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ABSTRACT

A study was conducted to develop a procedure for linking occupational attribute preferences (OAPs or "job values") to occupations in DISCOVER, a computer-based career planning system. A 30-attribute Inventory of Work Preferences (IWP) was constructed and field tested with high school students. Procedures for rating occupations on IWP attributes were developed and implemented for the 497 occupations in DISCOVER. Analyses of occupational attribute differences across the 497 occupations were conducted in order to identify a small set of 16 IWP items that differentiate (in a reasonably appropriate manner) job clusters similar to Holland's (1985) occupational types and that differentiate American College Testing (ACT) Program job families. Principles guiding the development of a procedure for linking counselee attribute preferences to occupations via ACT's World of Work Map are described. The study concluded with four families that can be suggested for counselees on the basis of World-of-Work Map are described. The study concluded with four World-of-Work Map, the Inventory of Work Preferences, and 64 references.) (Author/KC)

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Linking Occupational Attribute Preferences to Occupations

Dale J. Prediger

Jane G. Staples

ACT

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Abstract

The purpose of this study was to develop a procedure for linking occupational attribute preferences ("job values") to occupations in DISCOVER, a computer-based career planning system. A 30-attribute Inventory of Work Preferences (IWP) was constructed and field tested with high school students. Procedures for rating occupations on IWP attributes were developed and implemented for the 497 occupations in DISCOVER. Analyses of occupational attribute differences across the 497 occupations were conducted in order to identify a parsimonious set of 16 IWP items that differentiate (in a reasonable, appropriate manner) job clusters similar to Holland's (1985) occupational types and that differentiate ACT job families. Principles guiding the development of a procedure for linking counselee attribute preferences to occupations via ACT's (1995b) World-of-Work Map are described.

Acknowledgments

Several ACT staff members contributed to the development of the procedure, described in this report, for linking occupational attribute preferences to occupational options via the World-of-Work Map (ACT, 1995b). Early work by Dale Prediger and Timothy Vansickle (with the assistance of Kyle Swaney) demonstrated that a World-of-Work Map linkage was feasible and identified occupational attributes that could be used (Vansickle & Prediger, 1991). In 1992, Marilyn Maze expanded the number of attributes and developed the student and occupational rating scales. Eve Carr (with the assistance of Marilyn Maze) rated DISCOVER occupations on the 30 attributes in what came to be called the Inventory of Work Preferences (IWP). A panel of doctoral-level vocational psychologists (Donald Mayall, James Sampson, and Donald Zytowski) provided consultation regarding these latter tasks.

The authors of this research report were responsible for analyses of the occupational ratings and the development of the World-of-Work Map linkage procedure implemented in ACT's DISCOVER programs in 1994. The linkage procedure was revised in 1996 after the collection and analyses of student responses to the IWP and further analyses of the occupational ratings.

The authors are grateful to Ron Cope, Tim Miller, Kyle Swaney, and Mike Valiga for helpful comments and suggestions regarding drafts of this report.

Linking Occupational Attribute Preferences to Occupations

Occupations may differ substantially with respect to their attributes. For example, some occupations involve much public contact; others involve little. Some require outdoor work and/or physical activity; others do not. This report describes the basis for, and specifics of, a procedure for helping counselees take into account their occupational attribute preferences as they identify and explore career options.

Context of Study

Occupational Attribute Preferences

People value different occupational attributes to varying degrees, and job satisfaction is related to degree of correspondence between the attributes people value most and those provided by their occupations (e.g., see Dawis, 1991). The value placed on an occupational attribute is usually termed a job value or a work value, but Pryor (1979) suggested that the term *work aspect preference* replace these terms. Pryor also noted that work aspect preferences may reveal the underlying needs of an individual (also see Dawis & Lofquist, 1984). Zytowski (1987) suggested that the word *preferences* be substituted for needs, values, and interests because preferences are more observable. Dawis (1991) described preferences as "a more basic term in defining interests and values" (p. 839). The following discussion combines the suggestions of Pryor, Zytowski, and Dawis and uses the term *occupational attribute preferences* (OAPs) in place of job (work) values.

Distinction Between OAPs and Interests

It is commonly recognized that OAPs and vocational interests overlap to some extent. According to Dawis (1991), an examination of OAP and interest measures suggests that they differ mainly in response scaling and content. Interests are scaled on a like-dislike dimension, whereas OAPs are scaled on an importance dimension. However, these distinctions fail in some instances, as Dawis noted. Some OAPs (e.g., travel) also involve considerations of liking and

disliking, and the descriptions of some OAPs (e.g., altruism) are similar to the descriptions of some vocational interests (e.g., social service).

The similarities between OAPs and interests are far from identities, however. Following his review of research on the relationship between interests and OAPs, Dawis (1991) concluded that "the two domains are distinct, if overlapping" (p. 847). Similarly, Super (1995) cited research showing that interests and OAPs are related, but separately identifiable constructs. In addition, many attributes in OAP inventories are not addressed by interest inventories. For example, only 4 of 21 occupational attributes (OAs) in Nevill and Super's (1986) Values Scale are similar to interests. Finally, as noted above, the focus of the measures is generally different. In an interest inventory, the focus is on whether a person likes or dislikes specific activities or occupations. In an OAP inventory, the focus is on the importance (to the person) of specific OAs. In summary, measures of OAPs and vocational interests appear to add substantially different pieces of information to the career planning process.

In an attempt to provide a unified structure for viewing OAPs and vocational interests, Prediger (1996) drew on the common distinction between extrinsic and intrinsic interests. "Extrinsic interests reflect the importance (personal value) of concomitants of working in a given occupation (e.g., travel, outdoor work, autonomy) or work outcomes (e.g., prestige, earnings, job security). Thus, extrinsic interests are subsumed by what are commonly called job or work values (e.g., see Dawis, 1991; Zytowski, 1970). Intrinsic (vocational) interests reflect specifics regarding only one job value: 'Having work tasks that I like.' Thus, vocational interests are also subsumed by job values (occupational attribute preferences)" (p. 60). As Katz (1993) has noted, counselees must decide "how much importance they want to attach to satisfying intrinsic activity interest—compared, say, with such *other occupational dimensions* [italics added] as altruism, wealth, autonomy, security, and so on" (p. 106).

Purposes of Study

This study was conducted to develop a procedure for linking the occupational attribute preferences of counselees to occupations in DISCOVER (American College Testing, 1995a), a computer-based career planning system. More specifically, the purposes of the study were: (a) to determine test-retest reliabilities and intercorrelations for OAPs obtained via ACT's Inventory of Work Preferences (described in the Variables section of this report); (b) to identify OAs that differentiate (in a reasonable, appropriate manner) job clusters similar to Holland's (1985) occupational types and that differentiate job families in the ACT Occupational Classification System (ACT, 1995b); and (c) to develop a procedure for linking counselee preferences for those OAs to job families on the World-of-Work Map (ACT, 1995b; see Figure 1), an interpretive aid used in eight ACT career services. (Figures and tables appear at the end of this report.)

Related Research

Because the effectiveness of an OAP-occupation linkage procedure depends on the OAs that are used, guidance on the choice of OAs was sought in the research literature. The following terms, individually and in various combinations, were used to search the PsycINFO data base (American Psychological Association, 1995) for the years 1967 to present: job values, work values, work attributes, occupational attributes, and job characteristics. Also, citations of two articles (Pryor, 1979; Zytowski, 1970) were used to search the Social SCISEARCH data base (Institute of Scientific Information, 1995) for the years 1972 to present. Finally, the contents of 15 journals (e.g., *Career Development Quarterly*, *Journal of Counseling Psychology*, *Journal of Vocational Behavior*) were reviewed for the years 1972-1995. Because Vansickle and Prediger's (1991) study was a forerunner of this study, their literature review was updated here.

The literature searches sought sources that were data-based, that comprehensively reviewed the relevant topics, or that were concerned with the development of an OAP inventory.

Sources addressing the OAPs of specific occupational groups or college majors (e.g., Delin, 1991) were excluded. The following summary includes only those sources that appear to be relevant to the purposes of this study. The summary is organized around two topics: Attribute preferences of persons (OAPs) and attributes of occupations (OAs). Attributes commonly supported by research and practice are noted in the Integration of Findings section at the end of the review.

Occupational Attribute Preferences

Endorsement rates. Several studies have examined the endorsement or ranking of OAs by individuals. For example, Sampson, Stripling, and Pyle (1978) asked 3,654 college students to rank the following 10 OAs in terms of personal importance: high income, prestige, independence, helping others, security, variety, leadership, working in a particular field of interest (interesting work), leisure, and early entry. Across the total sample, the four OAs receiving the highest rankings were interesting work, high income, security, and helping others.

Lebo, Harrington, and O'Shea (1995) asked high school students in six countries to select their four most important attributes from the 14 OAs in the Career Decision-Making System. Good salary, job security, variety-diversion, and working with people (not necessarily in that order) were among the four most frequently endorsed attributes in all but one country, where working with people ranked fifth. (For the results of another international study, see Šverko, 1995.)

According to Katz (1993), developers of the System of Interactive Guidance and Information (SIGI PLUS; Educational Testing Service, 1990) used a variety of methods to identify a set of OAs that were comprehensive and "of importance to significant proportions of the population" (p. 117). The 15 OAs in SIGI PLUS were selected after a series of studies involving large samples of high school and college students who ranked OAs in various ways.

(Rankings varied somewhat across studies.) Table 1 lists the eight OAs on which occupations can be rated, independently. SIGI PLUS also includes OAs that involve a person-occupation interaction (e.g., challenge) and that depend on the specific job a person holds (e.g., easy commute).

OAP dimensions based on factor analysis. Pryor (1987) administered the Work Aspect Preference Scale (WAPS), which consists of 13 factor-based subscales, to two large samples of Australian high school students and to a large sample of adults. Principal components analyses with varimax rotations supported the following three factors: Freedom (e.g., creativity and independence), Human/Personal Concern (e.g., altruism, coworkers), and Non-Work Orientation (e.g., detachment, money). Although these second-order factors appeared consistently across age groups, they accounted for only about 55% of total variance. Pryor noted that the "large amount of specific variance [45%] may be a direct consequence of the factorial derivation of the original WAPS subscales" (p. 427).

The Minnesota Importance Questionnaire (MIQ) is one of the major instruments used in research on the theory of work adjustment (Dawis & Lofquist, 1984). In a factor analysis of 20 MIQ scores for 5,358 employed workers, vocational rehabilitation clients, and students, Lofquist and Dawis (1978) obtained six varimax-rotated factors: Safety, Comfort, Self-Aggrandizement (subsequently called Status), Altruism, Achievement, and Autonomy. The six factors accounted for 53% of total variance. For purposes of comparison, Lofquist and Dawis conducted separate analyses on eight, sex-by-age subgroups based on a new sample of 9,377 vocational rehabilitation clients. The subgroup factor structures were similar to those cited above. According to Lofquist and Dawis, the six factors can be grouped into three categories, which were later (Dawis, Dohm, Lofquist, Chartrand, & Due, 1988) called Internal/Self (Achievement, Autonomy, and Status),

Social (Altruism), and Environmental (Comfort and Safety). Similarities with Pryor's three factors are evident.

Nevill and Super (1986) described the development of the Values Scale (VS), a 21-scale replacement of the Work Values Inventory (WVI; Super, 1970). In a series of factor analyses of VS item responses for three samples (high school students, college students, adults), Nevill and Super consistently obtained seven unrotated factors: Prestige, Risk, Cultural Identity, Creativity, Altruism/Aesthetics, Social Interaction/Relations, and Work Autonomy. Other factors (Physical Activity and Prowess, Authority, Work Setting) were obtained for two of the samples. All factors closely paralleled selected VS attributes. The percent of total variance accounted for by the factors was not reported.

