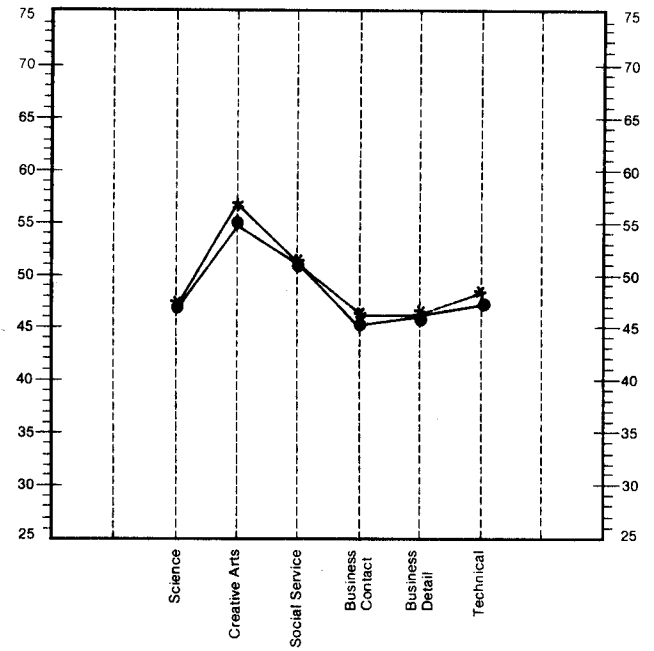


Marketing

[*Continued*]



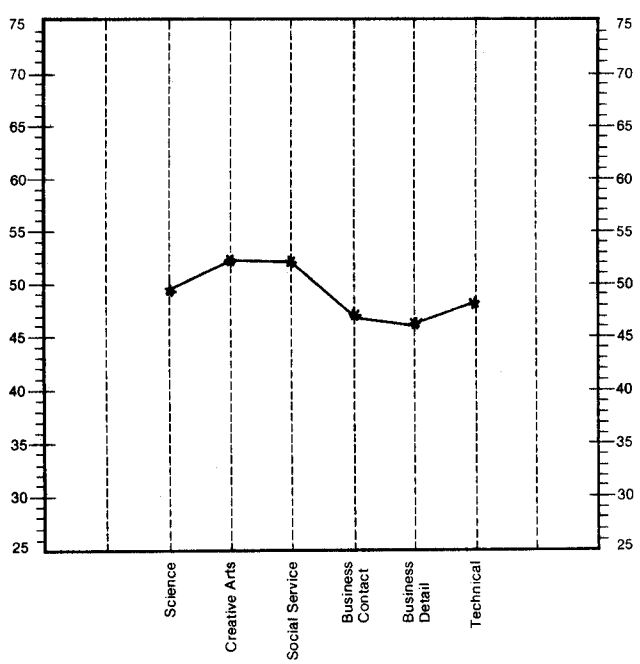
Mathematics



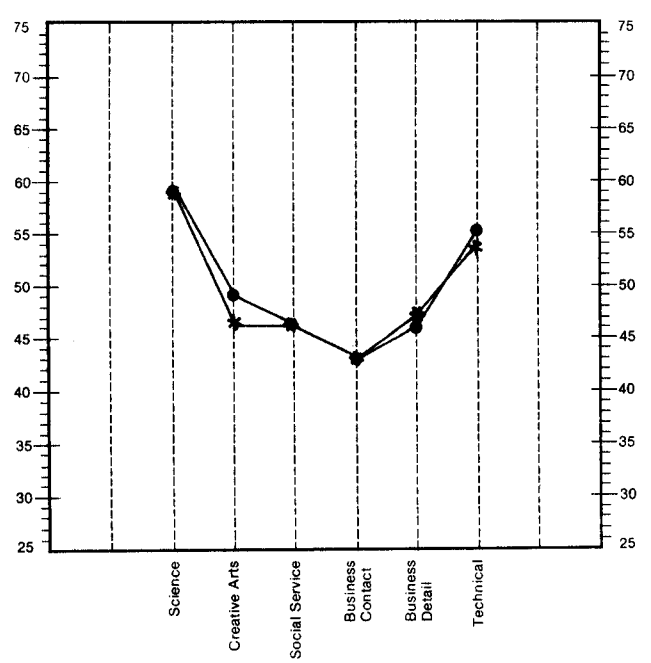
Music Education

MEN

WOMEN

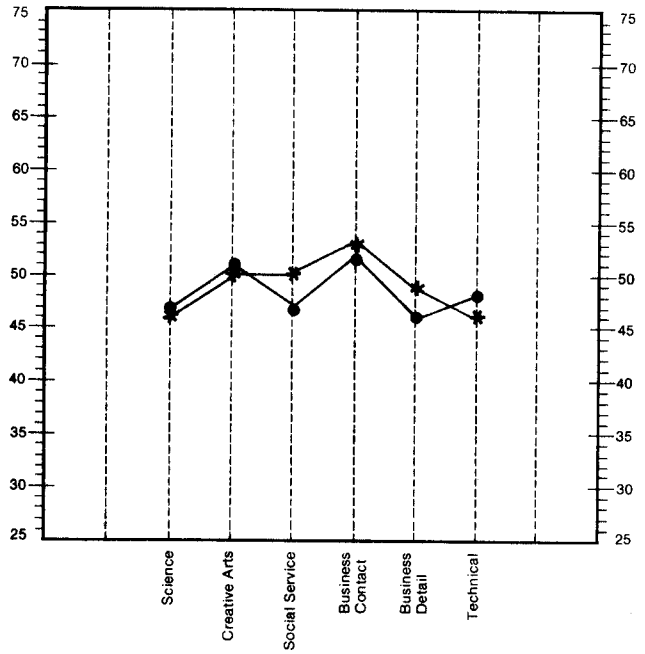


Philosophy & Religion

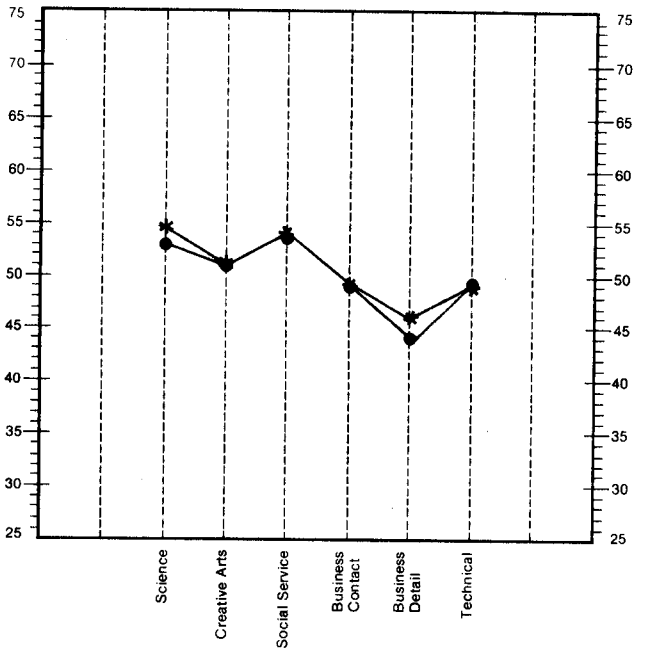


Physical Sciences

Fig. 7. [*Continued*]



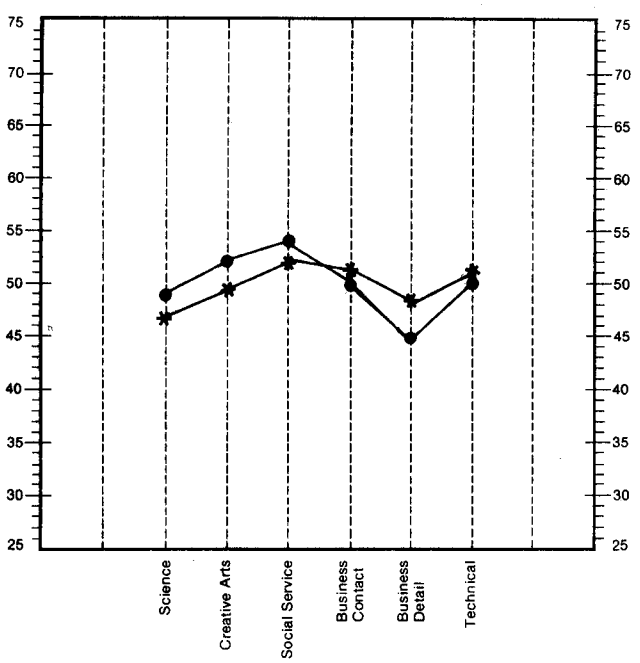
Political Science



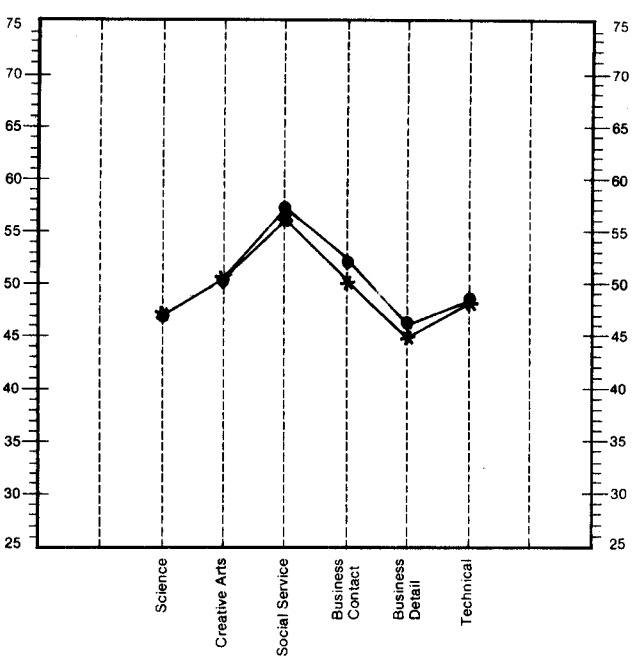
Psychology

MEN

WOMEN



Social Science



Sociology

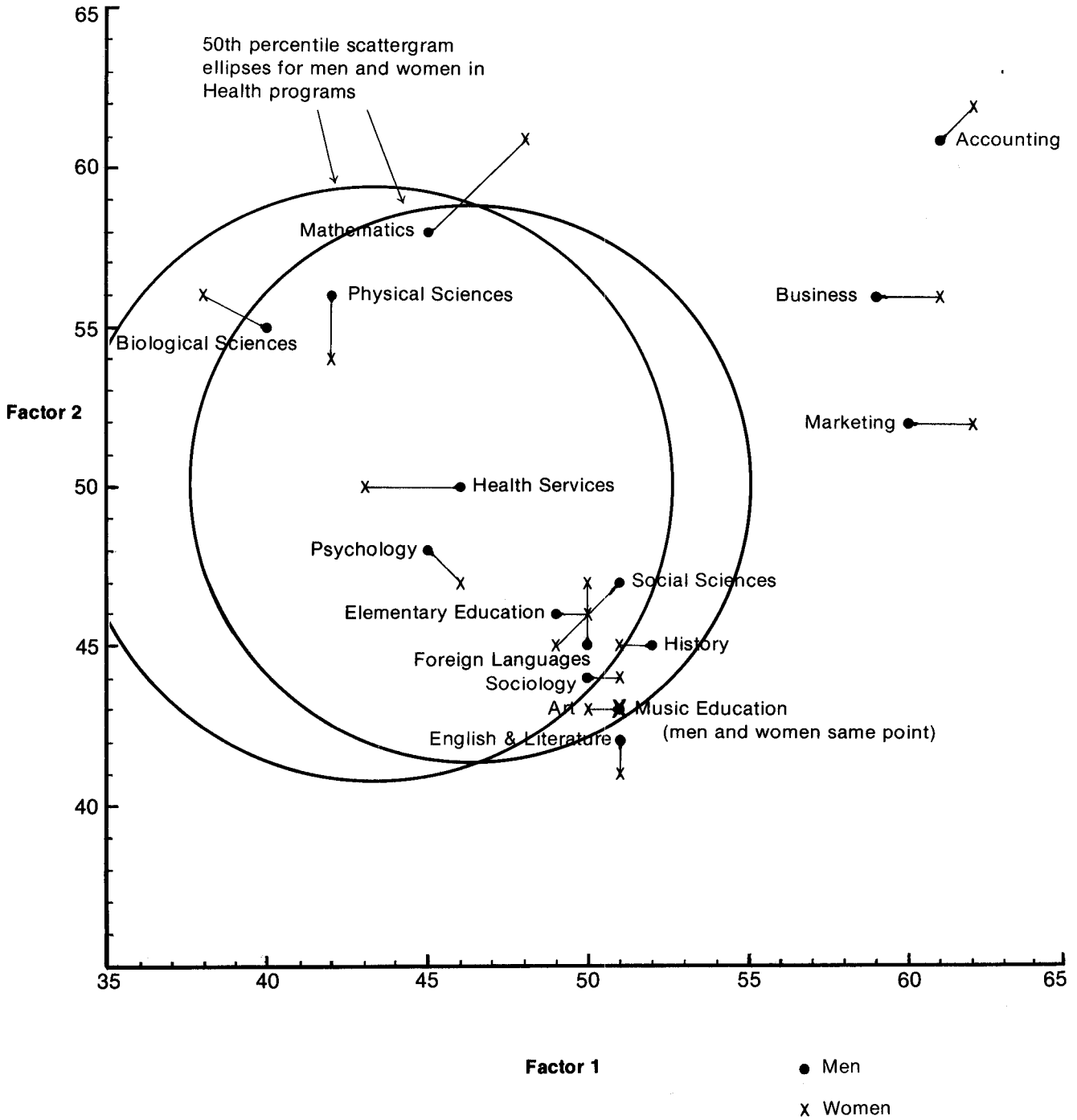


Fig. 8. Group centroids for men and women in the same educational major.

Educational major differences. Use of the ACT Interest Inventory for educational major exploration is based on the assumption that college seniors in various educational majors have meaningful as well as differential interest profiles based on the ACT Interest Inventory. Without differential interest patterns, little exploration would be possible. The purpose of this section is to examine how and to what degree college seniors in different educational programs differ.

As discussed in previous sections of this report, students in the same majors at different institutions have similar interests. Hence, it seems reasonable to combine students in the same major across institutions when forming the final criterion groups with which to examine educational major differences. Likewise, men and women in the same major may be included in the same criterion group because of their highly similar patterns of interest.

To determine the nature and extent of educational major differences, a 24-group discriminant analysis was conducted using the six ACT Interest Inventory standard scores as independent variables. The 24 groups consisted of all students who persisted to the second semester of their senior year and who indicated they were satisfied with their chosen major. Men and women were combined into the same criterion group, provided there were at least 75 members of each sex. Seventeen of the 24 educational majors met this criterion. Only males were included in the Agriculture, Economics, Engineering, Marketing, and the Philosophy and Religion majors. Only females were included in the Art Education and Home Economics majors.

The results of the analysis are summarized in Table 25 and Figure 9. Since very large sample sizes were involved, the univariate and multivariate analysis of variance statistical tests were sensitive to extremely small differences among groups. The univariate analysis of variance results for all six ACT Interest Inventory scales indicated statistically significant differences. The largest differences among groups were found for the Science and Business Detail scales. The 24 educational major groups differed the least on the Technical scale, as expected, since these were primarily 4-year college majors with a predominant number of majors in liberal arts areas.

The group centroid differences considered across the six scales simultaneously were much larger than

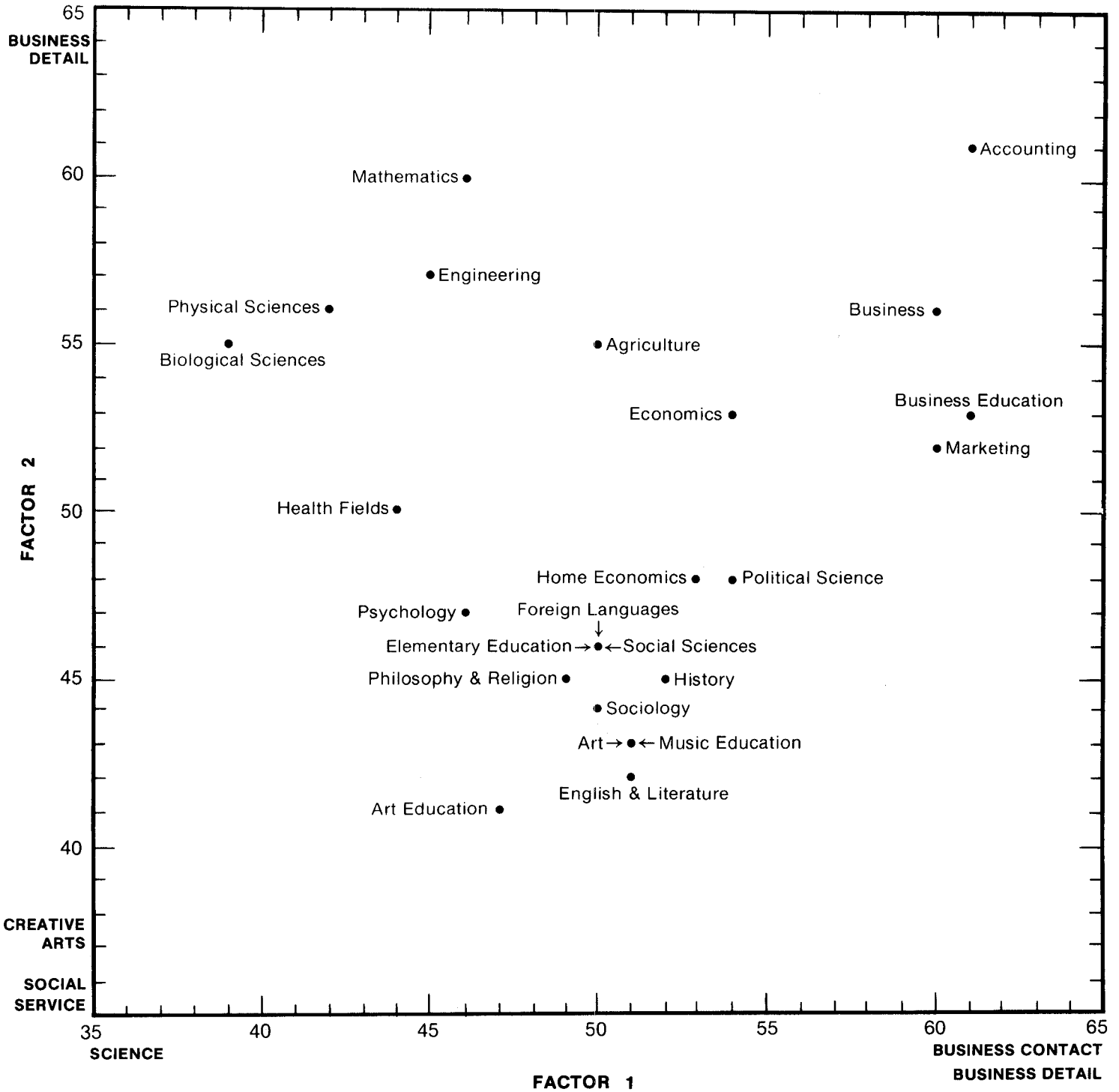
TABLE 25

Contribution of ACT Interest Inventory Scales to Differentiation of Educational Program Areas

ACT Interest Inventory Scales	Correlation with First 3 Discriminant Functions			Univariate F[a]
	1	*2*	*3*	
Science	-.72	.39	-.05	170.5
Creative Arts	-.05	-.64	-.35	109.4
Social Service	-.11	-.49	.73	104.4
Business Contact	.61	-.03	.12	110.5
Business Detail	.53	.56	.23	152.1
Technical	-.20	.26	-.21	34.0
Bartlett's X^2	5,322	4,845	1,956	
Degrees of freedom	28	26	24	
Percent of trace	39	35	12	

Note.—Wilks' Lambda = .305. The associated F-value is 115.8 (d.f. = 138 and 70,796).

[a]An F $>$ 1.8 is needed to exceed the 99th percentile point of the appropriate F distribution (d.f. = 23 and 12,145).



NOTE.—Factor score scales (mean = 50, SD = 10) are based on all students included in the analysis. ACT Interest Inventory scales correlating with the discriminant factors .40 or higher are shown as factor anchors.

Fig. 9. Distribution of educational majors on the first two discriminant factors for ACT Interest Inventory scales.

would be expected on the basis of chance alone, as indicated by a multivariate F-value of 115.8 (an F value of 1.8 is needed for statistical significance at the 1% level). The relatively low Wilks' Lambda of .30 indicates that little *within* group variation compared to the total variation or, conversely, considerable *among* group variation relative to total group variation, was found.

The nature of the interest dimensions differentiating the college majors is evident from the correlations of the ACT Interest Inventory scales with the first three discriminant factors and from the plot of the group centroids on the first two discriminant factors. The first discriminant function, which accounts for nearly 39% of the total discriminating power of the scales, is best described in terms of a bipolar factor with Business Contact and Business Detail scales at one pole and the Science scale at the other. A similar bipolar factor has been found in other studies, notably in the Project Talent studies (Flannagan et al., 1971) and others (Borgen, 1972; Stahmann, 1969; Baggaley & Campbell, 1967; Hanson & Prediger, 1973). Figure 9 and Table 26 show that college seniors majoring in Accounting, Business, Marketing, and Business Education obtain high scores on this factor and that students in the Biological Sciences, Physical Sciences, Engineering, and the Health Services majors obtain low scores. The second factor, also bi-polar in nature, accounts for approximately 35% of the variation and is defined by positive correlations with the Business Detail and Science scales and negative correlations with the Creative Arts and Social Service scales. College seniors majoring in Accounting, Mathematics, and Engineering (all requiring work with numbers) obtain high scores on the second discriminant factor, while students in Art Education, Sociology, and Philosophy and Religion obtain low scores. The third discriminant factor accounts for only 12% of the variation among groups and is defined by a high positive loading on the Social Service scale. This factor tends to separate students majoring in the social science and education areas such as Sociology, Social Sciences, general, Elementary Education, and Business Education from students majoring in the artistic areas such as Art, Art Education, and Music Education. These three discriminant factors account for a large portion (86%) of the variation among the 24 educational majors. The first two factors account for nearly three-fourths of the variation and are most useful in interpreting group differences.

These data suggest large and meaningful group differences among various educational majors. Table 26 shows the mean discriminant factor scores for each educational major group on the first three factors. On the first two factors there are differences as large as two standard deviations between the group centroids; on the third factor the differences are about one and a half standard deviations. Differences this large provide useful evidence that many of these educational majors have distinctly different patterns of interests. In addition, these differences are in expected directions and provide meaningful support for the concurrent and construct validity of the ACT Interest Inventory.

Cross-validation of educational major differences. Data reported in the previous section illustrated substantial differences in the interests of students majoring in different educational programs. Even though samples were large, thus minimizing the possibility of capitalizing on chance-related differences, the degree to which the results generalize to other samples should be examined. If a large portion of the observed differences were sample-specific, application of the procedure to new samples would result in less meaningful discrimination, that is, smaller and less sensible differences among groups. To determine the generalizability of the observed differences reported in the previous section, results of the discriminant analysis based on the validation sample were applied to a cross-validation sample consisting of 1,534 college seniors. Students were assigned to the cross-validation sample if they returned their interest inventory results after the established cutoff date or if they failed to provide the necessary identifying information used to merge their data with other background information. College seniors tested with the SVIB and ACT Interest Inventory (described on page 22) were also included in the cross-validation sample. The means and standard deviations of the six ACT Interest Inventory scales shown in Table 27 for the validation and cross-validation samples suggest that the two samples do not substantially differ.

The cross-validation analyses are summarized by three kinds of data analyses. First, the degree of discrimination among the cross-validation groups was determined by plotting their mean group centroids on the original validation sample discriminant factors. Second, centour scores (Rulon, et al., 1967) for all 24 major groups were calculated for each individual in each major to determine if college seniors in the cross-validation sample obtained their highest mean centour score for the major in which they were enrolled or for a very similar major. Third,

TABLE 26

Ordering from Highest to Lowest of Mean Discriminant Factor Scores for 24 Educational Majors

Discriminant Factor (Coordinate) Scores	Factor 1	Factor 2	Factor 3
62			
61	Accounting, Business Education	Accounting	
60	Business, Marketing	Mathematics	
59			
58			
57		Engineering	
56		Business, Physical Sciences	
55		Agriculture, Biological Sciences	Business Educ., Elementary Educ., Health Fields, Sociology
54	Economics, Political Science		
53	Home Economics	Business Educ., Economics	Psychology
52	History	Marketing	Accounting
51	Art, English & Literature, Music Education		Home Ec., History, Mathematics, Phil. & Rel., Social Sciences
50	Agriculture, Elementary Education, Foreign Languages, Social Sciences, Sociology	Health Fields	
49	Philosophy & Religion		Biol. Sci., Business, Econ., Pol. Sci.
48		Home Economics, Political Science	Foreign Languages, Music Educ., Physical Sciences
47	Art Education	Psychology	Agriculture
46	Mathematics, Psychology	Elementary Educ., Foreign Languages, Social Sciences	English & Literature, Marketing
45	Engineering	History, Philosophy, & Religion	Art Education, Engineering
44	Health Fields	Sociology	
43		Art, Music Education	
42	Physical Science	English & Literature	
41		Art Education	
40			Art
39	Biological Sciences		
38			
37			

the accuracy of classifying a new sample of college seniors into their actual group membership using centour scores was examined.

TABLE 27

Comparison of Validation and Cross-Validation Sample Means and Standard Deviations on the Six ACT Interest Inventory Scales

ACT Interest Inventory Scales	Validation Sample (N=12,169)		Cross-Validation Sample (N=1,534)	
	Mean	*S.D.*	*Mean*	*S.D.*
Science	50.7	11.2	50.5	10.6
Creative Arts	49.4	10.9	50.5	11.6
Social Service	50.0	10.7	50.3	11.0
Business Contact	49.5	10.9	48.7	11.2
Business Detail	49.3	11.3	48.3	11.2
Technical	50.7	10.0	49.5	10.6

To examine the cross-validation results, the centroids for each educational major comprising the cross-validation sample were plotted on the first two discriminant factors developed on the validation sample. If the ACT Inventory scales differentiate among educational majors, the degree of differentiation and group centroid locations should be about the same for the cross-validation sample as for the validation sample. The locations of the group centroids may vary somewhat because of sampling differences between the validation and cross-validation samples. Assuming the educational majors in the cross-validation groups are the same as those in the validation groups, the variation or spread among groups should remain approximately the same, however. That is, the range between the highest and lowest group centroid on each discriminant factor should be about the same for the cross-validation group as for the validation sample, and the relative distances among the group locations should remain approximately the same.

The plot of the cross-validation group centroids, shown in Figure 10, suggests nearly the same degree and type of differentiation as obtained for the validation sample, although some "regression" toward the overall centroid is apparent. The group centroids are separated by just slightly less than two standard deviations on the first discriminant factor. On the second discriminant factor the same general pattern was evident. Cross-validation educational majors with high scores on the second factor were slightly lower than the validation sample (e.g., Accounting, Mathematics), while the educational programs with low scores on the second factor obtained approximately the same scores for both groups. The second discriminant factor continued to differentiate among the business-related educational majors, although the Agriculture, Engineering, and Mathematics majors were less well differentiated than they were for the validation sample.

Another way to determine the generalizability of the discrimination found among the validation sample groups is to examine the mean centours across the 24 cross-validation educational major groups. A centour score for each major group was calculated for each individual. Ideally, the mean centour scores for the members comprising a given group should be highest for the group to which they belong, or for a highly similar group. That is, students enrolled in an Accounting major should obtain a higher mean centour score for the Accounting program than for dissimilar programs such as Art, Engineering, or Psychology. In addition, the mean centour scores for programs which are similar to Accounting should be higher than those for dissimilar programs. For example, the mean centour for the Accounting major based on students enrolled in Accounting is 43.7, shown in Table 28. Reading down the column, educational majors which also received relatively high mean centour scores are: Business, general (43.9), Business Education (37.7), Marketing (37.5), and Economics (36.9).

In this example, the mean centour scores for the Accounting and Business, general programs were nearly identical. Not all groups obtained their highest mean centour scores for the same-named educational major, however. For example, students majoring in Elementary Education obtained a mean centour score of approximately 46 for their own major, but obtained mean centour scores of about 48 for the History, Philosophy and Religion, and the Social Science educational majors. In nearly all cases, however, whenever a higher mean centour score was obtained for a different-named edu-

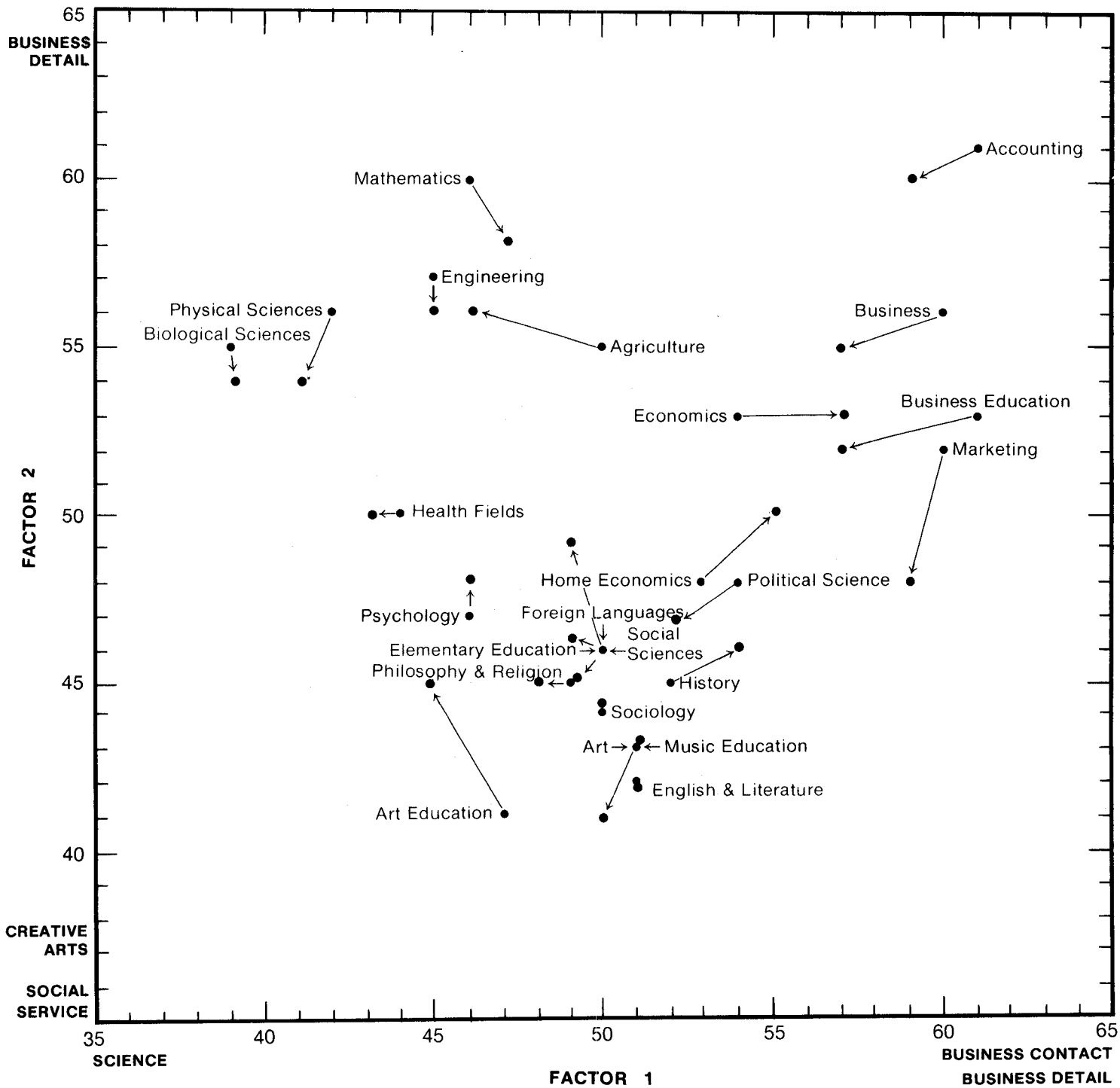


Fig. 10. Cross-validation educational major centroid locations plotted on the validation sample.