Šverko (1995) described the results of principal components analyses based on VS scales, rather than items. As part of the Work Importance Study, an 18-scale edition of the VS was administered to 19 samples (N = 18,218) from seven countries. Five varimax-rotated factors, accounting for 59% of the total variance, were obtained for the pooled sample: Utilitarian, Self-Actualizing, Individualistic (or Independent), Social, and Adventurous. Results from separate analyses of data for the 19 samples generally were similar to results for the pooled sample. The five factors accounted for 54% to 66% of total variance, depending upon the sample.

Macnab and Fitzsimmons (1987) used eight OAs, each represented by a WVI, VS, MIQ, and WAPS scale, in a multitrait-multimethod analysis of the OAPs of 438 university students. Their series of confirmatory factor analyses supported eight factors which accounted for 48% of total variance (about twice as much as the four methods factors). These results indicate that the eight sets of scales from the four instruments were assessing similar OAPs. Macnab and Fitzsimmons concluded that "Although the traits [factors] are correlated, they are not so strongly related that they should be combined" (p. 13).

Recently, Crace and Brown (1995) reported results from a series of factor analyses of the responses of 419 college students to a pool of 141 life values items. They identified the following ten promax-rotated factors: Financial Prosperity, Spirituality, Altruism, Scientific Inquiry, Affiliation, Order, Solitude, Physical Expression, Creativity, and Independence. The factors, which accounted for 58% of total variance, are represented by ten scales on the recently published Life Values Inventory (Crace & Brown, 1995).

OAP dimensions based on multidimensional scaling analysis. Elizur (1984) and Borg (1986), in highly similar studies, used smallest space analysis (SSA; a form of multidimensional scaling analysis) to study OAP structure. In the latter study, Borg (1986) obtained importance ratings for 13 occupational attributes (e.g., high income, interesting work, responsibility) from a representative sample of 1,500 West German adults. An SSA of the attribute intercorrelation matrix produced two dimensions. Borg divided the resulting plane into three regions: cognitive-psychological (e.g., independence, responsibility), affective-social (e.g., altruism, contact with people), and instrumental-material (e.g., security, income). These regions correspond to the modality facet of work outcomes proposed by Elizur (1984), and they appear to be similar to three second-order factors obtained by Pryor (1987), as described above. (Also see discussion of Lofquist and Dawis, 1978.)

Attributes of Occupations

The studies reported in the previous section were based on the OAPs of people. In the studies reported below, the attributes of occupations were assessed either through expert judgment (several studies) or the OAPs of people preparing to enter the occupations (one study).

OA dimensions based on cluster analysis. Research sponsored by the U.S. Department of Defense (DOD) resulted in the 13 OAs used in the Armed Services Vocational Aptitude Battery Career Exploration Program (ASVAB-CEP; U.S. DOD, 1994). Ninety-one OAs

identified in a literature review were assigned to homogenous groups by a panel of subject matter experts working independently. Cluster analyses of a dissimilarity matrix based on the group assignments identified 15 attribute clusters. Prior to implementation, four attributes were dropped for logistical reasons; one was added, and one was dichotomized. Table 1 lists the 11 OAs on which occupations can be rated, independently. The other two OAs were challenge and working in a group.

OA dimensions based on factor analysis. In an extension of a study by Tinsley and Weiss (1974), Shubsachs, Rounds, Dawis, and Lofquist (1978) factor analyzed Minnesota Job Description Questionnaire (MJDQ) ratings for 109 occupations. They obtained three varimax-rotated factors: Self-Reinforcement (e.g., creativity, achievement, autonomy), Reinforcement via Altruism (e.g., social service, coworkers, moral values), and Environmental/Organizational Reinforcement (e.g., company policies/practices, nature of supervision, compensation), which were later called Internal/Self, Social, and Environmental (Dawis et al., 1988). The three factors accounted for 51% of the total variance. As noted above, Lofquist and Dawis (1978) grouped their six MIQ factors (based on large samples of *people*) into the same three categories. (The MJDQ and MIQ assess parallel attributes.)

In the forerunner of the study reported here, Vansickle and Prediger (1991) sought to determine the feasibility of linking OAPs to ACT's World-of-Work Map (ACT, 1995b; see Figure 1). The 36 OAs used in the study included 18 in DISCOVER at that time and 18 of the 27 OAs in the *Guide for Occupational Exploration* (GOE; Harrington & O'Shea, 1984). Results of a principal components analysis indicated that, taken as a whole, the 36 OAs effectively differentiated the 425 occupations in DISCOVER. The first three unrotated factors were labeled Educational Level (e.g., recognition, independence, variety), Working with People (e.g., working with people, helping others, public contact), and Work Setting (e.g., outdoor work, physical work,

travel). (Subsequent factors were unnamed.) The first three factors accounted for 28%, 9%, and 8% of total variance, respectively. The first factor correlated .79 with educational level ratings for the occupations. (Results of new analyses confirming the Educational Level factor are reported in the section on OA differences across occupations). Prediger (1996) noted that an OA-based educational level factor may parallel an OAP-based aspiration level factor.

Especially given that different OA instruments and occupational ratings were used, the OAs loading on the first two factors were surprisingly similar to those loading on two of the three varimax-rotated factors obtained by Shubsachs et al. (1978), as summarized above: Internal/Self (29% of total variance) and Social (8%). The OAs available for the third factor differed appreciably for the two instruments. Nevertheless, the labels for the third factor (Work Setting and Environmental) were similar. (For supportive results based on OAPs, see Borg, 1986, and Lofquist & Dawis, 1978; both are cited above).

OAs differentiating occupations grouped by Holland's types. In the only study of OAs based on people, Ben-Shem and Avi-Itzhak (1991) compared the OAPs of Israeli college freshmen enrolled in a variety of programs (e.g., engineering, economic/accounting) with those of students enrolled in programs characterized as helping professions (e.g., nursing, occupational therapy). In an analysis of variance of each of the 15 WVI scales, statistically significant differences were obtained for 8 of the scales. The helping profession aspirants (Holland's, 1985, Type S) scored higher on associates and altruism. The other aspirants (primarily Types I and R) scored higher on creativity, management, independence, intellectual stimulation, variety, and way of life. Although of limited scope, this study provides evidence that OAPs differentiate Holland's types.

In an extension of a study by Toenjes and Borgen (1974), Rounds, Shubsachs, Dawis, and Lofquist (1978) sought to identify differences among the mean MJDQ ratings of 181 occupations

grouped by Holland's (1985) six types. Statistically significant differences among types were observed for 17 of the 21 MJDQ scales. However, the differences were as hypothesized (on the basis of Holland's RIASEC model) for only four MJDQ scales: ability utilization, compensation, creativity, and responsibility. The results of multidimensional scaling analyses and discriminant analyses involving the MJDQ mean ratings also failed to support Holland's. The analyses produced the following arrangements, respectively: REAISC, REASIC. These results suggest that the OAs characterizing Holland types differ, but not in ways compatible with Holland's hexagonal model.

In an extension of a study by Holland, Viernstein, Kuo, Karweit, and Blum (1972), Hyland and Muchinsky (1991) used scores for the 13 overall dimensions of the Position Analysis Questionnaire (PAQ) to obtain mean profiles for 86 occupations grouped by Holland's types. An analysis of variance revealed statistically significant mean scale score differences among Holland's types for 11 of the 13 PAQ dimensions. However, only 18% of the PAQ comparisons for opposite types on Holland's hexagon were statistically significant—a finding which indicates that PAQ differences among Holland's types do not follow Holland's hexagonal model. This finding is surprising, given the apparent correspondence between a number of PAQ dimensions and Holland types—e.g., machine/equipment operation (Type R), clerical (Type C), service (Type S). A discriminant analysis showed that the arrangement of Holland's types on the two significant discriminant functions was RESIAC, not RIASEC. As with the Rounds et al. (1978) study, the results of this study indicate that the OAs characterizing Holland's types differ, although not according to the hexagonal model.

Vansickle and Prediger (as part of the study cited above) conducted discriminant analyses across occupations grouped by Holland type and, within each type, by ACT (1995b) job family. Results indicated that the OAs differentiated Holland's types and job families within the types.

Furthermore, the peaks and valleys in OA mean score profiles for Holland types and for job families generally made good sense. Vansickle and Prediger concluded that a linkage between OAs and the World-of-Work Map was possible but, because of job family differences within Holland type, the linkage must be via job families rather than Holland type or region on the World-of-Work Map (ACT, 1995b; see Figure 1).

Integration of Findings

Attributes commonly identified. The number of OA and OAP dimensions (factors) identified by the factor analytic studies reviewed above varied from three to ten, in part due to the different criteria used to determine when to stop factoring. In no case did the factors account for more than 60% of total variance. As noted by Pryor (1987), OAP scales constructed to be relatively unique may be expected to contain a large amount of specific variance. (The same would appear to hold for OA scales.) The results obtained by Macnab and Fitzsimmons (1987) are instructive in this regard. As noted above, they used four scales to represent each of eight OAs and obtained eight corresponding factors. Probably because there was relatively little variance to share, the eight WAPS-supported factors obtained by Macnab and Fitzsimmons were reduced to three factors in Pryor's analysis of all 13 WAPS scales, and the eight MIQ-supported factors obtained by Macnab and Fitzsimmons were reduced to six factors in the Lofquist and Dawis (1978) analysis of all 20 MIQ scales.

It was not the intent of this review to provide a detailed comparison of factors (e.g., via an analysis of attribute loadings) across various instruments and studies. Rather, the intent was to obtain a general perspective on the attributes associated with major OAP and OA dimensions differentiating people and occupations, respectively. The attribute groupings labeled Internal/Self, Social, and Environmental by Dawis et al. (1988) received partial to good support in several studies of OAP and OA dimensions. (Evidence regarding the OAs differentiating Holland's types

was mixed, however.) In general, the review suggests that OAPs and OAs can be used to differentiate people, occupations, and occupational groups. Results of the review are summarized in Tables 1 and 2.

Recommended attributes. Table 1 lists attributes recommended by Vansickle and Prediger (1991) for use in the linkage of OAPs to occupations. These attributes continue to be supported by research and practice. Their research support is indicated by the Rationale column, which is cross-referenced to studies listed in Table 2 (studies that were cited above). Table 1 includes only attributes on which occupations can be rated, a prerequisite for an OAP-occupation linkage. For the following reasons, it excludes attributes that sometimes appear in established instruments: (a) they can not be rated independent of a specific job (e.g., pleasant coworkers, easy commute); (b) they require knowledge of a person-occupation interaction (e.g., ability utilization, life-style preference); or (c) they have little support in the OA research literature (e.g., risk, working with hands).

The 14 OAs listed in Table 1 are divided into two categories according to whether they were included in the 30-OA Inventory of Work Preferences (IWP) used in this study. These 14 OAs and the remaining attributes in the IWP are discussed in the Variables section of this report.

Overview of Study

As noted above, the primary purpose of this study was to develop a procedure for linking OAPs to the occupations in DISCOVER via the World-of-Work Map. Four substudies addressed this purpose. The first was conducted to determine test-retest reliabilities and endorsement rates for the OAs in a preliminary version of the IWP. This substudy is described in the report section titled "1992 Field Study." After the IWP was revised and finalized following the 1992 field study, a second field study was conducted to determine test-retest reliabilities and intercorrelations. This substudy is described in the report section titled "1994 Field Study."

Following the 1992 field study, the 497 occupations in DISCOVER were rated on the 30 OAs in the IWP (see Variables section), and a principal components analysis and two discriminant analyses were conducted to identify OAs that differentiate occupations primarily on the basis of educational level. (Identified OAs were candidates for exclusion from the OAP-occupation linkage procedure.) Next, a discriminant analysis was conducted to identify OAs that appropriately (validly) differentiate occupations grouped by six job clusters (ACT, 1995b) similar to Holland's (1985) occupational types. Finally, differentiation of ACT (1995b) job families by individual OAs was examined via mean attribute rating profiles based on occupations in the job families. This series of analyses (the third substudy) resulted in the linkage procedure used in DISCOVER from 1994 to 1996.