TABLE 28

Mean Educational Major Centour Scores for 24 Educational Major Groups Included in the Cross-Validation Sample

Educational Major Groups for Which Centours Were Obtained	Actual Group Membership Cross-Validation Sample																							
	1	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*	*13*	*14*	*15*	*16*	*17*	*18*	*19*	*20*	*21*	*22*	*23*	*24*
1. Accounting	43.7	17.8	4.7	1.6	6.2	35.6	33.4	31.4	7.9	15.5	5.8	16.9	8.8	23.9	15.2	21.8	24.6	5.9	9.7	5.3	14.7	8.2	9.7	7.0
2. Agriculture	29.7	48.7	19.5	22.7	35.1	42.1	39.2	42.3	30.7	56.5	23.3	36.5	30.7	39.6	30.3	44.4	30.2	23.9	27.5	34.0	36.7	34.8	37.7	30.9
3. Art (Fine & Applied)	16.4	24.1	48.7	47.2	17.2	26.1	32.5	35.8	47.8	24.8	49.3	37.8	32.8	38.2	47.1	20.8	34.5	49.6	45.4	27.6	47.8	41.7	52.4	52.7
4. Art Education	9.9	18.5	45.0	47.3	16.1	16.0	24.4	24.2	42.8	18.0	43.7	37.2	30.9	27.0	38.0	16.4	21.9	42.8	41.9	25.9	39.8	39.2	45.8	46.1
5. Biological Sciences	6.2	33.3	12.6	23.8	53.4	13.2	10.3	18.5	22.2	42.5	13.4	27.3	33.1	14.9	11.3	31.7	7.5	14.4	22.5	43.4	18.1	30.2	19.4	18.7
6. Business, general	43.9	28.8	13.4	8.8	9.8	46.9	47.3	44.0	20.0	24.3	15.9	25.6	17.0	40.2	32.5	27.2	46.0	17.8	19.0	10.4	31.3	17.9	24.1	19.3
7. Business Education	37.7	26.7	16.6	12.5	8.6	45.1	47.2	46.0	23.6	21.1	19.5	25.8	18.8	41.5	38.0	22.6	51.9	22.2	20.7	10.3	35.7	20.1	27.8	23.1
8. Economics	36.9	42.1	23.6	24.0	21.5	47.2	47.2	47.9	33.9	42.2	27.5	36.2	29.2	46.1	39.1	36.0	41.6	29.1	29.9	24.2	42.2	33.7	41.9	33.9
9. Elementary Education	20.0	30.1	42.2	45.4	19.4	30.6	37.3	39.8	46.3	30.9	43.9	40.0	34.9	39.9	45.6	25.1	34.0	44.7	42.4	29.0	48.1	43.2	53.5	48.8
10. Engineering	12.9	39.3	10.6	15.4	40.6	23.8	16.3	25.4	18.9	52.8	12.7	26.8	23.8	20.6	13.3	38.8	11.5	12.4	17.7	35.2	21.0	25.8	21.5	19.1
11. English & Literature	14.0	18.3	48.3	44.6	12.3	22.3	28.9	31.3	44.9	17.6	47.9	33.9	28.5	34.5	45.2	15.8	33.4	48.4	43.4	23.1	44.6	37.2	48.4	50.1
12. Foreign Languages	20.1	31.9	41.7	44.7	21.7	31.4	37.0	41.0	46.4	34.1	43.9	39.9	35.5	40.4	45.4	26.9	34.0	44.6	42.4	30.6	48.3	43.7	53.5	49.2
13. Health Services	15.1	40.9	29.1	42.2	45.0	25.9	28.7	35.0	40.5	48.7	32.2	43.3	43.9	31.2	31.4	36.5	20.6	31.6	38.0	44.6	39.0	47.5	44.5	39.8
14. Home Economics	25.1	33.7	36.6	37.3	18.7	37.6	42.1	45.3	43.4	34.1	39.6	37.2	32.7	45.2	46.9	27.6	42.1	41.8	38.7	26.3	48.4	40.6	51.0	45.1
15. History	21.9	30.2	45.6	44.6	18.9	33.8	39.3	43.1	48.4	30.8	47.5	39.5	34.5	44.6	50.4	25.4	41.9	48.8	44.8	28.3	51.2	42.8	54.5	52.0
16. Mathematical Science	20.9	44.3	12.1	18.1	44.0	29.8	21.3	27.9	20.7	58.8	14.0	29.6	26.7	25.4	15.8	47.4	14.2	13.5	20.4	39.6	22.9	27.8	23.4	20.2
17. Marketing	37.5	24.9	19.9	14.2	7.4	44.7	46.4	46.1	25.7	19.1	22.5	26.0	19.0	43.7	40.9	21.7	55.6	25.4	23.4	9.9	37.4	20.5	29.4	25.6
18. Music Education	16.1	23.5	48.9	47.8	16.6	25.6	32.5	35.1	47.9	23.6	49.2	38.3	32.9	37.8	47.2	20.2	34.6	49.6	45.6	27.2	47.8	41.8	52.4	52.4
19. Philosophy & Religion	18.0	29.8	43.0	49.0	22.7	28.5	36.0	39.1	48.3	30.6	45.0	42.9	38.9	39.4	46.4	25.3	34.4	45.1	45.1	31.8	48.8	46.5	54.3	49.8
20. Physical Sciences	12.9	44.6	19.9	32.9	56.0	22.9	19.9	28.9	30.6	56.3	21.4	36.5	38.5	24.6	20.5	42.5	14.2	21.7	28.8	49.9	28.7	38.6	31.5	28.7
21. Political Science	29.6	33.1	40.0	38.6	16.6	41.8	47.2	49.1	45.7	31.1	42.5	39.4	33.2	49.6	52.3	27.4	50.6	45.0	41.5	24.9	52.2	40.1	52.6	47.4
22. Psychology	14.9	35.2	37.7	48.9	35.3	24.8	30.9	35.1	45.6	39.9	39.8	45.1	43.1	33.2	37.9	31.0	23.7	38.9	43.0	40.1	43.8	49.2	50.5	46.2
23. Social Science, general	20.7	33.3	43.6	46.5	23.7	32.5	38.1	42.3	48.3	35.7	45.8	41.8	37.3	42.2	47.3	28.3	36.1	46.5	44.5	32.4	50.2	45.6	55.2	51.3
24. Sociology	17.1	25.2	44.3	45.5	16.5	26.7	33.6	36.4	45.7	25.5	45.2	37.5	32.5	37.2	45.0	21.2	32.5	45.9	42.6	26.9	46.6	41.1	51.7	49.1
Sample Size	74	26	79	16	111	93	43	16	154	50	97	39	62	41	81	64	42	44	25	62	51	90	82	92

cational major, it was for a major (or majors) similar in nature. As another example, students majoring in Engineering obtained a mean centour score of 53 for their own major, but obtained mean centour scores of 59, 57, and 56 respectively for the Mathematical Sciences, Agriculture, and Physical Sciences educational majors. Similar results were found for the Occupational Scales of the SVIB (Campbell, 1971). For example, the College Professor criterion group obtained a mean of 50 on its own scale but obtained means of 55, 55, 54, and 53 for the Physicist, Anthropologist, Astronomer, and Mathematician scales respectively.

In summary, 13 of the 24 educational majors obtained a mean centour score for their own major which was as high as or higher than their score for any other major. The remaining groups typically obtained a higher mean centour score for a differently named but a highly similar group. Hence, in a general way, these data support the generalizability of the results obtained for the validation sample.

Another way to look at the degree of discrimination among the cross-validation groups is to determine the accuracy of classifying individuals into their respective educational majors using centour scores (Rulon, et al., 1967). Centour scores based on the first two discriminant factors were calculated for every educational major for each individual. The higher an individual's centour score for a given group, the more similar that person is to that group. Thus, an individual could be classified into a particular group if the centour for that group was higher than for any other group. However, in guidance use of interest inventories, the purpose is *not* to predict what the counselee will do.[3] Rather, it is to suggest appropriate alternatives for exploration. These would consist of all programs with relatively high centours. For this reason, the results presented here include "hit rates" for the five highest centours. A "hit" was tabulated if any one of the five highest centour scores was the same as the actual group membership. The accuracy of classifying the cross-validation sample into the various educational major groups may be evaluated by comparing the cross-validation hit rates with hit rates based on a chance level of classification. In this case, individuals would be classified as a hit or near hit 5 times out of 24 (21%) by chance alone. Cross-validated hit rates which improve on this chance level of classification provide supporting evidence of the criterion-related validity of the ACT Interest Inventory.

The percentages of hits and near hits based on the five highest centour scores are presented in Table 29 for the cross-validation sample. The cumulative percentage of correct classifications ranged from a high of 77% for the Biological Sciences major to a low of 8% for the Foreign Languages major. The obtained hit rates based on the five highest centours exceeded the chance level classification hit rate (21%) for 22 of the 24 educational major groups. For the entire group, approximately 47% of the individuals were correctly classified. Those majors (e.g., Elementary Education and Foreign Languages) for which chance levels of classification were found were programs which were not well differentiated by the first two discriminant factors. For example, the Elementary Education and Foreign Languages majors occupy the same location. Hence, little or no discrimination can be made between these two groups in terms of the interest dimensions which work well to differentiate other groups; the result is a lower level of hit rates.

In general, the cross-validation analyses support the degree and type of educational program differentiation found for the validation sample. The locations of the cross-validation educational major group centroids on the validation sample discriminant factors indicated a relatively small degree of "regression" toward the overall group centroid. Meaningful differences among cross-validation educational major groups were also evident, as indicated by the improvement over the chance level "hit" rate for most educational majors when group membership was "predicted" for students from the cross-validation sample. Another indication of the meaningful differentiation found among the cross-validation sample was the general pattern of mean centour scores for students enrolled in various educational majors. Generally, a group of students enrolled in a particular major obtained their highest mean educational major centour for the program in which they were enrolled or for a highly similar one. Lower mean centour scores were obtained for dissimilar educational majors. Taken together, these analyses suggest considerable validity generalization.

[3]If this were the purpose, as it often is in clinical applications, procedures that optimize the accuracy of group membership predictions (Tatsuoka, 1971) would be more appropriate.

TABLE 29

Percentages of Cross-Validation Students within Each Educational Program Who Received One of Their Five Highest Centour Scores for the Program in Which They Were Enrolled

Educational Major	Centour Rank					Cumulative Percentages for the Five Highest Centours	Sample Size
	Highest	*2nd Highest*	*3rd Highest*	*4th Highest*	*5th Highest*		
Accounting	47.3	9.5	0.0	8.1	4.0	68.9	74
Agriculture	19.2	0.0	3.8	7.7	7.7	38.5	26
Art (Fine & Applied)	5.1	22.8	7.6	22.8	1.3	59.5	79
Art Education	25.0	0.0	6.3	12.5	0.0	43.8	16
Biological Sciences	41.4	15.3	7.2	7.2	5.4	76.6	111
Business, general	5.4	19.4	21.5	6.5	4.3	57.0	93
Business Education	20.9	14.0	7.0	6.9	7.0	55.8	43
Economics	0.0	6.3	6.3	6.3	25.0	43.8	16
Elementary Education	0.6	1.9	3.2	2.0	1.3	9.1	154
Engineering	8.0	16.0	14.0	18.0	6.0	62.0	50
English & Literature	30.9	11.3	5.2	1.1	7.2	55.7	97
Foreign Languages	0.0	2.6	0.0	0.0	5.1	7.7	39
Health Services	14.5	14.5	21.0	3.2	4.9	58.1	62
History	2.5	7.4	4.9	8.7	19.7	43.2	81
Home Economics	0.0	2.4	9.8	7.3	7.3	26.8	41
Marketing	31.0	23.8	4.8	2.4	2.4	64.3	42
Mathematical Sciences	26.6	9.4	14.1	6.3	1.5	57.8	64
Music Education	0.0	2.3	31.8	9.1	9.1	52.3	44
Philosophy & Religion	0.0	0.0	12.0	4.0	20.0	36.0	25
Physical Sciences	21.0	22.6	16.1	11.3	4.8	75.8	62
Political Science	3.9	7.8	2.0	11.8	11.8	37.3	51
Psychology	14.4	11.1	3.3	11.1	4.4	44.4	90
Social Science, general	3.7	1.2	11.0	3.6	4.9	24.4	82
Sociology	0.0	1.1	0.0	4.3	25.0	30.4	92

Summary

The process of validating the ACT Interest Inventory began with an examination of evidence related to its descriptive and exploratory uses. Evidence supporting the descriptive uses included correlational information showing that the six ACT Interest Inventory scales are relatively independent, are interrelated in a circular fashion according to theoretical expectations, are essentially unrelated to ACT ability measures, are moderately related to ACT Out-of-Class Accomplishment scales, and are highly related to SVIB scales measuring the same interest dimensions. Evidence supporting the use of the ACT interest Inventory to facilitate focused exploration of possible educational programs of study included analyses of institutional differences, sex differences, and educational program differences. Results from the multiple discriminant analyses used to examine these group differences showed that people in the same educational major attending different educational institutions had similar interest profiles; that men and women in the same educational major had highly similar patterns of interests when scores were scaled separately by sex; and that people in different educational majors had

quite different interest profiles. That similar educational program differences were found for a cross-validation sample supported the generalizability of these data. Similar analyses with different forms of the ACT Interest Inventory generally support these findings (ACT, 1974).

Overall, the data reported illustrate meaningful group differences on the scales of the ACT Interest Inventory as well as meaningful relationships with other types of variables. This section of the report merely marks the beginning of a long validation process; additional research is needed to continue the process. The next section outlines several critical areas which will receive attention in the near future.

Future Research Directions

In addition to the research summarized in previous sections of this report, several important areas need further investigation. Brief descriptions of the major questions and issues related to each topic are provided below.

Impact of interest inventories on career choice. Few studies have examined whether or not the results of interest inventories influence the career choices of students. For example, do the ACT Interest Inventory results stimulate career exploration? Does the ACT Interest Inventory reinforce existing sex role stereotypes? Would students make different career choices if they didn't have the results of the ACT Interest Inventory? Do students seek more information about educational majors and occupations as a result of having taken the ACT Interest Inventory?

Sex differences in item responses. Men and women respond differently to the items of the ACT Interest Inventory. The instrument as a whole has a reasonably good balance of items for both men and women, although individual scales may contain a disproportionate number of items which favor one sex or the other. The question becomes whether items could be written to which men and women would respond in a similar manner. Would scales composed of these items measure the same interest dimensions as the ACT Interest Inventory? Would these "sex-neutral" scales be as reliable? Would they differentiate among career choice groups as well as the scales of the ACT Interest Inventory? Would the circular configuration of interests found for other interest inventories be evident if the sex-neutral scales were used?

Validity of the ACT Interest Inventory for minority students. The use of interest inventories with ethnic minority students has received little attention. As with many assessment instruments, there is concern that possible cultural bias of interest inventories may reduce the accuracy with which the interests of individuals who are not from the white middle-class population are measured. Important questions in need of further research include: Does the circular structure of the scales of the ACT Interest Inventory hold for ethnic minority groups? Can the results of the ACT Interest Inventory correctly classify ethnic minority students as well as whites into the appropriate educational major or occupation? Do the six ACT Interest Inventory scales differentiate among ethnic minority educational major or occupational choice groups as well as they do for whites? Do the results of the ACT Interest Inventory suggest career alternatives to ethnic minority students which are different from those suggested to white students?

Discriminant factor structure. The empirical results of the discriminant analysis using the ACT Interest Inventory scales to differentiate among college senior educational major groups showed that two major bipolar factors accounted for a substantial portion of the variation among these groups. These two factors were used to construct a Map of College Majors (see description on p. 54) on which students could plot their scores and examine the similarity of their interests to the interests of the educational major groups. ACT Interest Inventory scales were used to "define" these factors in order to help students understand the differences among majors. If different groups or a different interest inventory had been used, the two factors might have been quite different. The major research questions for this problem are: Do the empirical results provide the most meaningful explanation of the differences among educational majors? Could the discriminant factors be "rotated" to provide a more psychologically meaningful structure? Are there "basic" factors which best differentiate among a variety of different types of groups? Could such basic factors be identified using other interest inventories? Additional research in this area would help provide a new "map" which might have more

meaning to students trying to understand the relationship of their interests to the interests of various educational major groups.

Predictive validity studies. The relatively recent development of the ACT Interest Inventory has precluded longitudinal studies of its predictive validity. Though the primary uses of the ACT Interest Inventory include the description of interests and the identification of personally relevant educational majors for further exploration, it is important that the interests of students be related to subsequent educational and vocational behavior. Research is needed to answer the following kinds of questions: Are the measured interests of high school students related to subsequent entry into educational majors? Are they related to subsequent entry into occupations? Are students who enter majors consistent with their interests more likely to persist in college than those who enter majors not consistent with their interests? Do students with less well defined patterns of interests change majors more frequently than students with well defined patterns of interests?

Relationship of interests and satisfaction. A major assumption underlying the use of the ACT Interest Inventory is that interests can be used to help people identify and explore careers in which they would be satisfied. This assumption implies a strong relationship between interests and satisfaction. No studies which examine this relationship for the ACT Interest Inventory have been conducted, however. Related research questions include: Do people satisfied with their educational majors have patterns of interests different from those of people who are dissatisfied? Do people who enter and persist in educational programs consistent with their interests indicate a greater degree of satisfaction than students who enter programs inconsistent with their interests? Does ability moderate the relationship between interests and satisfaction? Can satisfaction with future educational majors be "predicted" for high school students using ACT Interest Inventory scales?

Relating the Map of College Majors to the world of work. Choosing an educational major is an intermediate step in the career decision process for most students. While the Map of College Majors allows students to compare their interests with the interests of college seniors in different educational major groups, it does not provide a direct link to occupations and the world of work. A more direct link is provided through the ACT Interest Inventory and the use of a World-of-Work Map described by Prediger and Roth (in press) and summarized in Appendix 1. Scores from the ACT Interest Inventory can be converted to a "region indicator" which shows the locations, on the World-of-Work Map, of various job clusters (families) with respect to two bipolar work activity dimensions called People/Things and Data/Ideas. Additional research is needed to answer questions which deal with the relationship of the interests of college major groups to the world of work. Such questions might include: What are the work activity preferences of various college majors? Are these work activity preferences of college students related in a logical way to the occupations these college students expect to enter? Where are the various college major groups located on the World-of-Work Map?

Summary. These research topics include a few of the more critical questions which will receive attention in the immediate future. Research studies investigating some of the questions have been initiated; others will be begun when sufficient data are available. Also, any change of emphasis in the use of the ACT Interest Inventory will undoubtedly result in yet another set of issues and topics requiring additional research effort. As mentioned earlier, validation, as a process, is never finished.

Application of ACT Interest Inventory Research to Interpretation of Scores

The interpretive procedures for the ACT Interest Inventory were developed in the belief that self-exploration and career exploration should not be pursued independently. The use of interest inventories results for self-exploration has long been a standard procedure in career guidance. However, much less attention has been given to procedures for helping students explore themselves *in relation* to careers—for using assessment results to "facilitate self/career exploration" (Prediger, 1974). Too often in the past, counselors have been provided with a test score profile, some general validity data, a few suggestions, and little else. They have been forced to rely almost solely on "clinical interpretation" in deriving implications from test results. Certainly, clinical interpretation plays an important role in any use of tests. However, counselors faced with serving hundreds of students in a career guidance program seldom have the time clinical interpretation requires. Neither can most counselors, even with the best of training, be expected to possess the comprehensive and detailed knowledge of tests and the world of work that is required.

What is needed are well defined, built-in procedures for helping counselors and students "bridge the gap" between a test score profile and its educational and occupational significance (Goldman, 1971; Prediger, 1971). The following sections describe two reporting procedures developed to bridge this gap which can be used to facilitate a student's self/career exploration.

Relating Student Interests to Educational Majors

The first procedure for bridging the gap between an individual's interest profile and its educational significance is the use of the Educational Major Plot Scores and the Map of College Majors. The Map of College Majors helps students identify educational majors for possible exploration by showing the similarity of their interests to the interests of typical successful and satisfied college seniors in a variety of educational majors. A high similarity between a student's interests and those of students in a particular major (or majors) indicates that the student likes and dislikes the same types of career-related activities as typical members of that group. Counselors may use this information to help students explore educational options by showing them what groups of people with interests like theirs have done in the past. Although similarity of interests with fellow students is only one of several important aspects to be considered in educational and vocational exploration, it does provide a reasonable basis for beginning the exploration of possible educational majors.

A previous section of this report showed that college seniors graduating from different educational majors had substantially different profiles of interest (see the profile charts on pp. 36-41 as examples). These profile differences were summarized by plotting the educational major group means on the two discriminant functions or "factors" (see Figure 9, page 44) which best discriminated among all groups. The resulting Map of College Majors can also be used to show the similarity of an *individual's* interests to the interests of college seniors in these same majors. On the ACT Student Profile Report, students are provided two coordinate points ("factor" scores) to plot their location on the Map of College Majors. The closer a student's location is to a particular major or group of majors on the map, the more similar the student's interests are to the interests of typical members of that group. If a student's location does not fall near any of the educational major groups, his or her interest scores are probably much higher or lower than the average scores for the groups. An individual should still examine those majors nearest his or her location on the map, however. Though different in some respects, the student's interests are more like the interests of those college majors nearest his or her location than any other majors found elsewhere on the map. Students interested in understanding "why" they obtained their particular location on the Map of College Majors may examine the interest scale titles printed near the ends of each coordinate. These "anchor points" explain how educational majors differ across the interest scales. Factor 1 (horizontal) is best described in terms of business-related interests at one end and science-related interests at the other. For example, college seniors majoring in Accounting, Business, Business Education, and Marketing typically have high interest scores on the Business Contact and Business Detail scales, while Biological and Physical Science majors typically have high scores on the Science scale. Factor 2 may be interpreted much the same way, in terms of Business Detail interests at one anchor point and Creative Arts and Social Service at the other. For other applications of

the Map of College Majors, refer to the ACT Assessment *Counselor's Handbook* and *Student's Booklet.*

Relating Student Interests to the World of Work

The Map of College Majors provides information about the similarity of a student's general interests to the interests of *groups of students* enrolled in each of several college majors. The second procedure for helping students and counselors "bridge the gap" between interest scores and their implications, the World-of-Work Map, focuses on another important consideration—the similarity of a student's job-related activity preferences to the *activities characterizing various occupations.* As with the Map of College Majors, use of the World-of-Work Map is based on the rationale, explicated by Prediger (1974), that a major role of tests in career guidance is to stimulate, broaden, and provide focus to career exploration.

To help students obtain an overview of the world of work and to facilitate representation of occupations on the World-of-Work Map, groups of similar occupations have been organized into 25 "job families." These job families, along with examples of typical occupations, are listed according to six job clusters in Figure 11. The job clusters and job families are primary organizational elements in the ACT Occupational Classification System described in Appendix 1. The World-of-Work Map appears in Figure 12 as it is presented to students.

The World-of-Work Map is based on research (summarized in Appendix 1) which indicates that basic work tasks and job-related activity preferences can be represented by two relatively independent bipolar dimensions—a data/ideas dimension and a people/things dimension. The approximate positions of job families on these dimensions are shown on the map. Principal components analyses of the six ACT Interest Inventory scales indicate that when the effects of response level are removed, the job-related activity preferences of students can also be summarized by these same dimensions. Thus, there is a common basis for comparing student job-related activity preferences with the work tasks characteristic of the job families.

Equations obtained from the principal components analyses are used to translate student scores on the six interest scales to scores on the data/ideas and people/things dimensions. These equations assign weights to the six interest scores in order to derive scores on the two dimensions. The correlations between student scores on the two dimensions and scores on the six interest scales are shown for two independent samples in Table 30. These correlations (factor patterns) provide a general indication of the contribution of each interest scale to scores on the two bipolar dimensions. For example, the Social Service scale is weighted heavily on the people/things dimension; high scores place a student near the people end of the dimension. Likewise, students with high Business Detail interests typically score near the data end of the data/ideas dimension.

A student's scores on the data/ideas and people/things dimensions are used to locate the student on the World-of-Work Map. But rather than reporting the coordinates for a point, as is done for the Map of College Majors, the student's location is reported as a region on the map. This reporting procedure was chosen because the World-of-Work Map was not intended to be a precise scientific statement about the work world. Its purpose, as noted earlier, is to stimulate and facilitate career exploration.

To this end, and in accordance with the level of precision that was desired, the map was arbitrarily divided into 13 regions. Twelve of the regions, each covering 30° on the map, span the world of work. The 13th region ("region 99"), which falls at the center of the map, is used when student scores on the Interests Scales are inconclusive with respect to preferences for data/ideas and people/things work tasks.

The translation of interest scores into a region on the map provides students with a general picture of their standing on the data/ideas and people/things dimensions. The ACT Assessment *Student's Booklet* urges students to look into job families and associated educational programs in their region and others nearby. Alternative procedures for using the World-of-Work Map are suggested to students in region 99.

The *Student's Booklet* emphasizes the exploratory, rather than limiting, uses of the World-of-Work Map. Information about job families and ideas for career exploration are presented. Students are reminded that career decisions are also life decisions and that in making such decisions, they are doing more than simply "preparing for a job." The importance of educational decisions to the achievement of one's life goals is also stressed. Further information about the World-of-Work Map and its uses may be found in the *Student's Booklet* and the *Counselor's Handbook.*

BUSINESS SALES & MANAGEMENT JOB CLUSTER

A. PROMOTION AND DIRECT CONTACT SALES
Public relations workers, fashion models, travel agents, sales workers who visit customers (for example—real estate brokers, insurance agents, wholesalers, office supplies sales workers)

B. MANAGEMENT AND PLANNING
Hotel, store, and company managers, bankers, executive secretaries, buyers, purchasing agents, small business owners

C. RETAIL SALES AND SERVICES
Sales workers in stores and shops, auto salespersons, retail sales workers

BUSINESS OPERATIONS JOB CLUSTER

D. CLERICAL AND SECRETARIAL WORK
Typists, file clerks, mail clerks, office messengers, receptionists, secretaries

E. PAYING, RECEIVING, AND BOOKKEEPING
Bank tellers, accountants, payroll clerks, grocery check-out clerks, ticket sellers, cashiers, hotel clerks

F. OFFICE MACHINE OPERATION
Adding, billing, and bookkeeping machine operators, computer and data processing machine operators, telephone operators

G. STORAGE, DISPATCHING, AND DELIVERY
Shipping and receiving clerks, stock clerks, truck and airplane dispatchers, delivery truck drivers, cab drivers, mail carriers

TECHNOLOGIES & TRADES JOB CLUSTER

H. HUMAN SERVICES CRAFTS
Barbers, hairdressers, tailors, shoemakers, cooks, chefs, butchers, bakers

I. REPAIRING AND SERVICING HOME AND OFFICE EQUIPMENT
Repairing and servicing—TV sets, appliances, typewriters, telephones, heating systems, photo copiers

J. GROWING AND CARING FOR PLANTS/ANIMALS
Farmers, foresters, ranchers, gardeners, yard workers, groundskeepers, plant nursery workers, animal caretakers, pet shop attendants

K. CONSTRUCTION AND MAINTENANCE
Carpenters, electricians, painters, custodians (janitors), bricklayers, sheet metal workers, construction laborers, (buildings, roads, pipelines, etc.)

L. TRANSPORT EQUIPMENT OPERATION
Long haul truck and bus drivers, bulldozer operators, crane operators, forklift operators

M. MACHINE OPERATING, SERVICING, AND REPAIRING
Auto mechanics, machinists, printing press operators, sewing machine operators, service station attendants, laborers and machine operators in factories, mines, lumber camps, etc.