Because data from the 1994 field study indicated that five OAs in the IWP were not sufficiently reliable to be included in the linkage procedure, the analyses cited above were repeated for 25 of the 30 IWP attributes. This fourth substudy, which superseded the third, is described in the report section titled "Analyses of Attribute Differences Across Occupations." The fourth substudy resulted in the linkage procedure introduced by DISCOVER in the Fall of 1996.

The remainder of this report describes the procedure used to link counselee OAPs, as assessed via the IWP, to job families on the World-of-Work Map (ACT, 1995b). Four job families are suggested to counselees on the basis of their OAPs.

Variables

Variables used across the various substudies are collectively described below.

Inventory of Work Preferences

Attributes included. Ten of the OAs supported by research and practice (see Tables 1 and 2) are represented in the Inventory of Work Preferences (IWP; see Appendix A), either directly

or indirectly. Influencing others, public contact, and physical activity appear as in Table 1. The wording of two attributes was changed: Authority was rewritten as management; earnings was rewritten as high income. Four aspects of work setting were represented separately as working in an office, working inside, working partially inside and partially outside, and working outside. Two aspects of creativity were represented separately as new ideas and problem solving. Other OAs were split into sub-attributes. Travel was split into occasional travel and routine travel. Flexible schedule became 40-hour week and non-standard hours. Finally, job opportunities (sometimes subsumed by job security, as per Table 1) was split into occupational opportunity, short training time, and easy reentry. Altogether, 18 of the 30 IWP attributes have their basis in the OAs listed in Table 1.

Two of the remaining 12 IWP attributes were derived from items in the GOE values checklist (Harrington & O'Shea, 1984). Working with hands and working with machines or equipment were combined into making things, and public attention was rewritten as immediate response. The safety attribute was a reversal of the risk attribute in Nevill and Super's (1986) VS. The final nine IWP attributes (i.e., authority, certification, creating order, defined tasks, financial challenge, precision, project work, working with coworkers, and working separately) were formulated after a review of U.S. Department of Labor (DOL) occupational ratings categories (U.S. DOL, 1991b) and instruments not listed in Table 1 (Edwards, 1959; Hahn, 1969; Hall & Tarrier, 1976; Johansson, 1977; Knapp & Knapp, 1990). Because the 12 OAs, taken together, have little basis in previous research, they might best be thought of as plausible hypotheses. In any case, each of the 30 IWP attributes must pass several empirical hurdles in order to be used in the OAP-occupation linkage procedure developed in this study.

Potential attributes not included. Five OAs listed in Table 1 were not included in the IWP. Occupational ratings for these OAs (along with four others) were used in DISCOVER until

1994, when the IWP replaced DISCOVER's OAP inventory. In 1984, OAs based on a precursor of Nevill and Super's (1986) VS were also considered, and DISCOVER occupations were rated by a panel of vocational psychologists consisting of Henry Borow, JoAnn Bowlsbey, Helen Farmer, Dorothy Nevill, Dale Prediger, Donald Super, and Donald Zytowski. After eliminating attributes that panel members found difficult to rate and after refining attribute definitions and rating procedures, a new panel of vocational psychologists (Henry Borow, Joann Bowlsbey, Eve Carr, Lenore Harmon, and Donald Zytowski) re-rated DISCOVER's occupations on the five attributes (plus four others). Inter-rater (Cronbach alpha) reliability coefficients for the five attributes ranged from .79 to .95 (median of .91). Thus, it appears that the five attributes would be good candidates for inclusion in the next edition of the IWP—especially since their presence in at least five of the six OAP instruments cross-referenced in Table 1 demonstrates their basis in the expectations of counselors and counselees.

Response options. Initially, three response options (*Very Important, Somewhat Important,* and *Not Important*) were used with IWP attributes. After the 1992 field study, a fourth response option was added (i.e., *Don't Want*) in order to allow counselees to express their desire to avoid occupations with certain OAs (e.g., physical activity, routine travel). The final set of instructions and response options appears with the IWP items in Appendix A.

Occupational Ratings

A procedure for linking OAPs to job families and occupations requires a comparison of counselee preferences with the attributes of occupations. Hence, DISCOVER occupations must be rated on each of the 30 OAs in the IWP. The occupational rating rules and procedure are described below.

Bases for rating rules. The following guidelines shaped the occupational rating rules: (a) the rating rules must draw on objective occupational information, whenever possible; (b) the

rating rules must be sufficiently clear and detailed to direct rating decisions when objective information is not available; and (c) the rating rules must be sufficiently clear and detailed so that the occupational ratings can be independently reproduced.

During their first meeting, members of the consultant panel (see Acknowledgments section) discussed potential IWP attributes, revised attribute definitions, and began to formulate rules for rating occupations. Prior to their second meeting, panel members were asked to rate 30 occupations on 16 OAs thought to be difficult to rate. *Occupational Outlook Handbook* (OOH; U.S. DOL, 1992) descriptions were provided for each occupation. The rating scale included two categories: *Yes* and *No*. During their second meeting, panel members compared ratings and the rating rules they had independently formulated. Rating disagreements often resulted from various interpretations of the adjectives used in the OOH to describe the presence or absence of attributes (e.g., many, most, little). In resolving the rating disagreements, panel members discussed percentage-of-time and the percentage-of-workers criteria for a *Yes* rating (e.g., defining *Yes* as "most of the time," meaning 60% or more of at-work time). For each of the 16 OAs, panel members suggested rating rules, including percentage-of-time and percentage-of-workers criteria required for *Yes* ratings. The percentage-of-time criterion differed across attributes (e.g., making things, project work) in order to permit the threshold for an attribute's "presence" (a *Yes* rating) to vary from attribute to attribute.

Subsequently, two ACT staff members defined rating rules for each of the 30 IWP attributes and independently rated a set of 44 diverse occupations. Comparisons of discrepancies in the staff members' ratings identified a problem with the *Yes*, *No* rating scale. For example, using "60% of workers and 60% of the time" as the criteria for a *Yes* rating for a given attribute meant that an occupation would be rated *No* even though 55% of the workers experienced the

attribute 55% of the time. To address this problem, the rating rules were modified to include a third option (*Maybe*).

To maximize agreement between the two raters, attribute definitions were revised and additional rating rule refinements were made. For example, the initial rating rules provided guidance when an attribute was described in the OOH. When there was no mention of the attribute in the OOH, discrepancies in ratings were more frequent. Hence, the rating rules were revised to include statements governing rating decisions based on other occupational descriptions and labor market data.

Finally, another set of 46 occupations (two per job family) was selected and independently rated. Fewer discrepancies occurred between the two raters. Additional rating rule refinements were made to address the remaining discrepancies. This process continued until the two staff members were able to apply the rating rules with approximately the same results.

Description of rating rules. A document titled "Occupational Attribute Definitions and Rating Rules" (available from the ACT Research Division) describes the rating ("coding") rules used to assign ratings (*Yes*, *Maybe*, or *No*) for 30 attributes to each of 497 DISCOVER occupations. The dual, interacting criteria used in assigning attribute ratings were (a) percent of workers experiencing an attribute (e.g., doing project work) and (b) percent of time workers experience the attribute. Categories for percent of workers were defined as follows:

1. *Yes* = at least 60% of workers experience the attribute at least X% of the time, where X is specified by percent-of-time level (see below) assigned to the attribute.

2. *Maybe* = 11% to 59% of workers experience the attribute at least X % of the time.

3. *No* = 10% or less of workers experience the attribute at least X% of the time.

Percent-of-time levels vary from attribute to attribute. The three levels (and the number of attributes assigned to each level) were defined as follows:

1. Level 1: 10-39% of the time (4)
2. Level 2: 40-59% (9)
3. Level 3: 60-100% (10)
4. Level not applicable (7)

As implied above, the rating rules are jointly applied. For example, a *Yes* rating for making things (a Level 3 attribute) means that at least 60% of the workers in Occupation X are engaged in (experience) making things at least 60% of the time. A *Yes* rating for project work (a Level 1 attribute) means that at least 60% of the workers in Occupation X are engaged in project work at least 10% of the time. A *Maybe* rating for project work means that 11% to 59% of the workers in Occupation X are engaged in project work at least 10% of the time; and so on.

For attributes for which the percentage-of-time criterion does not apply, *Yes*, *Maybe*, and *No* ratings are based on considerations unique to each attribute. For example, the rating criteria for the attribute, easy reentry, were as follows: Occupations must not have any of these negative—

1. Not a small occupation;
2. Not keen competition (not very keen);
3. Skills which are setting specific must not take more than a month to learn—when a worker starts a new job, the job should use the skills the worker gained in previous jobs;
4. If skills are required which take more than a month to learn, then they must not deteriorate rapidly (for example, an engineer would be out-of-date if he/she stopped out for a couple of years). Code "no" if *Occupational Outlook Handbook* indicates nature of work changes rapidly, must keep abreast of change, etc.

The rating criteria for the seven attributes for which the percent-of-time criteria do not apply (e.g., easy reentry, occupational opportunity, non-standard hours) are provided in the rating

document cited above. In the discussion that follows, attention is focused on the other 23 attributes.

Ambiguities in occupational ratings. As illustrated below, permitting the percent-of-time criterion for an attribute's presence (or absence) to vary from attribute to attribute results in ambiguities in the meaning of occupational ratings. Complicating the matter is that percent of at-work time may refer to hours per day, days per week, etc. *Frequency* of occurrence (less than monthly, on a daily basis, etc.) provides an alternative for determining the presence (or absence) of an attribute—an alternative which does not require assessment of *duration* of occurrence vs. total at-work time. This alternative (along with others) will be considered when the occupational ratings are updated.

The following two examples illustrate ambiguities in the occupational ratings. As noted above, a *Yes* rating for project work (one of four Level 1 attributes) means that at least 60% of workers in Occupation X are engaged in project work at least 10% of the time. The remaining 40% may do project work 0% of the time. Thus, a *Yes* rating for project work means that the percent of time typically associated with project work could vary from 6% (the sum of 60% of the workers times 10% of the time, plus 40% of the workers times 0% of the time) to 100%. The meanings of *Maybe* and *No* ratings are also ambiguous. For example, a *No* rating for making things (one of 10 Level 3 attributes) means that the percent of time typically associated with making things could vary from 0% to 63% (the sum of 10% of the workers times 100% of the time, plus 90% of the workers times 59% of the time). Implications of rating ambiguities for the selection of an OAP-occupation linkage model are discussed in the section describing the linkage procedure.

Rating rules vs. what counselees see. As noted above, counselees completing the IWP indicate whether a given attribute is *Very Important* to them, *Somewhat Important*, *Not Important*,

or whether they *Don't Want* ("want to avoid") occupations with the attribute. They do not know what percent-of-workers and percent-of-time criteria apply to a given attribute—or that such criteria apply at all. For example, the IWP describes project work as follows: "Working on tasks that last for a week or more and have a definite end." The description seems to imply occupations in which typical workers (not a given percentage of workers) spend "a lot of time" on project work. The low percentage-of-time criterion (10%) for a *Yes* rating is not cited. Even if it were, a counselee who says that having project work is *Very Important* can have the same match between his/her preference and a *Yes* rating for an occupation—whether the likely percentage of time that he/she will experience project work is 100% or 6%. How discrepancies between the IWP response scale (*Very Important*, etc.) and the occupational rating scale (*Yes*, *Maybe*, *No*) were addressed is discussed in the section describing the OAP-occupation linkage procedure.

Influence of rating rules on rating accuracy. In order to determine whether to assign a *Yes*, *Maybe*, or *No* rating to an OA, an occupational rater must first determine whether the percent-of-time criterion applies. If not, then the criteria unique to the attribute (e.g., see easy reentry) must be applied. If the percent-of-time criterion does apply, the rater must ask: "Is this a Level 1, 2, or 3 attribute with respect to percentage-of-time?" If it is a Level 2 attribute (for example), the rater must then ask "What percentage of workers (60% to 100%, 11% to 59%, 0% to 10%) experience the attribute 40% to 59% of the time?"

Given that each of 497 occupations were rated, one occupation at a time, on each of 30 attributes (14,910 ratings); that the percent-of-time criterion changes from attribute to attribute; and that, for each of seven attributes, other complex judgments are required—the rating task is difficult. Contributing to the difficulty is the fact that, with few exceptions, published occupational descriptions (e.g., the OOH) report what *typical* workers do—not what specific

percentages of workers do—and what workers *typically* do—not the percentage of time various percentages of workers experience OAs (e.g., making things, project work, immediate response).

For the reasons noted above, the OAP-occupation linkage procedure developed in this study had to minimize the impact of individual OA ratings on the occupations suggested to counselees. Implications for the selection of a linkage model are discussed in the section describing the linkage procedure.

Occupational Rating Procedures

As described above, DISCOVER's occupational ratings had been provided by panels of consultants until the IWP was introduced in 1994. This approach was not followed with OAs in the IWP because of the immensity of the rating task, especially from the perspective of otherwise-employed consultants. The alternative that was chosen (described below) primarily involved ACT's occupational analyst, a full-time staff member. Although this alternative precluded obtaining an inter-rater agreement (reliability) index, it is well-known that reliability is a prerequisite of validity. The research results reported in the section on attribute differences across occupations provide evidence of attribute rating validity—i.e., the ratings differentiate job clusters and job families in appropriate ways. Thus, it appears that the occupational analyst was able to overcome the ambiguities in the rating rules—to capture their intent without being overwhelmed by the specifics.

As noted in the description of the rating rules, two ACT staff members (the occupational analyst and her supervisor) reached agreement on IWP attribute ratings for two occupations in each of the 23 ACT job families. These ratings served as attribute scale anchors. So that similar occupations could be examined and rated at the same time, DISCOVER occupations were arranged by ACT job family. After reading a description of an occupation, the occupational analyst rated the occupation on 28 of the 30 attributes. (Ratings for occupational opportunity and

high income were obtained from the Bureau of Labor Statistics and the Economic Research Institute.) The analyst's supervisor checked for rating reasonableness by looking at how occupations ranked within job families on a given OA. Disagreements were resolved by discussion.

1992 Field Study

A field study involving a preliminary edition of the IWP was initiated in 1992 in order to determine OA endorsement rates and test-retest reliability. The IWP was administered to 540 predominantly 9th grade students attending five schools located in rural, suburban, and urban communities. After rating the importance of 33 attributes on a 3-point scale (*Very Important, Somewhat Important, Not Important*), students were asked to identify and rank up to 9 of the 33 attributes as most important to them. Approximately two weeks later, 331 students in the original sample repeated the exercise.

Endorsement Rates

Response distributions and ranks based on the first administration were reviewed to identify nonfunctional attributes, defined as attributes which were ranked among the top nine by fewer than 4% of the students. All 33 OAs were judged to be functional by this criterion. Financial risk and creating order, the least endorsed attributes, were ranked among the nine most important attributes by 9% of the students. Defined tasks and working separately followed at 10%. Attributes most frequently ranked among the top nine were physical activity (45%), high income (42%), minimal health risk (35%), and public contact (33%). The percentage of students rating a given OA as *Very Important* or *Important* ranged from 50% to 91% across the 33 OAs. The four attributes with the highest percentages were high income, physical activity, certification, and minimal health risk.

Reliability

At the time of the study, two procedures for linking OAPs to occupations were under consideration. Both required counselees to rank OAs in order of preference. Hence, it was necessary to assess the test-retest reliability of the OA ranks. For each of the 253 students who ranked at least five attributes during both administrations of the IWP, a rank order correlation was obtained. The median intra-student correlation was .38 (interquartile range of .11 to .63). For 20% of the students, the correlation was negative. On the basis of these results, use of counselee rankings of OAs in the linkage procedure was no longer considered.

1994 Field Study

As noted in the overview section, the IWP was revised following the 1992 field study. Hence, a second field study was initiated in the fall of 1994 in order to determine whether any of the 30 OAs in the current edition of the IWP should be excluded from the occupational linkage procedure due to low reliability or redundancy.

Sample

The study design required a total of approximately 300 9th graders and 300 12th graders in a cross-section of schools. Urban, suburban, and rural schools in a variety of states were identified through use of *School Directories* (Market Data Retrieval, 1994). Counselors from 19 schools were contacted by phone, provided with a brief verbal description of the study, and asked if they would like to have a set of sample materials to review. Recruiting was discontinued when six schools agreed to participate in the study. Late in the school year, one of the three 12th grade schools had to withdraw from the study. Attempts to find a replacement school were unsuccessful due to the time of the year.

Tables 3 and 4 provide demographic information for the schools and students participating in the study. As shown by Table 3, the test-retest interval ranged from 1-3 weeks. (Because of

scheduling difficulties in School 3, the second testing session was delayed by a holiday period.) For the three 9th grade schools, there were 724 students with both test and retest records. After elimination of 48 records identified as invalid, there were 676 students in the Grade 9 sample. Of these, 583 had a complete set of test-retest responses.

Due to the late withdrawal of one of the schools, the 12th grade sample included students who did not have both test and retest records. After elimination of 11 invalid records, there were 294 students with test or retest data relevant to the study. Of these, 176 had a complete set of test-retest responses.

Results

Endorsement rates. IWP response distributions were reviewed to identify nonfunctional items (i.e., items for which one or two response options predominate). As shown by Table 5, responses for each of the IWP items were dispersed across at least three of the four response options. The majority of the item response distributions are symmetrical or flat. In general, the amount of response dispersion across the response options suggests that all IWP items can contribute to the OAP-occupation linkage procedure.

Although there were some differences across the two samples, the attributes assigned *Very Important* ratings by the most students include high income (Item 14), certification (4), and physical activity (9). The attributes assigned *Don't Want* ratings by the most students included working separately (30), financial challenge (8), and working outside (20).

Reliability. Invariably, discussions about reliability are based on a set of items (e.g., a scale, a test; e.g., see Gable & Wolf, 1993). The two factors identified as having the most influence on the size of reliability coefficients are the number of items in the scale and the homogeneity of the item content. Acceptable reliability standards for various types of psychological measures have been suggested in the literature. Test and scale reliability

coefficients for affective measures (scales, etc.) can be as low as .70, depending on the decisions to be made (Gable & Wolf, 1993).

In the case of multiple, single-item scales, methods of assessing internal consistency reliability are not applicable. According to Lord and Novick (1968), the most appropriate method of estimating reliability is to determine the temporal stability of the items. The literature, however, does not provide guidance regarding acceptable reliability levels for single-item affective measures.

In evaluating the acceptability of single-item reliabilities, it is necessary to consider (a) any problems associated with the test-retest method used in the study, (b) how scores will be obtained from the items, and (c) the decisions that will be based on the scores. Most of the problems inherent in test-retest reliability studies (e.g., changes in an examinee's ability, fatigue, etc.) are not relevant to this study. However, there may be a memory effect on the second administration. If so, there would tend to be correlated errors across the two administrations and, hence, some inflation of the reliability coefficients.

How will scores be obtained from the OAs in the IWP, and what decisions will be based on them? The procedure used to link counselee OAPs to occupations is described later in this report. Two aspects are germane to these questions. First, counselee OAPs are compared, *as a group*, to the OA ratings for occupations, and mean congruence (degree-of-fit) scores are obtained for job families. Second, these scores are used to *suggest* job families for exploration. No decisions are made on the basis of individual OAPs (single items) or the congruence score composites derived from them.

Because counselee OAPs are considered as a group, a high level of reliability for individual OAPs is not crucial. Nevertheless, one would not wish to base congruence score composites on unreliable OAPs. Although absent in the literature, guidance regarding an

acceptable reliability level for single items (OAPs) can be obtained from other affective instruments. For example, the Unisex Edition of the ACT Interest Inventory (UNIACT) is an established, well-studied, affective instrument (Swaney, 1995). Test-retest responses (1-2 week interval) from a study of 416 11th graders (Staples & Swaney, 1994) were analyzed to determine single-item UNIACT reliabilities. Across the 90 items, reliabilities ranged from .42 to .78 (median of .62). On the basis of these results and the other considerations noted above, OAP test-retest reliability coefficients of .46 and higher were considered to be acceptable.

Table 6 shows IWP results for the field study samples. For Grade 9, reliability coefficients ranged from .42 to .72 (median of .53); for Grade 12, they ranged from .32 to .75 (median of .57). These single-item reliability coefficients are similar to those obtained for UNIACT items.

In order to obtain a more stable estimate of test-retest reliability, the Grade 9 and 12 reliability coefficients for each OA were averaged prior to applying the .46-or-higher criterion. Guilford and Fruchter (1973) suggest that correlations can be averaged if they are not large and do not differ considerably in size. Otherwise, they recommend using Fisher's *z* transformation before obtaining an average. Six Grade 9, Grade 12 pairs of test-retest correlations were averaged using both methods to determine the magnitude of the differences. The selected pairs had either large differences or high correlation coefficients. Since the two methods yielded the same results when rounded to two decimal places, a simple average is reported in Table 6. The five OAs with an average reliability coefficient of .45 or below were not considered for use in the OAP-occupation linkage procedure.

IWP item redundancy. Grade 9 and Grade 12 IWP item intercorrelations (excluding the five low-reliability items) are available from the ACT Research Division. Disattenuated intercorrelations based on these data were examined in order to determine if any of the items

were measuring the same construct. In the absence of an established criterion, the redundancy criterion was set, a priori, at a disattenuated correlation of .90 or above. Items falling below this criterion would have at least 20% unique, true-score variance.

According to Lord and Novick (1968), the quantities used to obtain disattenuated correlations should involve the same sources of error to guard against over- or under-correcting. Test-retest reliabilites were available for use in the disattenuation formula; therefore, the disattenuated intercorrelations were calculated using intercorrelations based on the two administrations (i.e., test and retest). Since, for each pair of items, there are two intercorrelations (i.e., $r_{T1,R2}$ and $r_{T2,R1}$; where T1 = test item 1, R2 = retest item 2, etc), disattenuated intercorrelations were obtained for each. To make the task of reviewing the disattenuated intercorrelations for each attribute more manageable, values for the pairs were averaged. (As before, the data justified omission of Fisher's *z* transformation.)

The size of a linear correlation coefficient (including disattenuated coefficients) may be restricted when the distributions of the two variables differ in shape. Consequently, the shapes of the two distributions need to be considered when reviewing correlations. Nunnally (1978) indicated that there are no formulas for forecasting the effects of distribution shape on correlation coefficients. However, he did provide some examples of effects for both continuous and dichotomous variables.

As noted above, Table 5 reports response distributions for IWP items. A distribution was considered to be skewed when more than two-thirds of the students used the top two (or bottom two) response options. Distributions considered to be skewed were labeled moderately skewed (M) when 34% or less of the students answered *Very Important* (or *Don't Want*) and highly skewed (H) when 35% or more indicated *Very Important* (or *Don't Want*). Level of skewness for IWP items is indicated in Table 5.

Disattenuated IWP intercorrelations for Grades 9 and 12 (available from the ACT Research Division) were examined, taking into consideration skewness of the response distributions. The median disattenuated intercorrelations were .24 (interquartile range of .14 to .32) and .21 (interquartile range of .10 to .32) for Grades 9 and 12, respectively. The highest disattentuated intercorrelations (.74 and .86) were obtained for items 10 (occasional travel) and 11 (routine travel). Because response distributions for the two items were similar in shape, the sizes of these correlation coefficients were unlikely to be restricted. In summary, none of the intercorrelations met the redundancy criterion noted above.