N. ENGINEERING AND OTHER APPLIED TECHNOLOGIES
(For science and medical technicians, see Job Families O and P.)
Engineers and engineering technicians, draftsmen and draftswomen, pilots, surveyors, computer programmers

NATURAL, SOCIAL, & MEDICAL SCIENCES JOB CLUSTER

O. NATURAL SCIENCES AND MATHEMATICS
Biologists, chemists, lab technicians, physicists, geologists, statisticians, agricultural scientists, ecologists

P. MEDICINE AND MEDICAL TECHNOLOGIES
Dentists, doctors, veterinarians, medical technologists and lab workers, pharmacists, X-ray technicians, optometrists, dental hygienists, dietitians

Q. SOCIAL SCIENCES AND LEGAL SERVICES
Sociologists, lawyers, political scientists, psychologists, home economists

CREATIVE & APPLIED ARTS JOB CLUSTER

R. CREATIVE ARTS
Authors, concert singers, musicians, actresses and actors, dancers, artists

S. APPLIED ARTS (VERBAL)
Reporters, technical writers, interpreters, newscasters, newswriters, ad copy writers

T. APPLIED ARTS (VISUAL)
Interior decorators, architects, commercial artists, photographers, fashion designers

U. POPULAR ENTERTAINMENT
Night club entertainers, popular singers and musicians, disc jockeys, circus performers

SOCIAL, HEALTH, & PERSONAL SERVICES JOB CLUSTER

V. EDUCATION AND SOCIAL SERVICES
Teachers , counselors, social workers, librarians, athletic coaches, recreation workers, clergymen and clergywomen

W. NURSING AND HUMAN CARE
Child care aides, nurses, dental assistants, physical therapists, hospital attendants

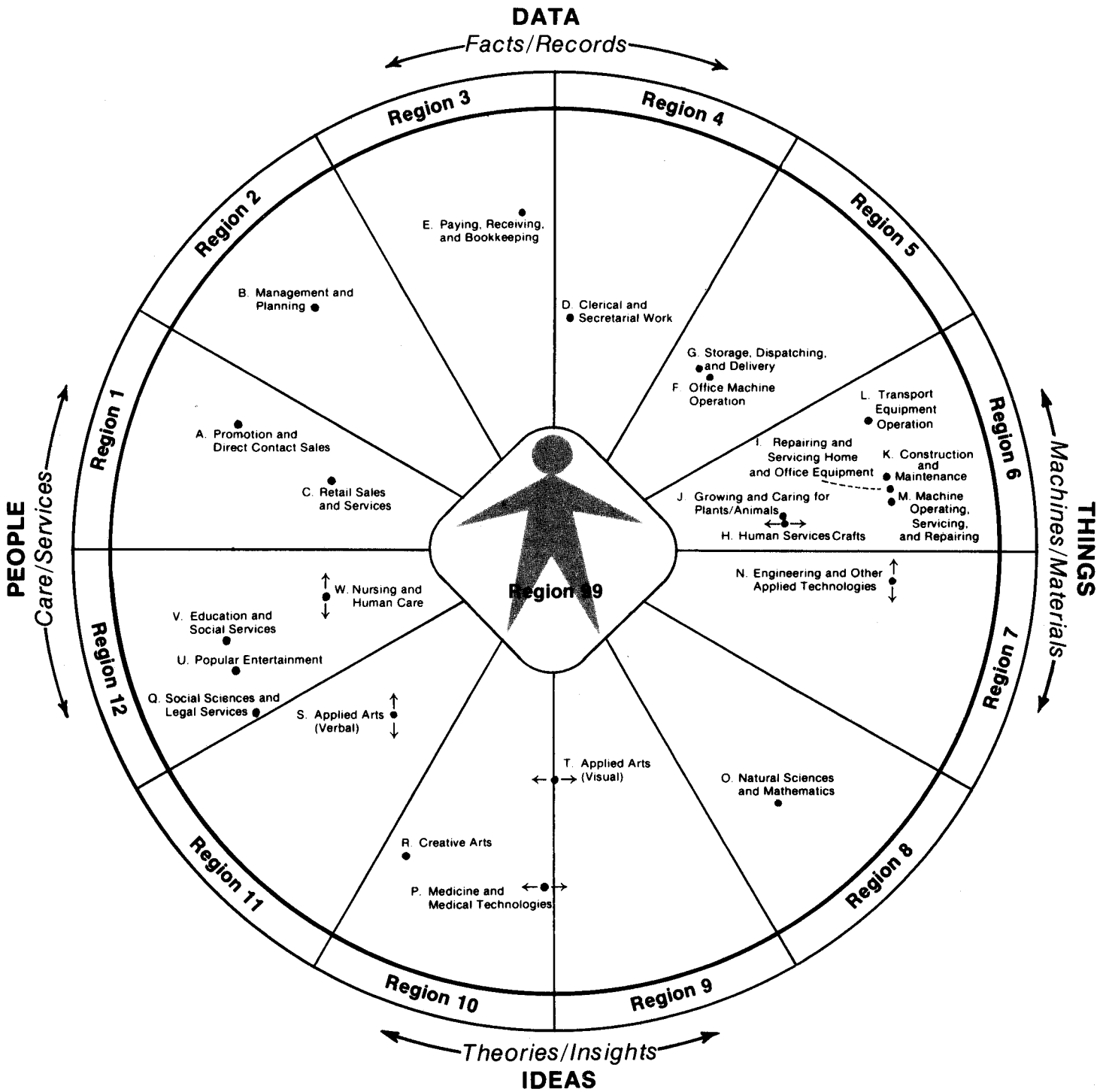
X. PERSONAL AND HOUSEHOLD SERVICES
Waiters and waitresses, airline stewardesses and stewards, housekeepers, porters, car hops, butlers and maids

Y. LAW ENFORCEMENT AND PROTECTIVE SERVICES
Police officers; building, food, and postal inspectors; watchmen; plant guards; firefighters

Fig. 11. Job clusters, related job families, and typical occupations in each job family.

This map locates Job Families in the World of Work according to their involvement with DATA, IDEAS, PEOPLE, and THINGS. Arrows by a Job Family show that work tasks often heavily involve both PEOPLE AND THINGS (←→) or DATA AND IDEAS (↕). Although each Job Family is shown as a single point, the jobs in a family vary in their location. Most will scatter near the point that is shown for the Job Family, however.

See your CPP Student Report (bottom, center) for the region of the map in which your interests fall.



Note.—Because not enough information was available, the following two Job Families in the Social, Health, and Personal Services Cluster are not on the map: X. *Personal and Household Services,* and Y. *Law Enforcement and Protective Services.* Jobs in both of these families tend to fall in the inner area of Regions 2 through 5.

Fig. 12. World-of-Work Map for job families.

APPENDIX 1

Development of the ACT Occupational Classification System and the World-of-Work Map

Research on the ACT Occupational Classification System, the World-of-Work Map, and their relationship to the ACT Interest Inventory is summarized here. A more extensive report of this research (Prediger & Roth, in press) can be obtained by writing ACT Publications, P.O. Box 168, Iowa City, Iowa 52240.

Development of the ACT Occupational Classification System

Identification by the U.S. Department of Labor (1965) of more than 35,000 occupational titles provides dramatic testimony to the complexity of the world of work. Those who seek to help students with career exploration and planning have long recognized that some means of organizing and summarizing this complexity is needed. As a result, a number of occupational classification systems have been developed. Examples range from the 15 industry-based clusters developed by the U.S. Office of Education (1971) to the 72-group, psychologically-based typology constructed by Holland (1972). Undoubtedly, the most widely used and influential occupational classification systems are those appearing in the *Dictionary of Occupational Titles* (U.S. Department of Labor, 1965).

A review of the above systems and more than 15 others identified in a cursory search of the professional literature indicated that, from the standpoint of career guidance, each had certain strengths and weaknesses. None had all of the characteristics important in helping students with career exploration. Indeed, it appeared that the perfect classification system did not, and would not ever, exist because of the complexity of the world of work. In each of the systems that were reviewed, certain compromises were made to achieve the desired emphases. None of the systems helped students relate their *selves* to the world of work in the manner ACT envisioned for measurement-based career guidance programs. Thus, with this primary goal in mind, ACT undertook the development of a new occupational classification system.

Overview of classification system. Figure 13 shows the hierarchical structure of the ACT Occupational Classification System. At the most general level, there are six "job clusters" similar in nature to the six occupational environments described by Holland (1973). At the second level of the hierarchy, each job cluster subsumes from 3 to 7 "job families," with a total of 25 job families across the six clusters. (The word "job" is used in both titles because the classification system is intended for use with students. "Occupation" would be the more appropriate term for a professional audience.) The job families, in turn, are subdivided into three categories of formal job preparation. As an alternative, the system also provides for the division of job families into the 603 3-digit occupational code groups used in the *Dictionary of Occupational Titles* (DOT). Finally, occupational titles are listed according to typical types of formal preparation. In instances where complete specificity is not warranted, these titles may subsume a range of individual occupations (e.g., factory machine operators, editors, retail sales workers, school teachers).

The six job clusters and related job families appear in Figure 11 (see p. 56) in the form they are presented to students. The third level of classification, type of preparation, is shown in the Job Family Charts in the ACT Assessment *Student's Booklet.* More than 250 occupations and related educational programs are listed in these charts according to job cluster, family, and type of preparation. Hence, the charts provide a comprehensive overview of the entire classification system.

Objectives on which the system is based. As noted above, there can be no perfect occupational classification system. Any system will reflect a series of compromises necessitated by the complexity of the work world. The compromises made in developing the ACT Occupational Classification

System were based on the following objectives.

1. The system must encompass the entire world of work.

2. The system must be appropriate for persons at various stages of career development.

3. The system must provide an overview of the world of work in occupational terms. That is, occupations should be grouped on the basis of similarities in job duties rather than by industry or by the psychological characteristics of workers.

4. The system must make it possible for students to identify occupations for exploration on the basis of their educational plans and personal characteristics, specifically, their interests and abilities.

In order to accomplish the first objective, the 13,800 occupations identified as unique in the DOT were used as the primary units of analysis in developing the classification system. However, for documentation purposes, it was desirable to be able to define the occupational content of the job families by 3-digit DOT code groups rather than by lists of thousands of specific occupational titles. Hence, whenever possible, the integrity of the 603 occupational code groups appearing in the DOT was maintained. Several compromises were made in this direction, and as a result, the DOT 3-digit code groups, when arranged by job family, provide a comprehensive summary of the occupational content of the classification system.

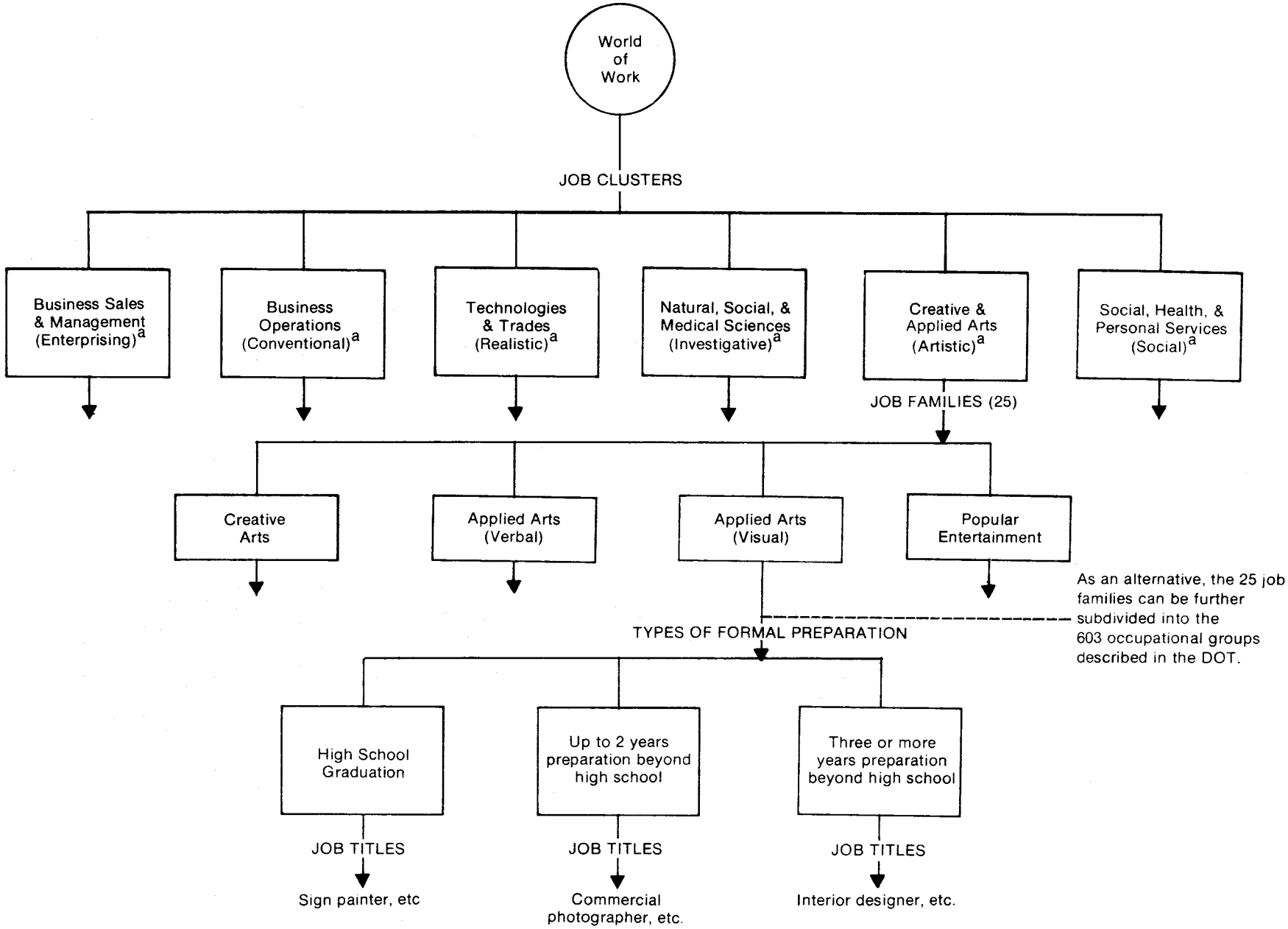
The major compromise made in order to accomplish the second objective for the classification system was to minimize the number of classification categories and to provide three classification levels of increasing specificity. From the standpoint of simplicity of use, especially for persons in an early stage of career development, an occupational classification system should have as few categories as possible. However, too few categories may cloud important differences and relationships among occupations. The categories may be so heterogeneous that their value in career exploration and planning will be minimal.

In response to this dilemma, the hierarchical system illustrated in Figure 13 was developed. At the most general level of the hierarchy, students can be introduced to the six job clusters, each of which covers a relatively unique region of the work world. At the second level, 25 job families are used to summarize the complexity of the work world. Because the job families are organized according to job cluster, their number is not unmanageable. Finally, at the third level of the hierarchy, students are referred to specific occupations classified according to job cluster, job family, and type of formal preparation.[4] At this level of complexity there are potentially 75 groups in the system. However, only 25 job families are involved, and because each has been subdivided into the same job preparation categories, specificity is obtained without sacrificing simplicity.

The third and fourth objectives for the ACT Occupational Classification System appear, at first glance, to be incompatible. That is, the classification system must provide an overview of the work world in occupational terms and, at the same time, it must have a psychological basis in order to help students relate their personal characteristics to occupations. Accomplishing both of these objectives with the same system was, indeed, quite difficult. Expressed in terms of the two DOT occupational classification systems, the third objective meant that the job families should be structured along the lines of the occupational group arrangement rather than the worker traits arrangement. The former classifies occupations according to work field, purpose, product, service, etc., while the latter groups occupations according to some combination of aptitudes, interests, temperaments, etc.

Although the DOT worker traits arrangement has a number of desirable features, the number of groups (114) is unwieldy from a guidance standpoint, and the occupations in a specific group are often quite diverse. In order to provide students with a comprehensive yet simple overview of occupations, job families that were as homogeneous as possible with respect to work field, etc., were preferred. Yet, it was also crucial that the system contribute to helping students relate their personal characteristics to the job families. As described below, the compromise that evolved during 2 years of research and study uses characteristics of both of the DOT classification systems in forming job families.

[4]One of the three types, "high school graduation desirable," is not used in the ACT Assessment Program.



[a]Related title in Holland's typology for occupational environments.

Fig. 13. Overview of the ACT occupational classification system.

Data/Ideas and People/Things Dimensions of Work. Information on the worker traits associated with each of the 13,800 occupations identified as unique in the DOT was obtained on computer tape from the U.S. Department of Labor. Analyses of this information and Holland codes for the 603 3-digit DOT groups (Holland, 1973) indicated that there are two basic and relatively independent bipolar dimensions of work tasks on which occupations and 3-digit DOT code groups differ—a data/ideas dimension and a people/things dimension. Occupations having high involvement with data (e.g., accountant, air traffic control, office management) tend to have low involvement with ideas. Conversely occupations having high involvement with ideas (e.g., creative writing, social psychology, and zoology) tend to have low involvement with data. Similarly, occupations with high "people" involvement (e.g., school counseling, nursing, sales management) tend to have low "things" involvement, and vice versa.