Patterns of relationships among IWP items. Finally, the disattenuated intercorrelations were reviewed to determine whether the patterns of intercorrelations made good sense, given the OA descriptions in the IWP and the occupational rating rules. In order to facilitate the review, intercorrelations for each of the 25 OAs meeting the reliability cutoff were profiled. For all but one attribute (i.e., creating order), the pattern appeared to be consistent with both the OA descriptions and the occupational rating rules. Creating order correlated .40 or higher with immediate response, management, authority, influencing others, financial challenge, and new ideas. These correlations suggest that the respondents interpreted the OA more broadly than warranted by the rating rules. Hence, the item needs to be rephrased when the IWP is revised.

Summary of results. In summary, 5 of the 30 OAs in the IWP were eliminated on the basis of low test-retest reliabilities. All of the remaining 25 OAs were found to be non-redundant and to have functional responses. The intercorrelations of all but one of the OAs appeared to be consistent with the occupational rating rules.

Analyses of Attribute Differences Across Occupations

The analyses reported below were briefly described in the Overview of Study section. Their purpose was to identify a parsimonious set of OAs that appropriately (validly) differentiate,

on other than educational level, occupational groups consisting of (a) job clusters and (b) job families. Such OAs were needed for DISCOVER's OAP-occupation linkage procedure.

Variables

Occupational attributes and ratings. The OAs in the IWP and the corresponding occupational ratings scales were described in the Variables section. Additional variables specific to the analyses reported here are described below.

Occupational groups. The 497 occupations in DISCOVER at the time of the analyses were classified according to the six job clusters and 23 job families in the ACT Occupational Classification System (ACT-OCS; ACT, 1995b). Table 7 shows the 23 job families organized by the six job clusters. Job cluster titles, related Holland (1985) types, and their abbreviations are: Business Contact—Enterprising (E), Business Operations—Conventional (C), Technical—Realistic (R), Science—Investigative (I), Arts—Artistic (A), and Social Service—Social (S). In the following discussion, job cluster titles will be used.

Educational level. In DISCOVER, typical entry levels of education are provided for each of the 497 occupations. To facilitate statistical analyses, the five educational levels were combined into three categories, as follows: on-the-job-training, apprenticeship, and technical/trade; 2-year college degree program; and 4-year college degree program and graduate degree. Table 7 provides the number of occupations by educational level, within job cluster and job family.

For each DISCOVER occupation, U.S. DOL (1991b) ratings for General Educational Development (GED) Reasoning Development (hereafter called *GED—Reasoning*) and General Learning Ability were obtained. Across the 497 DISCOVER occupations, these ratings correlated .77 and .76, respectively, with educational level. Hence, they were included in certain analyses as indicators of educational level (hereafter called *marker attributes*).

General Considerations

Exclusion of education-related OAs. As noted in the literature review, Vansickle and Prediger (1991) found that educational level was the major OA dimension on which occupations differed. Typical or required amount of education is certainly an important attribute of occupations--so important that counselees are almost always advised to give it consideration. Printed materials (e.g., the *OOH*; U.S. DOL, 1996) and computer-based career planning systems (e.g., DISCOVER) help persons identify occupations appropriate to various educational levels.

Because educational level can and does receive separate consideration in career planning, OAs highly related to educational level (hereafter called *education-related OAs*) may contribute little more than redundant variance to an OAP-occupation linkage procedure. In addition, such OAs may reduce an occupational search that is presumably based on a variety of OAPs to one that is primarily based on educational level. Hence, the first three analyses described below had, as their goal, the identification of OAs that differentiate occupations *primarily* on the basis of educational level. Such OAs were excluded from the OAP-occupation linkage procedure unless they made an important, noneducational-level contribution to the procedure. In the future, DISCOVER may use a counselee's education-related OAPs to suggest the level of education most appropriate to the OAPs.

Tests of statistical significance. A multivariate analysis of variance conducted in conjunction with each of the three discriminant analyses reported below yielded a Wilks' lambda index of among-group differences that was significant at the .0001 level. In each of the analyses, the final discriminant function was also significant at the .0001 level. (By definition, prior functions account for at least as much among-group variance.) Hence, the criterion group differences revealed by results of the discriminant analyses can not reasonably be attributed to chance. However, the Wilks' lambda values reported in the study tables may capitalize on

chance due to the large number of variables (range of 21-33, depending on the analysis) relative to the number of occupations available for an analysis (range of 180 to 497).

Guidelines regarding the sample sizes (individual criterion group and total) required for a discriminant analysis vary (e.g., see Huberty, 1975; Stevens, 1996; Tabachnick & Fidel, 1989) and may depend on the purpose of the analysis (e.g., see Huberty & Barton, 1989). In this study, the purpose was descriptive--in particular, the determination of OA correlations (loadings) with up to three discriminant functions, depending on the analysis. In each analysis, the correlations generally made good sense, given OA content and the nature of criterion group differences. This being contrary to expectations for random results, sample sizes were judged to be adequate for study purposes.

Results of Statistical Analyses

Differentiation of occupations. A principal components analysis was conducted to identify major OA dimensions on which the 497 DISCOVER occupations differed. The 30 occupational ratings and the 3 educational level variables were included in the analysis. The analysis yielded seven orthogonal factors (principal components) with eigenvalues greater than one. Together, these seven factors accounted for 71% of the total variance. Table 8 provides OA correlations with the first four factors. The first factor accounted for 32% of the total variance and had loadings of $|.60|$ or higher for education level (.89), GED Reasoning (.82), General Learning Ability (.82), and 12 of the 30 OAs—e.g., influencing others (.80), new ideas (.79), management (.77). Thus, this factor was labeled Education Level. On the basis of high loadings for immediate response (.76), public contact (.75), working separately (-.67), and making things (-.46), the second factor (11% of total variance) was labeled Working with People. The next two factors were labeled Outside Work Setting (9% of total variance) and Inside Work Setting (6% of total variance).

The four OA factors are highly similar to those reported by Vansickle and Prediger (1991): Educational Level, Working with People, and Work Setting. In the analysis reported above, the latter factor was split into two factors—probably because of separate ratings for working inside, working outside, etc. As noted in the literature review, Shubsachs et al. (1978) obtained similar factors in an analysis of OA ratings. (Also see Lofquist & Dawis, 1978, for factors based on OAPs.)

The results of the principal components analysis indicate that OAs in the IWP primarily differentiate occupations on educational level. As shown in Table 9, the 12 attributes that had loadings on the Education Level factor of | .60 | or higher were considered to be candidates for education-related OAs.

Differentiation of occupations grouped on educational level. To further evaluate the OAs tentatively identified as education-related, a discriminant analysis was conducted with the 497 occupations grouped by educational level. The three groups were assigned equal weights in the analysis to avoid distortions due to an imbalance in the number of occupations per level. In addition to the 30 OAs, GED Reasoning and General Learning Ability were included as marker attributes.

As shown by Table 10, OA correlations with the first discriminant function generally correspond with the factor loadings for the first principal component (i.e., the Education Level factor). Of the 12 education-related attributes, all except problem solving correlated | .60 | or higher with the first discriminant function. Hence, these 11 OAs continued to be candidates for education-related attributes (see Table 9).

Differentiation of job clusters equated on educational level. To determine whether the candidates for education-related OAs differentiated job clusters on other than educational level, a discriminant analysis was conducted with job clusters equated on educational level. Equating

was achieved by selecting a sample of 30 occupations for each job cluster so that, within a job cluster, there were approximately equal numbers of occupations at the three educational levels.

Because the results of this discriminant analysis (and the subsequent one) were to be prime considerations in identifying OAs used to suggest job families to counselees (i.e., OAs used in the linkage procedure), the five OAs with low test-retest reliabilities (see 1994 Field Study section) were not included in the analyses. One of the 11 education-related candidates (defined tasks) was thereby eliminated. Hence, the analysis included 10 education-related candidates, 15 other OAs, and education level (used as a marker attribute).

Given the large number of variables (26) relative to the sample size (180 occupations), OA correlations were examined for only the first two discriminant functions (58% of among-group variance). These correlations and *F*-to-remove ranks are reported in Table 11. The *F*-to-remove ranks reflect the unique contributions of the OAs to job cluster differentiation (e.g., see Huberty, 1994). Hence, they indicate which OAs did the best job of differentiating job clusters when used in conjunction with other OAs. The very low *F*-to-remove rank (22) for educational level and the very low correlations between educational level and the discriminant functions indicate that the job clusters were successfully equated on educational level.

Three of the 10 OAs identified as education-related candidates (i.e., certification, influencing others, and financial challenge) correlated $|.40|$ or higher with the first or second discriminant functions. These correlations and the *F*-to-remove ranks (6, 2 and 7, respectively) indicate that the three OAs make a contribution beyond educational level to the differentiation of job clusters. Hence, they were not included in the final list of education-related OAs. The remaining seven OAs (see Table 9) were included on the list. However, three (high income, short training time, 40-hour week) were used in the linkage procedure for reasons noted in the summary for this section.

Differentiation of job clusters. In order to identify OAs that differentiate job clusters as they naturally occur (i.e., unequated on educational level), a discriminant analysis was conducted with the 497 occupations grouped by job cluster. The six job clusters were assigned equal weights in the analysis to avoid distortions due to an imbalance in the number of occupations per cluster. Of the 30 OAs in the IWP, the 5 low-reliability OAs and 4 of the 7 education-related OAs (see Table 9) were excluded from the analysis.

As shown by Table 12, 12 of the 18 non-education-related OAs correlated | .40 | or higher with at least one of the discriminant functions—the criterion for including an OA in the linkage procedure. (Results for the last two functions are not reported because the criterion was not met by additional OAs.) Generally, the *F*-to-remove ranks support use of the criterion. However, the low ranks for working in an office (20th of 21) and public contact (18th) may reflect the presence of highly related OAs—e.g., working outside and working separately, respectively.

Job cluster locations on the discriminant functions generally were as one would expect. (Also see Results of Profile Analyses section.) For example, the first function (high positive loadings for making things, working separately, etc. and high negative loadings for influencing others, public contact, etc.—see Table 12) differentiated the Technical Cluster from the Business Contact and Social Service Clusters. This dimension appears to be similar to the bipolar Things-People Dimension of the World-of-Work Map (ACT, 1995b; see Figure 1). The second discriminant function (high positive loadings for creating order, short training time, etc.) mainly differentiated the Business Operations Cluster from the other clusters. The World-of-Work Map's bipolar Data/Ideas Dimension was not clearly defined, perhaps because none of the OAs in the analysis clearly represented the Ideas pole. As in the Rounds et al. (1978) and Hyland and Muchinsky (1991) studies cited in the literature review, the arrangement of the job clusters

(RIAESC) did not correspond with Holland's (1985) RIASEC model, although the approximation was better.

Results of Profile Analyses

Differentiation of job clusters. Mean OA rating profiles for pairs of job clusters are shown in Figures 2-4. When considered in conjunction with the OA correlations in Table 12, the profiles generally make good sense. For example, influencing others had an *F*-to-remove rank of 1 and correlated -.75 and -.47 with the first two discriminant functions. In Figures 2-4, the mean OA ratings for influencing others are dispersed across the entire rating scale. For the Social Service Cluster, the mean rating was above 2.7; whereas for the Technical Cluster the mean rating was 1.1 (see Figure 2). Conversely, working outside had an *F*-to-remove rank of 19 and relatively lower correlations (i.e., .38, -.06, and .11) with the three discriminant functions. In Figures 2-4, the working outside ratings for occupations in the six clusters are bunched together. The mean rating for the Technical Cluster is approximately 1.5 and, for the remaining five clusters, the mean ratings are below 1.2.

Differentiation of job families within job clusters. Using OAs partially overlapping those in the IWP, Vansickle and Prediger (1991) conducted a discriminant analysis for each job cluster with job family as the grouping variable. Because of the small number of occupations in some of the job families, the number of attributes used in the analyses was reduced and, where necessary, some job families were excluded from the analyses. Results of the six discriminant analyses (and mean rating profiles) indicated OAs that differentiate job clusters also differentiate job families within job clusters.

Due to the large number of OAs in the current study and the relatively small number of occupations in some job families, a non-statistical approach was adopted for determining whether OAs differentiated job families within the six job clusters. Figures 5-10 provide mean OA rating

profiles for job families within job clusters. Inspection of Figures 5-10 shows that job families generally have appropriate profiles and that many have unique profiles. For example, the mean OA ratings for the tv job families in the Business Contact Job Cluster (Figure 5) differ substantially on immediate response, working in an office, easy reentry, public contact, etc. Because job families within each of the six job clusters tend to have unique profiles, a procedure that links OAPs to job clusters rather than job families would result in counselees being referred to inappropriate job families. The linkage procedure developed in this study accommodates these within-cluster differences among job families.

Analyses Addressing Special Problems

Separation of job families in two job clusters. The mean OA rating profiles of the seven education-related attributes and attributes not differentiating job clusters (as determined by the third discriminant analysis) were inspected in order to determine whether they could differentiate job families within the Business Operations and Technical Job Clusters—job clusters with job families that show the least amount of differentiation. One attribute, working outside, appeared to make a substantial contribution to the separation of job families. As shown by Figure 7, the six job families in the Technical Job Cluster differ widely on this attribute. Consequently, working outside was included in the linkage procedure.

Augmentation of referrals to two job clusters. After the 1994 edition of the OAP-occupation linkage procedure had been developed, counselee referral rates were determined for job families and job clusters. Referral rates for the Business Operations and Technical Clusters were substantially lower than for the other four clusters. Hence, education-related attributes were considered for their ability to refer counselees to these two job clusters. Student response distributions for OAs (based on the 1994 field study) were examined in conjunction with mean OA ratings for all 23 job families in order to identify relatively popular attributes that also

characterize the Business Operations and Technical Clusters. On this basis, two education-related attributes, short training time and 40-hour week, were included in the linkage procedure.

Summary of Bases for Selecting OAs for Linkage Procedure

Results of a principal components analysis and two discriminant analyses were reviewed, sequentially, to determine which of the OAs in the IWP were primarily education-related (i.e., did not differentiate occupations on a basis other than educational level). As shown by Table 9, seven OAs were found to be primarily education-related. Two of these OAs were included in the linkage procedure because they augmented counselee referral to the Business Operations and Technical Clusters. A third, high income, was included because of its high endorsement rate among counselees (see Table 6) and frequent appearance in other OAP instruments (see Table 1). The attribute, working outside (not education-related), was included because it helped to differentiate job families in the Technical Job Cluster.

Finally, 12 OAs were included in the OAP-occupation linkage procedure on the basis of discriminant analysis results and mean OA rating profiles showing that they appropriately (hence, validly) differentiated occupations grouped by job cluster. Table 13 summarizes the basis for selection of the 16 attributes used in the linkage procedure.

Procedure Used to Link OAPs to Occupational Suggestions

In a classic treatise on the use of tests, inventories, and other assessment procedures in counseling, Goldman (1971) pointed out that any interpretation of assessment results involves "bridging the gap" between scores and their real-world implications for the counselee. With respect to the IWP, this means linking OAPs to occupations having the attributes counselees prefer.

Overview of Linkage Procedures

The linkage procedure used since 1983 with DISCOVER's assessments of career-relevant interests, experiences, and abilities follows the discriminant (profile similarity) "bridge" described by Goldman (1971). Each of these assessments produces scores for ACT's six job clusters, which parallel Holland's (1985) six types of occupations. As described by Prediger and Swaney (1995), these scores are transformed into regions on ACT's World-of-Work Map (ACT, 1995b; Prediger, 1976; see Figure 1), and counselees are invited to explore job families and occupations in their map regions. However, the study reported here found substantial OA differences within job clusters and, hence, map regions. Because of these differences, a linkage procedure based on map regions was not feasible. A different procedure for linking OAPs to the World-of-Work Map, job families, and occupations was needed.

Typically, one of two procedures is used in computer-based links of OAPs to occupational options ("structured searches")—the sequential elimination model (SEM), sometimes called the elimination-by-aspects model, or the expected utility model (EUM), sometimes called the compensatory model. (Both are examples of Goldman's profile similarity bridge.) Lichtenberg, Shaffer, and Arachtingi (1993; also see Brown, 1990; Gati, 1986, 1990) describe these models in the context of decision-making, in general, and career decision-making, in particular. Lichtenberg et al. note that the EUM "is still considered the best available strategy for decision making; and it is generally held as a rational standard against which to compare alternative models" (p. 239). With the introduction of the IWP in September, 1994, the EUM replaced the SEM as the procedure used by DISCOVER to link OAPs to occupations. The World-of-Work Map linkage procedure, cited above, also uses a form of the EUM.

Starting with a review of DISCOVER's OA ratings, this section provides reasons for use of the EUM as DISCOVER's OAP-occupation linkage procedure. Principles guiding the linkage

procedure's development are described, along with how IWP responses are linked to job families on the World-of-Work Map (and hence, to occupations). The 16 OAs used in the linkage procedure (see Table 13) were selected on the basis of the research results reported in the previous section of this report.

Implications of Occupational Ratings for Choice of Linkage Procedure

As noted in the Variables section, the meaning of the same OA rating (e.g., *Yes*) can differ widely for a given attribute and from attribute to attribute; counselees are not aware of the occupational rating rules; and the IWP response scale counselees see is different from the OA rating scale. The procedure used to assess the degree of match between a counselee's OAPs and an occupation's attributes had to address these anomalies. Also, because the complexity of the rating rules made it difficult to obtain accurate ratings, the occupational linkage procedure had to minimize the impact of *individual* ratings on the job families suggested to counselees.

Implications for sequential elimination model. As noted above, two decision-making models are commonly used in the structured searches for occupational options—the SEM and the EUM. The SEM requires that an occupation be rated *Yes* (has attribute—perhaps at a specified level) or *No* (does not have attribute) for each attribute used in the search. A *Maybe* rating can not be used to accommodate uncertainty. The SEM eliminates occupations that do not "have" an attribute preferred by the counselee.

As the name implies, the SEM is applied sequentially to attributes in a structured search for occupational options. The first attribute selected by a counselee eliminates all occupations in the work world rated as not having the attribute. The second attribute is applied to the surviving occupations in order to eliminate those rated as not having the second attribute—and so on. Thus, occupations rated (on whatever basis) as not having each of the attributes selected

by the counselee are eliminated from the counselee's list. The counselee may never, otherwise, consider them.

Because inaccurate *No* ratings can eliminate suitable occupations from counselee consideration, the SEM places a premium on having accurate occupational ratings. The SEM also places a premium on (a) the counselee knowing what he/she wants from an occupation (e.g., project work); (b) the counselee's understanding of an attribute (e.g., financial challenge); and (c) the correspondence between the counselee's understanding and the occupational rater's understanding. Regarding limitations of the SEM, Lichtenberg et al. (1993) note that "an uncritical application may lead to poor decisions, since the model fails to ensure that the [occupational] alternatives that are retained along the process are, in fact, superior to the ones eliminated" (p. 250)—eliminated, perhaps, because of faulty *Yes-No* occupational ratings.

One apparent advantage of the SEM over the EUM is that the SEM introduces OAs one-at-a-time, according to a counselee's priorities. The OA ranking first in importance is introduced first, the OA ranking second in importance is introduced second, etc. However, the 1992 field study described above showed that counselees do not consistently prioritize OAs from time to time. Attribute rankings obtained about two weeks apart had a median intra-student correlation of .38. For 20% of the students, the correlation was negative. Thus, the occupations suggested to a counselee by the SEM may differ radically from week to week. For this reason, and because the SEM requires highly accurate OA ratings, its use as a procedure for "bridging the gap" is problematic, at best.

Implications for expected utility model. In contrast to the SEM, the EUM takes a "best fit" approach to a structured search for occupations. Rather than eliminate an occupation on the basis of an ambiguous *No* rating for a single OA, the EUM uses expected utilities—a combination of the value (degree of importance) a counselee places on an OA and the probability

of experiencing that OA in a given occupation—to determine the degree of fit between what an occupation "has" and what a counselee wants. Because occupational ratings and counselee preferences (wants) do not have absolute (retain or discard) implications for the occupations included in a structured search, the EUM accommodates imprecision in both. Thus, it appears to be appropriate to DISCOVER's occupational rating procedure and the IWP.

With the EUM, expected utilities are summed across all OAs used in an occupational search in order to obtain an overall utility ("degree-of-fit") score for each occupation. Occupations (or groups of occupations, if preferred) are then ranked on degree-of-fit, and counselees are referred to the highest ranking occupations (or occupational groups). The EUM is compensatory in that a good fit on one OA may compensate for a poor fit on another. Thus, it approximates compromises made in everyday life. Counselees not willing to compromise on a given OA can reject a deficient occupation during the process of occupational exploration, which the EUM encourages. The SEM rejects "deficient" occupations (however imprecisely rated) before the counselee sees them.

Linkage Procedure Guidelines

Principles guiding development of the linkage procedure used by DISCOVER are described below. The procedure was introduced in September, 1994. The OAs used by the procedure were revised in September, 1996, as a result of the analyses described in the previous section of this report.

1. *The EUM, not the SEM, should be used to link OAPs to occupations.* See the reasons noted above.

2. *Expected utilities must be determined a priori.* Ideally, applications of the EUM would insert into the standard expected utility formula (e.g., see Brown, 1990) a number representing the value (importance) of an OA for a given counselee and a number representing

the probability that an occupation will deliver the attribute at the level (e.g., amount of income, travel) preferred by the counselee. In fact, such specificity is not possible—even in computer-based applications. It may be possible for counselees to reliably assign numerical values (importance weights) to OAs, but it is not possible to obtain attribute probabilities for each of the occupations typically included in a structured search for occupational options (e.g., 497 in DISCOVER).

Although an ideal (textbook) application of the EUM is not possible, it is possible to use IWP importance responses as indicators of the value counselees place on experiencing OAs. Likewise, the *Yes*, *Maybe*, and *No* ratings for DISCOVER occupations can be used as general indicators of the probabilities that a worker in an occupation will experience the attribute. DISCOVER's job values linkage procedure uses these value and probability indicators to obtain expected utilities based on a counselee's OAPs.

Given the imprecise nature of the input data, expected utilities (reported in Table 14) were assigned, a priori. Because of their arbitrary nature, the expected utilities might best be thought of as *projected utilities*. They will be so named in the text that follows.

3. *Attributes used in the linkage procedure must meet reliability criteria appropriate to item responses*. As noted in the section describing the 1994 field study, 5 of the 30 attributes for which occupational ratings were available were eliminated on the basis of test-retest reliability data.

4. *Attributes used in the linkage procedure must differentiate among ACT job clusters and among ACT job families*. As described in the section on attribute differences across occupations, analyses conducted on occupational attribute ratings identified 16 attributes for use in the linkage procedure. These attributes (hereafter called *eligible attributes*) are listed in Table 13.

5. *Counselees must understand which of the 30 OAs are used in the linkage procedure.* The 16 eligible attributes are identified by DISCOVER after counselees complete the IWP. Counselees are then given an opportunity to change their preferences.