These same work task dimensions are also implicit in the circular configuration of occupations suggested by Roe (1956) and Roe & Klos (1969) and are compatible with the results of research on Holland's six types of personal orientations and occupational environments (e.g., see Cole, 1973; Cole & Hanson, 1971; Cole, Whitney, & Holland, 1971; Edwards & Whitney, 1972; and Holland, 1973). Indeed, a factor analysis by Cottle completed more than 20 years ago (Cottle, 1950) pointed to similar bipolar dimensions.

Recent research at ACT based on the scores of several hundred occupational groups on the Basic Scales of the Strong Vocational Interest Blank, Project TALENT interest measures, and Holland's Vocational Preference Inventory also support the bipolar dimensions. Typically, more than 60% of the variation of occupations on these measures is accounted for by the two dimensions, and occupations distribute themselves on the dimensions in quite sensible ways. Finally, principal components analyses of ACT Interest Inventory scales presented previously in this report indicate that, when the effects of response level are removed, the scales can be used to place students on the same two dimensions. Response level effects can be briefly defined as the general tendency to respond "like," "dislike," etc., to items, regardless of item content.

In summary, the accumulated evidence, especially when viewed in the context of the theoretical formulations of Roe and Holland, provides strong support for two basic, bipolar dimensions of work tasks and work orientations. For this reason, the data/ideas and people/things dimensions were used to summarize worker trait information for occupations. Since these dimensions are also compatible with Holland's six types of personal orientations and occupational environments, Holland's types were used as the framework for organizing the job families into job clusters.

The poles of the two bipolar dimensions are described below with alternate terms appearing in parentheses. Examples of work activities are also provided.

Data (facts, records, files, numbers; systematic procedures for facilitating goods/services consumption by people). "Data activities" involve *impersonal processes* such as recording, verifying, transmitting, and organizing facts or data representing goods and services. Purchasing agents, accountants, and secretaries work *mainly* with data.

Ideas (abstractions, theories, knowledge, insights, and new ways of expressing something—for example, with words, equations, or music). "Ideas activities" involve *intrapersonal processes* such as creating, discovering, interpreting, and synthesizing abstractions or implementing applications of abstractions. Scientists, musicians, and philosophers work *mainly* with ideas.

People (no alternative terms). "People activities" involve *interpersonal processes* such as helping, informing, serving, persuading, entertaining, motivating, and directing—in general, producing a change in human behavior. Teachers, salesmen and nurses work *mainly* with people.

Things (machines, mechanisms, materials, tools, physical and biological processes). "Things activities" involve *nonpersonal processes* such as producing, transporting, servicing, and repairing. Bricklayers, farmers, and engineers work *mainly* with things.

The occupations listed as examples were chosen with an emphasis on the primary purpose or focus of the job activities. For example, a scientist may work with data, but the primary purpose is *not* to produce or handle data; rather it is to create or apply scientific knowledge. Likewise, an accountant may work with ideas, but the ultimate goal is *not* to create

ideas; rather, it is to organize, record, and verify data in a systematic manner.[5]

Summary of classification system development. Through a process of successive approximation, DOT occupations were arranged into job families that are relatively homogeneous with respect to involvement with data/ideas and people/things. At the same time, care was taken to maintain homogeneity with respect to work field and insure that the job families made sense in terms of the types of occupations that were grouped together. Initially, 30 job families were formed, each assigned to one of the six clusters. These job families were revised to make them more usable by students and were then tried out on approximately 1,600 9th graders attending seven schools located in four states. In the tryouts, students were asked to record their first and second occupational preferences and then allocate them to the job families. Thus, a check could be made on the difficulties students had in comprehending the classification system.

Information from these tryouts and new analyses of DOT worker trait data led to further revisions of the occupational classification system. A version containing 25 job families was used in spring 1973 norming of ACT's Career Planning Program, Grades 8-11 (ACT, 1974). Information from the norm group study along with the theoretical considerations and research results cited above led to further revisions of the classification system. Included was the addition of the three job preparation categories. Allocation of occupations to the three categories was based on DOT ratings for the amount of time involved in preparing for occupations, supplemented by information in the *Occupational Outlook Handbook* (U.S. Department of Labor, 1972-73).

World-of-Work Map

The distribution of the job families on the data/ideas and people/things dimensions is shown by the World-of-Work Map reproduced in Figure 12 (see p. 54). Job families are located on the map according to the relative standing of their member occupations on the two dimensions, as indicated by the studies cited above. Although care was taken to make job families as homogeneous as possible on these dimensions, there is still considerable scatter among the occupations in a job family. As noted on the map, arrows are used to indicate the nature of this scatter when it is unusually large.

The reader is reminded that the World-of-Work Map summarizes information on some 13,800 occupations. The map was constructed to help students identify and explore career options. Hence, it is application-oriented and is not meant to constitute a precise scientific statement. While ACT believes that the map in its current form is useful for purposes of career exploration, certainly no claim to infallibility is made. ACT hopes and intends that the map, and the classification system on which it is based, will be the subject of continued study, revision, and improvement.

Differentiation of Job Family Preferences

Criterion-related validity evidence available for ACT Interest Inventory scales includes their effectiveness in differentiating among students (specifically, 11th graders) classified into job families according to their occupational preferences. The occupational preferences of 11th graders do not provide ultimate criteria for evaluating the criterion-related validity of interest measures. However, research has shown that occupational choices are moderately stable during the later years of high school (e.g., see Whitney, 1969), which indicates that many students have established a general direction for their careers during this stage of development. Because changes from initial occupational choices to related ones are accommodated by the broad job family groups, these groups should be satisfactory for use as intermediate criteria of occupational choice. Certainly, if expected differences in the scores of students across the job families do *not* occur, serious

[5]Some comments on the data, people, and things hierarchies in the DOT appear to be warranted in conjunction with the discussion in this section. Each occupation in the DOT is assigned a rating that summarizes its level of involvement with data, people, and things. (These ratings were taken into account in the analyses of occupations cited above). Because level of involvement with data and ideas is expressed on the *same* scale, there are dramatic differences among occupations with high ratings on the DOT data hierarchy (e.g., accountants and poets). In addition, the DOT treats the data, people, things hierarchies as if they were unrelated. However, research at ACT indicates that there is a substantial negative relationship between DOT ratings on the people and things hierarchies.

questions about the criterion-related validity of interest scales could be raised.

Students in the job family preference study were selected from the 11th grade norm group for the Career Planning Program, Grades 8-11 (ACT, 1974) which uses an interest inventory highly similar to the ACT Interest Inventory. Of the 9,307 students in this group, 2,046 who indicated they were "not sure at all" of their first occupational preference were eliminated from the job family groups. Interest score profiles were then developed for each job family. A z-score scale was used with sex differences and the effects of response level were removed.

Interest profiles for six "archetype" job families (ACT, 1974) selected from each of the job families show that students in the job families score as expected. For example, students in the Management and Planning Job Family score highest on the Business Contact and Business Detail scales, both of which cover types of activities typical of management and planning occupations. On the other hand, students preferring occupations in the Paying, Receiving, and Bookkeeping Job Family score highest on the Business Detail scale. Their somewhat lower, but still relatively high, score on the Business Contact scale is also congruent with expectations.

Further evidence of the effectiveness of ACT Interest Inventory scales in differentiating among job families is provided by the distribution of job families on the first two principal components for the scales. A principal components analysis was conducted on the scores of all students in a 10% sample randomly selected from the 11th grade norm group. Sex differences and the effects of response level were controlled in the analyses. The first two components accounted for 53% of total variance, and yielded eigenvalues of 1.79 and 1.41, respectively. Varimax loadings for these two components are shown in Table 31. They differ only slightly from the unrotated loadings.

Considered in light of ACT Interest Inventory scale content and in conjunction with other studies of interest dimensions (Prediger & Roth, in press), the first component can be interpreted as representing a data/ideas interest dimension, with the second component representing a people/things dimension. Whatever labels are used, however, the

TABLE 30

Comparison of Factor Patterns for CPP 8-11 and ACT Interest Inventory Samples after Rotating Principal Components to Data/Ideas and People/Things Interest Dimensions

	CPP 8-11 Sample		ACT Interest Inventory Norm Group Sample	
ACT Interest Inventory Scale	*Data/Ideas Factor*	*People/Things Factor*	*Data/Ideas Factor*	*People/Things Factor*
Science	-.638	-.246	-.648	-.424
Creative Arts	-.571	+.320	-.568	+.438
Social Service	-.080	+.703	-.083	+.736
Business Contact	.691	+.331	.716	+.384
Business Detail	.731	-.241	.737	-.339
Technical	-.066	-.730	-.054	-.740
Percent of variance accounted for by rotated factors	29.3	22.6	30.1	28.7
By unrotated factors	29.8	23.6	30.8	28.7

Note.—CPP 8-11 is the Career Planning Program for grades 8-11 (ACT, 1974). The CPP 8-11 sample was a 10% sample (N=930) randomly drawn from the 11th grade norm group.

TABLE 31
Varimax Loadings of First Two Principal Components for Interest Scales (N=930)

	Correlations with Principal Component	
Interest Scale	*1*	*2*
Science	-.65	.03
Creative Arts	-.43	.06
Social Service	-.19	.77
Business Contact	.72	.24
Business Detail	.77	-.12
Technical	-.15	-.86

distributions of job families on these two principal components provide evidence relevant to the criterion-related validity of the interest scales.

Mean scores for students choosing each of 25 job families described above were obtained for the two principal components. The job families are ranked according to their scores on each component in Table 32. With few exceptions, the distribution of the job families is congruent with the interest scale loading for the two components and with the suggested titles for the interest dimensions which the components represent. This evidence, together with evidence provided by the job family profiles, supports the criterion-related validity of ACT Interest Inventory scales.

TABLE 32

Rank Order of Job Families on First Two Principal Components for Interest Scales

Component 1		Component 2	
Job Family	*Number of Students*	*Job Family*	*Number of Students*
("Data" pole)		*("People" pole)*	
Paying, Receiving, and Bookkeeping	221	Social Sciences and Legal Services	150
Clerical and Secretarial Work	625	Education and Social Services	939
Management and Planning	206	Nursing and Human Care	612
Storage, Dispatching, and Delivery	36	Office Machine Operation[a]	271
Retail Sales and Services	85	Medicine and Medical Technologies	723
Office Machine Operation	271	Popular Entertainment	33
Promotion and Direct Contact Sales	128	Applied Arts, Verbal	109
Human Services Crafts	102	Management and Planning	206
(Middle 10 omitted)		*(Middle 10 omitted)*	
		Applied Arts, Visual	366
Growing and Caring for Plants/Animals	269	Engineering and Other Applied Technologies	469
Nursing and Human Care	612	Growing and Caring for Plants/Animals	269
Applied Arts, Visual	366	Repairing and Servicing Home and Office Equipment	128
Social Sciences and Legal Services	150	Transport Equipment Operation	58
Creative Arts	269	Construction and Maintenance	329
Medicine and Medical Technologies	723	Machine Operating, Servicing, and Repairing	381
Natural Sciences and Mathematics	294		
("Ideas" pole)		*("Things" pole)*	

[a]Data indicate that students in this job family (especially males) may prefer white collar, office-related activities and reject blue collar, things-related activities. Nevertheless, the position of this job family is puzzling.

APPENDIX 2

VOCATIONAL INTEREST PROFILE

Directions: This section is designed to measure your vocational interests in six major career areas. Please indicate how much you would like doing each of the activities listed. Try to mark an activity even if you are uncertain as to how you feel about it. Use the following scale to mark your answers on the answer sheet. PLEASE NOTE THAT THE ITEM NUMBERS GO DOWN THE ANSWER SHEET.

I would **dislike** this **very much** ..... DV
I would **dislike** this a little ..... D
I am **indifferent** or don't know much about it I
I would **like** this fairly well L
I would **like** this **very much** LV

1. Studying physics
2. Sketching and drawing
3. Selling appliances
4. Making out income tax returns
5. Studying sociology
6. Doing mechanical drawings
7. Studying calculus
8. Acting in plays
9. Selling clothing in a store
10. Keeping records for a store
11. Teaching children
12. Operating a power tool
13. Studying chemistry
14. Selling insurance
15. Bookkeeping
16. Helping friends with their problems
17. Repairing an automobile
18. Working in a science laboratory
19. Reading or writing poetry
20. Campaigning for a political office
21. Looking for errors in the draft of a report
22. Teaching in a high school
23. Riveting sheet metal
24. Singing in public
25. Conducting business by phone
26. Typing reports
27. Being a counselor
28. Catching or breeding fish commercially
29. Learning about nuclear particles
30. Writing for a newspaper
31. Making business trips
32. Filing documents
33. Reading school assignments to a blind student
34. Learning about blood chemistry
35. Listening to a symphony concert
36. Hiring a person for a job
37. Taking dictation
38. Supervising a summer camp program for children
39. Assembling mechanical units for aircraft
40. Conducting scientific experiments
41. Designing fashions
42. Working as a public relations person
43. Setting up a bookkeeping system
44. Assisting handicapped persons
45. Constructing a cabinet according to blueprints
46. Studying biological sciences
47. Reading magazines about art and music
48. Directing a sales staff for a large company
49. Operating electrical, mechanical, or computer equipment
50. Studying the effects of vitamins on animals
51. Drawing cartoons
52. Finding errors in a financial account
53. Interviewing people for a job
54. Grinding lenses for binoculars or eyeglasses
55. Doing bacterial research
56. Working for the Red Cross
57. Working as a hunting or fishing guide
58. Studying plant microorganisms
59. Writing short stories
60. Making charts and graphs
61. Helping the poor
62. Keeping expense account records
63. Working as a personnel director for a business
64. Reading about the writing style of modern novelists
65. Demonstrating a new product in a store
66. Handling deposits and withdrawals in a bank
67. Being a social worker
68. Investigating the effect of new tranquilizers on mental illness
69. Working as a professional dancer
70. Managing a sales campaign
71. Working as an accountant
72. Working with youth groups
73. Making dental plates, inlays, and bridgework
74. Investigating the psychological characteristics of creative thinkers
75. Composing or arranging musical scores
76. Working as a statistician
77. Helping a new student get acquainted at school
78. Engraving lettering or designs on printing plates
79. Experimenting with solar energy as a power source
80. Preparing drawings to illustrate magazine stories
81. Making travel arrangements for people
82. Working with drug addicts
83. Working on a survey crew
84. Working as a free lance artist
85. Repairing electronic equipment
86. Promoting publicity for individuals or organizations
87. Installing a telephone
88. Working on a new mathematical theory
89. Operating computer equipment
90. Taking care of babies or very small children

VOCATIONAL INTEREST PROFILE

One of the most important decisions college students ever make is their choice of major field of study. As you know, it isn't always an easy task. Now that you have that experience behind you, we would like your assistance in helping future students improve their decisions concerning which major to enter. With your responses we hope to develop an educational-vocational interest inventory which entering college students may use to compare their pattern of interests with those of college seniors in a variety of majors. To develop an interest inventory which is useful to a wide variety of people, we need to ask a few questions about your background and your experiences in college. Your answers to these questions will be held in strictest confidence and will be used only for research purposes to develop a better instrument.

Please read the directions carefully for each set of questions. Mark your answers on the answer sheet with a soft lead pencil only. DO NOT USE INK!

1. Carefully print your Social Security Number in the boxes in section 1 and then blacken the corresponding number in each column.

2. Please enter the month, day, and year of your birth in the appropriate boxes in section 2.

3. It is important that you identify your **current** major field of study from the list provided. Identify the corresponding number next to the general field of study which **best** describes your program and grid that number in section 3.

01. Accounting	12. Foreign Languages
02. Agriculture	13. Health Services
03. Art (Fine & Applied)	14. Home Economics
04. Art Education	15. History
05. Biological Sciences	16. Mathematical Sciences
06. Business, general	17. Marketing
07. Business or Commercial Education	18. Music Education
	19. Philosophy and Religion
08. Economics	20. Physical Sciences
09. Elementary Education	21. Political Science
10. Engineering	22. Psychology
11. English and Literature	23. Social Sciences, general
	24. Sociology

4. Blacken the grid next to M if you are male or F if you are female.

5. So that we can develop an instrument which is useful to people from a variety of backgrounds as well as determine if our items are fair to everyone, we would like you to indicate your ethnic background using the following code. Mark the corresponding number on the answer sheet in section 5.

Afro-American/black 1
American Indian 2
Caucasian American/white 3
Mexican/Spanish American 4
Oriental American 5
Other 6

6. What is your most important goal in attending college at the present time? Select **one** response below and grid the corresponding number in section 6.

To develop my mind and intellectual abilities 1
To secure vocational or professional training 2
To learn how to enjoy life 3
To earn a higher income 4
To develop my personality 5
None of these 6

7. Please indicate which statement best describes how you feel about your current major. Grid the number of that statement in section 7.

It is a major that I strongly dislike and I wish I could leave for some other 1
It is an unsatisfactory and unrewarding major 2
It is a major which is tolerable but not really what I would like to do 3
It is a major I entered, due to circumstances more or less beyond my control, but I am now satisfied with it 4
The major is approximately what I want to do and I am satisfied with it 5
The major is exactly what I want to do and I am **very** satisfied with it 6

8. How many times have you changed majors since you first enrolled as a freshman? Grid the correct number in section 8.

None ..... leave blank
Once 1
Twice 2
Three times 3
Four times 4
Five times 5
Six times 6
More than six times 7

9. Please indicate when you first entered your current major. Grid the correct number in section 9.

First half of freshman year 1
Last half of freshman year 2
First half of sophomore year 3
Last half of sophomore year 4
First half of junior year 5
Last half of junior year 6
First half of senior year 7
Last half of senior year 8

10. Approximately what overall grade average have you received in **all** of your college courses? Grid your answer in section 10.

D or lower 1	B 5
D+ 2	B+ 6
C 3	A 7
C+ 4	

11. Approximately what overall grade average have you received in the courses related only to your major field? Use the same scale as item 10 and grid your answer in section 11.

12. Following is a list of four possible sources of funds for financing your college work.

(A) Parents, family, and/or spouse
(B) Scholarship, fellowship
(C) Employment or personal savings
(D) Loans

In section 12 grid the **one** number from the list below corresponding to your principal source(s) of funds:

(A) only 0	(A) + (C) 5
(B) only 1	(A) + (D) 6
(C) only 2	(B) + (C) 7
(D) only 3	(B) + (D) 8
(A) + (B) 4	(C) + (D) 9

13. Please select the **one** statement which applies best to you and grid the corresponding number in section 13.

I found that as I continued in my major field, I increasingly tended to select my friends from those with the same major 1
I have always selected friends without regard to major field and continue to do so 2
I try to broaden my interests by selecting friends from outside my major field 3

14. What do you plan to be doing a year from now? Grid the number corresponding to your plans in section 14.

1. Attending a graduate or professional school
2. Beginning my career or profession
3. Traveling
4. I am undecided
5. Other

Thank you very much for participating in our study. Please remember to return the IBM card along with the answer sheet.

APPENDIX 3

TABLE 33

Raw Score to Standard Score to Percentile Rank Conversion Tables

	Science				Creative Arts				Social Service			
	Men		*Women*		*Men*		*Women*		*Men*		*Women*	
Raw Score	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank
1.0	25	1	25	1	24	1	22	1	20	1	20	1
1.1	28	2	28	3	28	2	24	1	23	1	20	1
1.2	31	3	33	4	31	3	26	1	25	1	20	1
1.3	33	5	35	5	33	5	28	1	27	1	20	1
1.4	34	6	37	6	35	7	29	2	29	2	21	1
1.5	35	8	39	8	36	9	31	3	30	2	22	1
1.6	36	10	41	10	38	12	32	4	32	3	23	1
1.7	37	12	42	17	39	15	34	5	33	4	24	1
1.8	38	14	43	25	41	19	35	6	34	5	25	1
1.9	39	16	44	29	42	23	37	8	35	6	26	1
2.0	40	19	45	32	44	26	38	11	36	8	27	1
2.1	41	22	46	36	45	30	39	13	37	10	28	1
2.2	42	24	47	40	47	34	40	15	38	11	29	2
2.3	43	27	48	43	48	40	41	18	39	13	30	2
2.4	44	30	49	47	49	45	42	22	40	15	31	3
2.5	45	33	50	50	50	50	43	26	41	18	32	4
2.6	46	35	51	54	51	54	45	31	42	22	33	4
2.7	47	39	52	57	52	59	46	35	44	23	34	6
2.8	49	43	53	61	53	63	47	39	45	26	35	7
2.9	50	47	54	64	55	68	48	43	46	35	36	9
3.0	51	51	55	67	56	72	49	48	47	40	37	10
3.1	52	55	56	70	57	76	51	53	49	45	39	13
3.2	53	59	57	73	58	79	52	58	50	51	40	15
3.3	54	62	58	76	59	83	53	62	52	58	41	18
3.4	55	66	59	79	60	85	55	67	53	64	42	22
3.5	56	69	60	81	62	88	56	71	55	69	44	26
3.6	57	73	61	84	63	90	57	75	56	74	45	30
3.7	58	76	62	87	64	92	58	80	58	78	46	35
3.8	59	80	63	89	65	94	60	83	59	82	48	41
3.9	60	83	64	91	66	95	61	86	60	85	49	47
4.0	61	85	65	93	67	96	62	89	62	88	51	51
4.1	62	88	66	94	69	97	64	90	63	91	52	60
4.2	63	90	67	95	71	98	65	92	65	93	54	66
4.3	64	92	68	97	72	99	67	96	67	95	56	71
4.4	65	94	69	98	75	99	69	97	68	96	57	77
4.5	66	96	70	98	77	99	71	98	70	97	60	83
4.6	68	97	71	99	79	99	73	99	71	98	62	88
4.7	70	98	73	99	80	99	75	99	73	99	64	92
4.8	72	98	75	99	80	99	77	99	75	99	67	96
4.9	75	99	78	99	80	99	79	99	78	99	71	98
5.0	78	99	80	99	80	99	80	99	80	99	77	99

	Business Contact				Business Detail				Technical			
	Men		*Women*		*Men*		*Women*		*Men*		*Women*	
Raw Score	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank	Std. Score	%ile Rank
1.0	23	1	20	1	22	1	23	1	21	1	23	1
1.1	26	1	22	1	26	1	27	2	23	1	27	3
1.2	29	2	26	1	29	2	30	3	26	1	31	5
1.3	30	3	29	2	31	4	32	4	28	1	35	8
1.4	32	4	31	3	34	5	34	6	30	2	38	12
1.5	33	5	32	4	36	7	36	8	31	3	41	17
1.6	34	6	33	5	37	10	37	10	33	4	42	22
1.7	35	7	35	6	39	13	39	13	34	6	44	26
1.8	37	9	37	8	40	16	40	16	35	7	46	31
1.9	38	11	38	11	41	19	41	19	36	8	47	36
2.0	39	14	39	14	43	23	42	22	37	10	48	41
2.1	41	17	40	17	44	27	44	26	39	12	49	47
2.2	42	21	42	21	45	31	45	30	40	15	50	52
2.3	43	25	43	25	46	35	46	34	41	18	52	57
2.4	45	29	44	29	48	40	47	38	42	22	54	63
2.5	46	34	46	33	49	46	48	42	44	26	55	68
2.6	47	39	47	37	50	51	49	46	45	31	56	73
2.7	49	44	48	43	51	56	50	51	46	36	58	78
2.8	50	50	50	49	53	61	51	55	48	41	59	82
2.9	51	56	51	55	54	66	53	60	49	46	61	86
3.0	53	62	53	60	55	71	54	65	50	52	63	90
3.1	55	68	54	66	57	75	55	69	52	58	65	92
3.2	56	73	56	72	58	79	56	73	53	63	66	94
3.3	58	78	57	77	60	82	57	76	55	68	68	96
3.4	59	82	59	81	61	86	58	80	57	74	70	97
3.5	61	86	60	84	62	89	59	82	58	79	72	98
3.6	62	88	62	88	64	92	60	84	60	83	74	99
3.7	63	91	63	90	66	94	62	87	61	87	76	99
3.8	65	93	65	93	67	96	63	90	63	90	78	99
3.9	67	95	67	95	68	96	64	92	65	93	79	99
4.0	68	97	68	96	69	97	65	94	67	95	80	99
4.1	70	98	69	97	70	98	66	95	69	97	80	99
4.2	71	98	70	98	72	98	68	96	71	98	80	99
4.3	73	99	72	98	73	99	69	97	73	99	80	99
4.4	75	99	73	99	75	99	72	98	75	99	80	99
4.5	76	99	76	99	77	99	74	99	77	99	80	99
4.6	77	99	77	99	78	99	75	99	79	99	80	99
4.7	79	99	78	99	79	99	77	99	80	99	80	99
4.8	80	99	79	99	80	99	79	99	80	99	80	99
4.9	80	99	80	99	80	99	80	99	80	99	80	99
5.0	80	99	80	99	80	99	80	99	80	99	80	99

APPENDIX 4

TABLE 34
Item Content of ACT Interest Inventory Scales

Science

Studying physics
Studying calculus
Studying chemistry
Working in a science laboratory
Learning about nuclear particles
Learning about blood chemistry
Conducting scientific experiments
Studying biological sciences
Studying the effects of vitamins on animals
Doing bacterial research
Studying plant microorganisms
Investigating the effect of new tranquilizers on mental illness
Investigating the psychological characteristics of creative thinkers
Experimenting with solar energy as a power source
Working on a new mathematical theory

Creative Arts

Sketching and drawing
Acting in plays
Reading or writing poetry
Singing in public
Writing for a newspaper
Listening to a symphony concert
Designing fashions
Reading magazines about art and music
Drawing cartoons
Writing short stories
Reading about the writing style of modern novelists
Working as a professional dancer
Composing or arranging musical scores
Preparing drawings to illustrate magazine stories
Working as a free-lance artist

Social Service

Studying sociology
Teaching children
Helping friends with their problems
Teaching in a high school
Being a counselor
Reading school assignments to a blind student
Supervising a summer camp program for children
Assisting handicapped persons
Working for the Red Cross
Helping the poor
Being a social worker
Working with youth groups
Helping a new student get acquainted at school
Working with drug addicts
Taking care of babies or very small children

Business Contact

Selling appliances
Selling clothing in a store
Selling insurance
Campaigning for a political office
Conducting business by phone
Making business trips
Hiring a person for a job
Working as a public relations person
Directing a sales staff for a large company
Demonstrating a new product in a store
Managing a sales campaign
Making travel arrangements for people
Promoting publicity for individuals or organizations
Interviewing people for a job
Working as a personnel director of a business

Business Detail

Making out income tax returns
Keeping records for a store
Bookkeeping
Looking for errors in the draft of a report
Typing reports
Filing documents
Taking dictation
Setting up a bookkeeping system
Finding errors in a financial account
Making charts and graphs
Keeping expense account records
Handling deposits and withdrawals in a bank
Working as an accountant
Working as a mathematician
Operating computer equipment

Technical

Doing mechanical drawings
Operating a power tool
Repairing an automobile
Riveting sheet metal
Catching or breeding fish commercially
Assembling mechanical units for aircraft
Constructing a cabinet according to blueprints
Operating electrical, mechanical, or computer equipment
Grinding lenses for binoculars or eye glasses
Working as a hunting or fishing guide
Making dental plates, inlays, and bridgework
Engraving lettering or designs on printing plates
Working on a survey crew
Repairing electrical equipment
Installing a telephone

References

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

The American College Testing Program. *The ACT Assessment Counselor's Handbook.* Iowa City, Iowa: Author, 1973.

The American College Testing Program. *Handbook for the Career Planning Program, Grades 8-11.* Iowa City, Iowa: Author, 1974.

Anastasi, A. *Psychological testing.* New York: Macmillan, 1961.

Baggaley, A. R., & Campbell, J. P. Multiple-discriminant analysis of academic curricula by interest and aptitude variables. *Journal of Educational Measurement,* 1967, **4,** 143-150.

Bayer, A. E., & Boruch, R. F. Black and white freshmen entering four-year colleges. *Educational Record,* 1969, **50,** 371-386.

Berdie, R. R. Factors related to vocational interests. *Psychological Bulletin,* 1944, **41,** 137-157.

Bingham, W. V. *Aptitudes and aptitude testing.* New York: Harper & Brothers, 1937.

Bordin, E. S. A theory of vocational interests as dynamic phenomena. *Educational and Psychological Measurement,* 1943, **3,** 49-65.

Borgen, F. H. Predicting career choices of able college men from occupational and basic interest scales of the Strong Vocational Interest Blank. *Journal of Counseling Psychology,* 1972, **19,** 202-211.

Campbell, D. P. *Handbook for the Strong Vocational Interest Blank.* Stanford, Calif.: Stanford University Press, 1971.

Campbell, D. P. *Manual for the Strong-Campbell Interest Inventory.* Stanford, Calif.: Stanford University Press, 1974.

Campbell, D. P., & Holland, J. L. A merger in vocational interest research: Applying Holland's theory to Strong's data. *Journal of Vocational Behavior,* 1972, **2,** 353-376.

Carter, H. D. Vocational interests and job orientation. *Applied Psychology Monographs,* 1944, **2.**

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

Cole, N. S., & Cole, J. W. L. *An analysis of spatial configuration and its application to research in higher education.* ACT Research Report No. 35. Iowa City, Iowa: The American College Testing Program, 1970.

Cole, N. S., & Hanson, G. R. Impact of interest inventories on career choice. In E. Diamond, *Issues of sex bias and sex fairness in career interest measurement.* Washington: U.S. Government Printing Office, in press.

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., & Hanson, G. R. The impact of interest inventories on career choice. Commissioned paper for the NIE Workshop on Sex Bias and Sex Fairness in Career Interest Inventories, Washington, March 1974.

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

Cooley, W. W., & Lohnes, P. R. *Multivariate procedures for the behavioral sciences.* New York: Wiley, 1962.

Cooley, W. W., & Lohnes, P. R. *Predicting development of young adults.* Pittsburgh: University of Pittsburgh, American Institutes for Research and School of Education, 1968.

Cooley, W. W., & Lohnes, P. R. *Multivariate data analysis.* New York: John Wiley & Sons, 1971.

Cottle, W. C. A factorial study of the Multiphasic, Strong, Kuder, and Bell inventories using a population of adult males. *Psychometrika,* 1950, **15,** 25-47.

Cronbach, L. J. Coefficient alpha and internal structure of tests. *Psychometrica,* 1951, **12,** 297-334.

Cronbach, L. J. Test validation. In R. L. Thorndike (Ed.), *Educational measurement.* Washington: American Council on Education, 1971.