6. *The counselee's search list (the eligible attributes used in the structured search for occupations) must meet length criteria.* Counselees who respond either *Very Important* or *Somewhat Important* to fewer than six eligible attributes are encouraged to reconsider their preferences. (In a subsequent research report, reliability data relevant to this cut-off will be presented.) Conversely, counselees who respond either *Very Important* or *Somewhat Important* to more than a given number of OAs can be encouraged to reconsider their responses. (Currently, this screen is set at 16 OAs, the number of eligible attributes.)

7. *Projected utilities must take account of attributes that counselees do not want in a job.* Perhaps with the exception of high income, there will be OAs for which some counselees respond *Do Not Want* (e.g., physical activity, working outside, working separately). Hence, the linkage procedure assigns a projected utility to these attributes when an occupation has a *No* rating.

8. *The linkage procedure must refer counselees to groups (families) of occupations with similar work tasks, purpose of work, and work setting.* Because DISCOVER is often used by persons in the early stages of career planning or replanning, this guideline is especially important. Such persons can consider work fields that have easily understood work-world titles before moving to the level of specific occupations.

9. *The job families to which a counselee is referred must be part of an empirically based, comprehensive occupational classification system.* The ACT Occupational Classification System (ACT-OCS; ACT, 1995b; Prediger, 1976) used by DISCOVER encompasses all occupations in the *Dictionary of Occupational Titles* (DOT; U.S. DOL, 1991a). The discussion under Guideline 12 summarizes the empirical basis for the ACT-OCS and the World-of-Work Map, its visual

summary. Figure 11 arranges ACT-OCS job families by job clusters paralleling Holland's (1985) occupational types. Examples of occupations are provided for each job family.

10. *The job families to which a counselee is referred must have the highest overall projected utilities.* Projected utilities (see Guideline 2) for each eligible OA are summed in order to obtain an overall projected utility ("degree-of-fit") score for each occupation. The mean of the degree-of-fit scores for the occupations in a job family is used as the job family's degree-of-fit score. Job families are ranked on this score, and the top four job families are referred to counselees. This number of job families, which may change if future research so indicates, is similar to the number suggested on the basis of separate administrations of DISCOVER's interest, experience, and ability measures.

11. *Within the job families with the highest projected utilities, only the best fitting occupations should be suggested to counselees.* Occupations within ACT's job families tend to be homogenous with respect to basic work tasks, purpose, and setting (Guideline 8), but not necessarily with respect to OAs. As shown in the previous section of this report, the OA profiles of job families and profile differences across job families generally make good sense. But this does not preclude differences among occupations within a given job family. Thus, some occupations in the Management and Planning Job Family have occasional travel, high income, non-standard hours, and public contact. Others do not. The same diversity among occupations applies to the Engineering and Related Technologies Job Family, etc.

For the above reason, the linkage procedure includes a cut-off score for determining which of a job family's occupations to suggest to counselees. Occupations scoring below this cut-off are not suggested. Currently, the cut-off is defined as the average of the degree-of-fit scores for the fourth- and fifth-ranking job families. Thus, counselees typically see more than half of the occupations in a job family they choose to explore. (The exact proportion depends on the nature

of the job family's score distribution.) In addition, occupations are ranked by degree-of-fit. That is, occupations that best fit a counselee's attribute preferences are at the top of the list of suggestions.

12. *The procedure for identifying occupational options must be easily understood.* The World-of-Work Map (Figure 1) provides the means for reporting the job families that best fit a counselee's OAPs. A counselee's top four job families are highlighted on the map and, in addition, they are listed in rank order. As noted above, DISCOVER uses the World-of-Work Map to help counselees consider, separately, their work-relevant interests, experiences, and abilities—and to determine personally relevant career options. Because map regions indicate the basic work task orientation of a counselee's assessment results, counselees can relate their results to everyday interactions with data, ideas, people, and things.

Holland's (1985) hexagonal arrangement of occupational types and the underlying Data/Ideas and Things/People Work Task Dimensions form the core of the World-of-Work Map. Holland's types and ACT job clusters appear on the periphery. Arrows indicate that the job clusters blend together, in contrast to existing as precise points (R, I, A, S, E, C). Job family map locations are based on the interests of workers (determined from the Holland-type interest profiles for 991 career groups) and their work tasks (determined from U.S. DOL job-analysis ratings for DOT occupations). Purpose of work and work setting were also considered (see Guideline 8). Specifics on World-of-Work Map development have been reported by Prediger (1976) and ACT (1995b). Prediger (1996) recently provided an overview of published research (11 journal articles) supporting the work task dimensions underlying Holland's hexagon.

Overview of Linkage Procedure

Counselee responses of *Very Important*, *Somewhat Important*, or *Don't Want* to the 16 eligible attributes determine the counselee's search list. An occupational search is not conducted

for counselees failing to meet the minimum and maximum criteria specified in Guideline 6. (Counselees have an opportunity to revise their IWP responses until the minimum-maximum criteria are met.) The counselee's preference for each attribute on the search list is compared with an occupation's rating (*Yes*, *Maybe*, *No*) for the attribute, and a projected utility is assigned as per Guideline 2 (see Table 14). As per Guideline 10, projected utilities are summed across all attributes on the counselee's search list in order to obtain a degree-of-fit score for the occupation. After degree-of-fit scores have been obtained for all DISCOVER occupations, mean scores are obtained for the occupations in each of DISCOVER's 23 job families. Job families are ranked on these scores and the top four job families are referred to the counselee.

Counselees wishing to explore job families that best fit their OAPs can request to see a list of occupations in one or more of the four job families. As per Guideline 11, only the best fitting occupations appear on the counselee's list. Counselees can obtain an extensive description of any occupation on their list via DISCOVER's occupational information data base. Thus, they can see how well an occupation meets their expectations. (DISCOVER also suggests other means of vicarious and first-hand occupational exploration.) Finally, on the basis of their OAPs (and career-relevant interests, experiences, and/or abilities—if they prefer), counselees are able to prepare a short list of occupations for further exploration.

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Appendix

Inventory of Work Preferences

Please rate each of thirty (30) characteristics common in work using the four ratings in the box below. Read the definition of each characteristic carefully. Then mark one of the four choices on the maroon answer sheet. Erase completely any ratings you change.

A = This characteristic is **very important** to me. I really want this characteristic in my work.
B = This characteristic is **somewhat important** to me. I hope to have this characteristic in my work.
C = This characteristic is **not important** to me. I don't care if my work has this characteristic or not.
D = I **don't want** this characteristic in my work. I want to avoid work that has this characteristic.

1. **Making or Fixing Things** -- Using your hands and/or tools to make or fix things; producing or repairing objects that you can see and touch.

2. **Project Work** -- Working on tasks that last for a week or more and have a definite end; when a project ends, you can think about the results of your work and move on to new projects.

3. **Immediate Response** -- Working where people (other than your manager) see and/or hear you while you work. If they like your work, they may clap or give you tips or compliments.

4. **Certification** -- Working in an occupation in which a license, credential, or degree certifies that you are competent to do the work and is usually needed to get a job.

5. **Management** -- Choosing a job in which you direct others in their work and make sure their work gets done correctly.

6. **Authority** -- Being responsible for telling people (who are not employees) what to do; preventing people from doing things they should not do.

7. **Influencing Others** -- Convincing or advising people to do the things you believe they should do, when you have no authority over them.

8. **Financial Challenge** -- Making decisions or advising others about money. These decisions could produce big payoffs, or could lose money for yourself, clients, or the organization you work for.

9. **Physical Activity** -- Moving around and getting exercise in your work, by walking, dancing, lifting, etc.

10. **Occasional Travel** -- Doing work that requires traveling to another community at least four times a year.

11. **Routine Travel** -- Doing work that requires leaving your usual place of work and traveling around, either within the community or to distant places, once a week or more.

12. **New Ideas** -- Developing new methods of doing things. Putting together ideas or concepts that have not been put together before.

13. **Problem Solving** -- Spending most of your time figuring out how to fix things or deciding the best way to get things done.

14. **High Income** -- Choosing an occupation in which you could expect to earn more than 75% of the people who work in the United States. (In 1994, this meant $23,000 starting and $30,000 with experience.)

15. **Occupational Opportunity** -- Working in a field in which it is relatively easy to find a job (after you have learned to do the work). This means fewer people choose to work in this field than are needed to fill the openings.

16. **Safety** -- Working in an environment which is unlikely to cause injury or illness. This means you will not work near fast moving machinery, dangerous chemicals, high places you could fall from, etc.

17. **Working in an Office** -- Working in an office most of the time.

18. **Working Inside** -- Working inside or sheltered from the weather, but not in an office.

A = This characteristic is **very important** to me. I really want this characteristic in my work.
B = This characteristic is **somewhat important** to me. I hope to have this characteristic in my work.
C = This characteristic is **not important** to me. I don't care if my work has this characteristic or not.
D = I **don't want** this characteristic in my work. I want to avoid work that has this characteristic.

19. **Working partially inside and partially outside** -- Working inside part of the time and outside part of the time.

20. **Working outside** -- Working outside, exposed to the weather, most of the time.

21. **Easy Reentry** -- Being able to move from one place to another or to stop working and raise a family, then to find a new job reasonably quickly, with no more than a few months of retraining.

22. **Short Training Time** -- Being able to start working with no training after high school or no more than 6 months' training.

23. **Non-Standard Hours** -- Being able to easily find jobs which are seasonal, temporary, part time, or available in different shifts.

24. **40-Hour Week** -- Being able to limit your work to not more than 40 hours a week; not being expected to work overtime or take work home.

25. **Creating order** -- Doing work in which you put things in order for others. Using a system or rules to organize, schedule, or arrange things or events.

26. **Defined Tasks** -- Doing work in which there are rules for the way things are done, so you do not need to face unexpected situations. If something unusual happens, you can ask someone else what to do.

27. **Precision** -- Doing work that uses exact standards, either by measuring very carefully or following procedures very carefully.

28. **Public Contact** -- Doing work that requires you to talk to or be seen by people who are not co-workers much of the time. You may talk to many different people in a day.

29. **Working with Co-Workers** -- Doing work that requires you to talk to or work with co-workers much of the time.

30. **Working Separately** -- Doing work that does not require you to talk to others very often. Spending much of your work time not talking to anyone.

TABLE 1

Occupational Attributes Supported by Research and Practice

Recommended by Vansickle and Prediger (1991)	Rationale[a]	Occupational attributes (OAs) in six established instruments					
		WAPS[b]	MIQ[c]	VS[d]	SIGI PLUS[e]	CDM-R[f]	ASVAB-CEP[g]
Attributes in Inventory of Work Preferences							
Authority	1 2 3 5 6 8 9	Management	Authority	Authority	Leadership	Leadership	--
Creativity	1 2 3 4 5 6 7 8 9	Creativity	Creativity	Creativity	--	Creativity	Creativity
Earnings	1 3 4 5 8 9	Money	Compensation	Economic rewards	High income	Good salary	Income
Flexible schedule	8	--	--	--	Flexible hours	--	--
Influencing others	8	--	--	--	--	--	--
Physical activity	1 3 4 5 8 9	Physical activity	Activity	Physical activity Physical prowess	--	Physical activity	Little/Challenging physical activity
Public contact	5 8	--	--	Social interaction	--	--	Public contact
Travel	8	--	--	--	--	--	--
Work setting	1 2 3 5 6 8 9	Surroundings	Working conditions	Working conditions	--	Outdoor work	Outdoor work
Attributes not in Inventory of Work Preferences							
Helping others	1 2 3 4 5 6 7 8 9	Altruism	Social service	Altruism	Contribution to society	Working with people	Helping others
Independence	1 2 3 4 5 6 7 8 9	Independence	Responsibility	Autonomy	Independence	Independence	Independence
Job security[h]	1 2 3 5 8 9	Security	Security	Economic security	Security	Job security	Security
Prestige	1 2 3 5 6 7 8 9	Prestige	Social status	Prestige	Prestige	Prestige	Prestige
Variety	1 5 6 8 9		Variety	Variety	Variety	Variety	Variety

[a]Rationale refers to the numbered statements in Table 2. [b]Work Aspect Preference Scale (Pryor, 1987). [c]Minnesota Importance Questionnaire Needs Scales (Rounds, Henly, Dawis, Lofquist, & Weiss, 1981). [d]Values Scale (Nevill & Super, 1986). [e]The OA component of the System of Interactive Guidance and Information PLUS (Educational Testing Service, 1990). [f]The OA component of the Career Decision-Making System—Revised (Harrington & O'Shea, 1993). [g]The OA component of the Armed Services Vocational Aptitude Battery Career Exploration Program (U.S. Department of Defense, 1994). [h]Job security sometimes subsumes job opportunities, which was separately recommended by Vansickle and Prediger (1991) because it is often considered separately in career exploration.