Darley, J. G. *Clinical aspects and interpretation of the Strong Vocational Interest Blank.* New York: Psychological Corporation, 1941.

Darley, J. G., & Hagenah, T. *Vocational interest measurement.* Minneapolis: University of Minnesota Press, 1955.

Dunn, F. E. Two methods for predicting the selection of a college major. *Journal of Counseling Psychology,* 1959, **16,** 15-26.

Edwards, K. J., & Whitney, D. R. Structural analysis of Holland's personality types using factor and configural analysis, *Journal of Counseling Psychology,* 1972, **19,** 136-145.

Flannagan, J. C., Shaycroft, M. F., Richards, J. M., Jr., & Claudy, J. C. *Five years after high school.* Palo Alto, Calif.: Project TALENT, 1971.

French, J. W. The logic of and assumptions underlying differential testing. In *Proceedings, 1955 Invitational Conference on Testing Problems.* Princeton, N. J.: Educational Testing Service, 1956, 40-48.

Fryer, D. *The measurement of interests.* New York: Henry Holt, 1931.

Goldman, L. *Using tests in counseling.* New York: Appleton-Century-Crofts, 1971.

Guilford, J. P. *Fundamental statistics in psychology and education.* New York: McGraw-Hill, 1965.

Guilford, J. P., Christensen, P. R., Bond, N. A., & Sutton, M. A. A factor analysis of human interest. *Psychological Monographs,* 1954, **68** (4, Whole No. 375).

Gump, J. P., & Rivers, L. W. The consideration of race in efforts to end sex bias. Commissioned paper for the NIE Workshop on Sex Bias and Sex Fairness in Career Interest Inventories, Washington, March 1974.

Hager, P. C., & Elton, C. F. The vocational interests of black males. *Journal of Vocational Behavior,* 1971, **1,** 153-158.

Hansen, J. C., & Johansson, C. B. The application of Holland's Vocational Model to the Strong Vocational Interest Blank for women. *Journal of Vocational Behavior,* 1972, **2,** 479-493.

Hanson, G. R. A canonical analysis of the ACT Vocational Interest Profile and SVIB-Holland Scales for women. Unpublished manuscript, 1973.

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

Hanson, G. R., Lamb, R. R., & English, E. An analysis of Holland's Interest Types for Women: A comparison of the Strong-Holland and the ACT Vocational Interest Profile scales for women. *Journal of Vocational Behavior,* 1974, **4,** 259-269.

Hanson, G. R., & Prediger, D. J. The vocational interests of students in career-oriented educational programs. In G. R. Hanson and N. S. Cole (Eds.) *The vocational interests of young adults.* ACT Monograph No. 11. Iowa City, Iowa: The American College Testing Program, 1973.

Harmon, L. W. Sexual bias in interest measurement. *Measurement and Evaluation in Guidance,* 1973, **4,** 496-501.

Harrington, T. F., Lynch, M. D., & O'Shea, A. J. Factor analysis of twenty-seven similarly named scales of the Strong Vocational Interest Blank and the Kuder Occupational Interest Survey, Form DD. *Journal of Counseling Psychology,* 1971, **18,** 229-233.

Holland, J. L. *Explorations of a theory of vocational choice: V. A one-year prediction study.* Moravia, N.Y.: Chronical Guidance Professional Service, 1964.

Holland, J. L. *Manual for the Vocational Preference Inventory.* Iowa City, Iowa: Educational Research Associates, 1965.

Holland, J. L. *The psychology of vocational choice.* Waltham, Mass.: Blaisdell, 1966.

Holland, J. L. *The occupations finder.* Palo Alto, Calif.: Consulting Psychologist's Press, 1972.

Holland, J. L. *Making vocational choices.* Englewood Cliffs, N. J.: Prentice-Hall, 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: The American College Testing Program, 1969.

James, W. *The principles of psychology.* New York: Holt, 1890.

Katz, M. A model of guidance for career decision-making. *Vocational Guidance Quarterly,* 1966, **15,** 2-10.

Kimball, R. L., Sedlacek, W. E., & Brooks, G. C., Jr. Black and White vocational interests on Holland's Self-Directed Search (SDS). Cultural Study Center Research Report 6-71. College Park, Md.: University of Maryland, 1971.

King, P., & Norrell, G. A factorial study of the Kuder Preference Record—Occupational, Form D. *Educational and Psychological Measurement,* 1964, **24,** 57-63.

Kitson, H. D. *The psychology of vocational development.* Philadelphia: Lippincott, 1925.

National Center for Educational Statistics. *Earned degrees conferred: 1969-70. Institutional data.* Washington: U.S. Government Printing Office, 1970.

Navran, L., & Posthuma, A. B. A factor analysis of the SVIB for men using the method of principal factors. *Journal of Counseling Psychology,* 1970, **17,** 216-223.

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

Prediger, D. J. The role of assessment in career guidance. In E. L. Herr (Ed.), *Vocational guidance and human development.* Boston: Houghton Mifflin, 1974.

Prediger, D. J., & Hanson, G. R. The distinction between sex restrictiveness and sex bias in interest inventories. *Measurement and Evaluation in Guidance,* 1974, **7,** 96-104.

Prediger, D. J., & Roth, J. D. *The data/ideas, people/things dimensions of work and interests: Summary of research and applications.* ACT Research Report. Iowa City, Iowa: The American College Testing Program, in press.

Prediger, D. J., Roth, J. D., & Noeth, R. J. *Nationwide study of student career development: Summary of results.* ACT Research Report No. 61. Iowa City, Iowa: The American College Testing Program, 1973.

Pucel, D. J., Nelson, H. F., Asche, M., & Faurot, L. M. *The abilities of standardized test instruments to differentiate membership in different vocational-technical curricula.* Project Mini-Score Final Technical Report. Minneapolis: University of Minnesota, Department of Institutional Education, 1972.

Roe, A. *The psychology of occupations.* New York: John Wiley, 1956.

Roe, A., & Klos, D. Occupational classification. *The Counseling Psychologist,* 1969, **1,** 84-89.

Rulon, P. J., Tiedeman, D. V., Tatsuoka, M. M., & Langmuir, C. R. *Multivariate statistics for personnel classification.* New York: John Wiley, 1967.

Schutz, R. E., & Baker, R. L. A factor analysis of the Kuder Preference Record—Occupational, Form D. *Educational and Psychological Measurement,* 1962, **22,** 97-104.

Stahmann, R. F. Predicting graduation major field from freshman entrance data. *Journal of Counseling Psychology,* 1969, **16,** 109-113.

Stewart, D., & Love, W. A general canonical correlation index. *Psychological Bulletin,* 1968, **70,** 160-163.

Strong, E. K., Jr. *Vocational interests of men and women.* Stanford, Calif.: Stanford University Press, 1943.

Strong, E. K., Jr. Interests of negroes and whites. *Journal of Social Psychology,* 1952, **35,** 139-150.

Strong, E. K., Jr. Are medical specialist interest scales applicable to negroes? *Journal of Applied Psychology,* 1955, **39,** 62-64. (a)

Strong, E. K., Jr. *Vocational interests 18 years after college.* Minneapolis: University of Minnesota Press, 1955. (b)

Strong, E. K., Jr. An eighteen-year longitudinal report on interests. In W. L. Layton (Ed.), *The Strong Vocational Interest Blank: Research and uses.* Minneapolis: University of Minnesota Press, 1960.

Super, D. E. *Appraising vocational fitness.* New York: Harper, 1949.

Super, D. E. *The psychology of careers.* New York: Harper, 1957.

Super, D. E., & Crites, J. O. *Appraising vocational fitness,* New York: Harper, 1962.

Tatsuoka, M. M. *Multivariate analysis: Techniques for educational and psychological research.* New York: 1971.

Terwilliger, J. S. Dimensions of occupational preference. *Educational and Psychological Measurement,* 1963, **23,** 525-542.

Thurstone, L. L. A multiple-factor study of vocational interests. *Personnel Journal,* 1931, **10,** 198-205.

Tiedeman, D. V. A model for the profile problem. In *Proceedings, 1953 Invitational Conference on Testing Problems.* Princeton, N.J.: Educational Testing Service, 1954.

Tiedeman, D. V., Rulon, P. J., & Bryan, J. G. The multiple discriminant function—A symposium. *Harvard Educational Review,* 1951, **21,** 71-95.

United States Department of Labor. *Dictionary of occupational titles.* (3rd ed.) Washington: Author, 1965.

United States Department of Labor. *Occupational outlook handbook 1972-73 edition.* Washington: Author, 1972-73.

United States Office of Education, Division of Vocational and Technical Education. USOE career clusters. Mimeographed. Washington: Author, 1971.

Whitla, D. K. *An evaluation of differential prediction for counseling and guidance* (Doctoral dissertation, University of Nebraska). Ann Arbor, Mich.: University Microfilms, 1957. No. 20-991.

Whitney, D. R. Predicting from expressed vocational choice: A review. *Personnel and Guidance Journal,* 1969, **48,** 279-286.

ACT Research Reports

This report is Number 67 in a series published by the Research and Development Division of The American College Testing Program. The first 26 research reports have been deposited with the American Documentation Institute, ADI Auxiliary Publications Project, Photoduplication Service, Library of Congress, Washington, D.C. 20540. Photocopies and 35 mm. microfilms are available at cost from ADI; order by ADI Document number. Advance payment is required. Make checks or money orders payable to: Chief, Photoduplication Service, Library of Congress. Beginning with Research Report No. 27, the reports have been deposited with the National Auxiliary Publications Service of the American Society for Information Science (NAPS), c/o Microfiche Publications, 305 East 46th Street, New York, New York 10017. Photocopies and 35 mm. microfilms are available at cost from NAPS. Order by NAPS Document number. Advance payment is required. Printed copies ($1.00) may be obtained, if available, from ACT Publications, The American College Testing Program, P.O. Box 168, Iowa City, Iowa 52240. A check or money order must accompany the request.

The reports since October 1970 in this series are listed below. A complete list of the reports can be obtained by writing to ACT Publications.

No. 37 *Practices and Outcomes of Vocational-Technical Education in Technical and Community Colleges,* by T. G. Gartland, & J. F. Carmody (NAPS No. 01441; photo, $6.80; microfilm, $2.00)

No. 38 *Bayesian Considerations in Educational Information Systems,* by M. R. Novick (NAPS No. 01442; photo, $5.00; microfilm, $2.00)

No. 39 *Interactive Effects of Achievement Orientation and Teaching Style on Academic Achievement,* by G. Domino (NAPS No. 01443; photo, $5.00; microfilm, $2.00)

No. 40 *An Analysis of the Structure of Vocational Interests,* by N. S. Cole, & G. R. Hanson (NAPS No. 01444; photo, $5.00; microfilm, $2.00)

No. 41 *How Do Community College Transfer and Occupational Students Differ?* by E. J. Brue, H. B. Engen, & E. J. Maxey (NAPS No. 01445; photo, $5.50; microfilm, $2.00)

No. 42 *Applications of Bayesian Methods to the Prediction of Educational Performance,* by M. R. Novick, P. H. Jackson, D. T. Thayer, & N. S. Cole (NAPS No. 01544; photo, $5.00; microfilm, $2.00)

No. 43 *Toward More Equitable Distribution of College Student Aid Funds: Problems in Assessing Student Financial Need,* by M. D. Orwig (NAPS No. 01543; photo, $5.00; microfilm, $2.00)

No. 44 *Converting Test Data to Counseling Information,* by D. J. Prediger (NAPS No. 01776; photo, $5.00; microfiche, $2.00)

No. 45 *The Accuracy of Self-Report Information Collected on the ACT Test Battery: High School Grades and Items of Nonacademic Achievement,* by E. J. Maxey, & V. J. Ormsby (NAPS No. 01777; photo, $5.00; microfiche, $2.00)

No. 46 *Correlates of Student Interest in Social Issues,* by R. H. Fenske, & J. F. Carmody (NAPS No. 01778; photo, $5.00; microfiche, $2.00)

No. 47 *The Impact of College on Students' Competence to Function in a Learning Society,* by M. H. Walizer, & R. E. Herriott (NAPS No. 01779; photo, $5.00; microfiche, $2.00)

No. 48 *Enrollment Projection Models for Institutional Planning,* by M. D. Orwig, P. K. Jones, & O. T. Lenning (NAPS No. 01780; photo, $5.00; microfiche, $2.00)

No. 49 *On Measuring the Vocational Interests of Women,* by N. S. Cole (NAPS No. 02071; photo, $5.00; microfiche, $1.50)

No. 50 *Stages in the Development of a Black Identity,* by W. S. Hall, R. Freedle, & W. E. Cross, Jr. (NAPS No. 02072; photo, $5.00; microfiche, $1.50)

No. 51 *Bias in Selection,* by N. S. Cole (NAPS No. 02073; photo, $5.00; microfiche, $1.50)

No. 52 *Changes in Goals, Plans, and Background Characteristics of College-Bound High School Students,* by J. F. Carmody, R. H. Fenske, & C. S. Scott (NAPS No. 02074; photo, $5.75; microfiche, $1.50)

No. 53 *Toward an Integration of Theory and Method for Criterion-Referenced Tests,* by R. K. Hambleton, & M. R. Novick (NAPS No. 02075; photo, $5.00; microfiche, $1.50)

No. 54 *College Student Migration,* by R. H. Fenske, C. S. Scott, & J. F. Carmody (NAPS No. 02215; photo, $5.00; microfiche, $1.50)

No. 55 *Predictions of Performance in Career Education,* by M. R. Novick, P. K. Jones, & N. S. Cole (NAPS No. 02216; photo, $5.00; microfiche, $1.50)

No. 56 *Predictors of Graduation from College,* by E. Nicholson (NAPS No. 02217; photo, $5.00; microfiche, $1.50)

No. 57 *Schooling and Subsequent Success: Influence of Ability, Background, and Formal Education,* by L. C. Solmon (NAPS No. 02218; photo, $5.00; microfiche, $1.50)

No. 58 *Common Fallacies about Heredity, Environment, and Human Behavior,* by A. Anastasi (NAPS No. 02220; photo, $5.00; microfiche, $1.50)

No. 59 *A Study of the College Investment Decision,* by W. W. McMahon, & A. P. Wagner (NAPS No. 02219; photo, $5.00; microfiche, $1.50)

No. 60 *Implementation of a Bayesian System for Decision Analysis in a Program of Individually Prescribed Instruction,* by R. L. Ferguson, & M. R. Novick (NAPS No. not available at this time.)

No. 61 *Nationwide Study of Student Career Development: Summary of Results,* by D. J. Prediger, J. D. Roth, & R. J. Noeth (NAPS No. not available at this time.)

No. 62 *Varieties of Accomplishment after College: Perspectives on the Meaning of Academic Talent,* by L. A. Munday, & J. C. Davis (NAPS No. not available at this time.)

No. 63 *Patterns of Concentration in Large Foundations' Grants to U.S. Colleges and Universities,* by R. Colvard, & A. M. Bennett (NAPS No. not available at this time.)

No. 64 *Vocational Choice Change Patterns of a National Sample of Community-Junior College Students,* by C. S. Scott, R. H. Fenske, & E. J. Maxey (NAPS No. not available at this time.)

No. 65 *Considerations and Procedures in National Norming: An Illustration Using the ACT Assessment of Career Development and ACT Career Planning Program, Grades 8-11,* by D. L. Bayless, J. W. Bergsten, L. H. Lewis, & R. J. Noeth (NAPS No. not available at this time.)

No. 66 *The Measurement of Economic Well-Being in Need Analysis Models,* by W. J. Goggin (NAPS No. not available at this time.)