TABLE 2

Rationale for Attributes Listed in Table 1

OAP dimensions based on factor analysis[a]

1. These attributes differentiated people on at least one of three factors, as indicated by factor loadings (Lofquist & Dawis, 1978) of .40 or higher.
2. These attributes differentiated people on at least one of eight factors obtained in an analysis of eight similar scales in four OAP inventories (Macnab & Fitzsimmons, 1987). Factor loadings "were generally high" (p. 13).
3. These attributes differentiated people on at least one of three factors (Pryor, 1987), as indicated by factor loadings of .40 or higher.
4. These attributes differentiated people on at least one of ten factors (Crace & Brown, 1995). Factor loadings were not reported.
5. These attributes differentiated people on at least one of six factors (Šverko, 1995), as indicated by factor loadings of .40 or higher.

OA dimensions based on factor analysis

6. These attributes differentiated occupations on at least one of three factors (Shubsachs et al., 1978), as indicated by factor loadings of .40 or higher. (Also see Vansickle & Prediger, 1991).

OAs differentiating Holland types

7. These attributes differentiated occupations grouped by Holland type (Rounds et al., 1978).
8. These attributes differentiated occupations grouped by Holland type and ACT job family (Vansickle & Prediger, 1991).

Commonly used OAs

9. These attributes are included in at least five of the six OAP inventories listed in Table 1.

Note. These rationale statements are indexed to the recommended attributes listed in Table 1. OAP = occupational attribute preference; OA = occupational attribute.
[a]The Crace and Brown (1995) and Nevill and Super (1986) studies are not listed because the factor analyses were based on items. Regarding Nevill-Super Values Scale scores, see Šverko (1995)—Item 5.

TABLE 3

School, Testing Interval, and Sample Size for the 1994 Field Study

School	Type of community	Test-retest interval	% of students participating	Initial sample size	Sample size[a]
			Grade 9		
1	Urban	7-10 days	70[b]	403	374
2	Suburban	9 days	85	256	238
3	Rural	21-24 days	78	65	64
Total				724	676
			Grade 12		
4	Urban	10 days	75[b]	210	204
5	Suburban	7 days	100	95	90
Total				305	294

[a]Number of students with test and/or retest records (see text). [b]Counselors in the two urban schools did not administer the Inventory of Work Preferences in English classes designated as English as a Second Language.

TABLE 4

Selected Characteristics of Grade 9 and Grade 12 Samples

Variable	Grade 9[a]	Grade 12[b]
Sex		
Males	48%	37%
Females	50	47
Did not respond[c]	2	15
Racial/Ethnic		
Afro-American/Black	1	15
American Indian, Alaskan Native	0	1
Caucasian American/White	26	20
Mexican-American/Chicano	44	35
Asian-American, Pacific Islander	6	2
Puerto Rican, Cuban, other Hispanic origin	4	3
Other	5	0
I prefer not to respond	8	3
Did not respond[c]	5	21

[a]$N = 676$ [b]$N = 294$ [c]Demographic information is not available for students who were not present for the second administration.

TABLE 5

Distributions of Inventory of Work Preferences Item Responses for Grades 9 and 12

Response category	Inventory of Work Preferences items																								
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	17	19	20	21	22	23	24	25	27	28	30
												Grade 9 (N = 665-676)													
Very Important	23	16	21	43	33	26	20	12	38	34	24	26	20	56	21	27	13	28	16	17	21	15	17	32	9
Somewhat Important	37	42	32	32	40	36	35	25	31	36	30	37	32	28	31	42	27	33	33	31	33	39	31	34	20
Not Important	24	29	30	20	21	25	31	32	23	21	27	27	31	12	25	24	37	27	30	33	36	31	36	25	33
Don't Want	16	13	16	5	6	13	14	30	8	10	19	9	16	3	23	7	24	12	22	20	9	15	16	9	37
Level of skewness[a]				H	M				H	M				H		M								M	
												Grade 12 (N = 221-228)													
Very Important	25	35	28	56	37	30	25	12	34	31	23	37	26	60	26	25	8	40	15	16	21	16	22	33	9
Somewhat Important	37	39	32	30	39	33	39	26	35	38	29	36	39	31	35	35	20	31	35	30	37	35	37	36	21
Not Important	27	19	27	13	19	28	26	33	24	21	27	22	25	15	25	31	39	22	27	28	30	38	32	20	29
Don't Want	12	7	13	1	4	9	10	29	7	10	21	4	11	4	14	9	33	7	24	25	12	12	9	10	41
Level of skewness[a]		H		H	H				M	M		H		H			M	H						M	H

Note. Response distribution values are from the first administration and are expressed as proportions (decimal point omitted). Attributes corresponding to Inventory of Work Preferences item numbers are shown in Table 6. Results for low reliability items (15, 16, 18, 26, and 29) are not reported.

[a]H = high; M = moderate (see text).

TABLE 6

Test-Retest Reliabilities for Grades 9 and 12

Inventory of Work Preferences items	Reliability		
	Grade 9[a]	Grade 12[b]	Average
1. Making or Fixing Things	.70	.75	.72
2. Project Work	.54	.57	.56
3. Immediate Response	.53	.58	.56
4. Certification	.57	.57	.57
5. Management	.53	.60	.56
6. Authority	.51	.57	.54
7. Influencing Others	.52	.46	.49
8. Financial Challenge	.55	.69	.62
9. Physical Activity	.64	.68	.66
10. Occasional Travel	.61	.60	.60
11. Routine Travel	.67	.69	.68
12. New Ideas	.55	.60	.58
13. Problem Solving	.56	.55	.56
14. High Income	.63	.56	.60
15. Occupational Opportunity[c]	.42	.37	.40
16. Safety[c]	.48	.32	.40
17. Working in an Office	.72	.69	.70
18. Working Inside[c]	.47	.43	.45
19. Working Inside & Outside	.51	.61	.56
20. Working Outside	.62	.72	.67
21. Easy Reentry	.52	.58	.55
22. Short Training Time	.58	.69	.64
23. Non-Standard Hours	.52	.56	.54
24. 40-Hour Week	.52	.46	.49
25. Creating Order	.53	.48	.50
26. Defined Tasks[c]	.42	.43	.42
27. Precision	.54	.54	.54
28. Public Contact	.53	.48	.50
29. Working with Co-Workers[c]	.44	.45	.44
30. Working Separately	.53	.50	.52

[a]N = 635-675. [b]N = 188-193. [c]Inventory of Work Preferences items not meeting the .46 cutoff.

TABLE 7

Distribution of DISCOVER Occupations by Job Cluster (Holland Type), Job Family, and Educational Level

Job cluster (Holland type) and job family	N	Educational level[a] 1	2	3
Business Contact (Enterprising)	65	9	23	33
A. Marketing and Sales	18	8	7	3
B. Management and Planning	47	1	16	30
Business Operations (Conventional)	62	42	10	10
C. Records and Communications	23	16	7	0
D. Financial Transactions	19	8	2	9
E. Storage and Dispatching	11	10	0	1
F. Business Machine/Computer Operations	9	8	1	0
Technical (Realistic)	124	95	25	4
G. Vehicle Operations and Repair	21	12	7	2
H. Construction and Maintenance	27	23	3	1
I. Agriculture and Natural Resources	11	7	3	1
J. Crafts and Related Services	13	11	2	0
K. Home/Business Equipment Repair	9	6	3	0
L. Industrial Equipment Operation and Repair	43	36	7	0
Science (Investigative)	111	11	36	64
M. Engineering and Other Applied Technologies	53	6	23	24
N. Medical Specialties and Technologies	26	5	13	8
O. Natural Sciences and Mathematics	26	0	0	26
P. Social Sciences	6	0	0	6
Arts (Artistic)	44	6	14	24
Q. Applied Arts (Visual)	15	4	8	3
R. Creative/Performing Arts	9	1	4	4
S. Applied Arts (Written and Spoken)	20	1	2	17
Social Service (Social)	91	28	16	47
T. General Health Care	27	4	5	18
U. Education and Related Services	19	2	1	16
V. Social and Government Services	25	7	5	13
W. Personal/Customer Services	20	15	5	0
Total	497	191	124	182

[a]Education levels are as follows: 1 = on-the-job training, apprenticeship, and technical/trade; 2 = 2-year college degree; 3 = 4-year college degree and graduate degree.

TABLE 8

Corrrelations of Occupational Attributes with the First Four Principal Components

Occupational attribute	Correlation with component			
	Educational Level	Working with People	Outside Work Setting	Inside Work Setting
Inventory of Work Preferences				
Making things	-.42	-.46	.19	.24
Project work	.76	-.21	.04	-.04
Immediate response	.11	.76	.34	.06
Certification	.60	-.01	.28	.36
Management	.77	.04	.06	-.05
Authority	.22	.43	.42	.00
Influencing others	.80	.34	.12	.01
Financial challenge	.77	.11	-.08	-.16
Physical activity	-.54	-.23	.58	.05
Occasional travel	.87	.07	.06	-.02
Routine travel	.01	-.29	.50	-.40
New ideas	.79	-.03	.08	.10
Problem solving	.66	-.19	.14	.12
High income	.71	-.18	.08	.15
Occupational opportunity	-.19	.36	.11	.46
Safety	.34	.35	-.63	-.10
Working in an office	.52	.04	-.65	-.25
Working inside	-.26	.12	.27	.62
Working inside & outside	-.04	-.25	.51	-.32
Working outside	-.24	-.34	.47	-.44
Easy reentry	-.29	.34	.05	.43
Short training time	-.70	.33	-.17	-.22
Non-standard hours	-.42	.31	.36	-.02
40-hour week	-.82	-.01	-.17	.13
Creating order	-.31	.53	-.18	-.07
Defined tasks	-.78	.17	-.21	-.03
Precision	-.23	-.39	-.06	.43
Public contact	.27	.75	.31	-.04
Working with co-workers	.27	-.14	.11	-.31
Working separately	-.18	-.67	-.31	.29
Marker attribute				
Educational level	.89	-.02	.03	.07
GED[a] Reasoning	.82	-.15	-.01	.23
General Learning Ability	.82	-.15	-.03	.18

Note. N = 497 occupations.
[a]GED = General Educational Development.

TABLE 9

Identification of Education-related Occupational Attributes

Occupational attribute (OA)	Candidates for education-related attributes: Principal components analysis	First discriminant analysis[a]	Second discriminant analysis[b]	Final education-related attributes
Making things				
Project work	X	X	X	X
Immediate response				
Certification	X	X		
Management	X	X	X	X
Authority				
Influencing others	X	X		
Financial challenge	X	X		
Physical activity				
Occasional travel	X	X	X	X
Routine travel				
New ideas	X	X	X	X
Problem solving	X			
High income	X	X	X	X[d]
Occupational opportunity				
Safety				
Working in an office				
Working inside				
Working inside & outside				
Working outside				
Easy reentry				
Short training time	X	X	X	X[d]
Non-standard hours				
40-hour week	X	X	X	X[d]
Creating order				
Defined tasks	X	X	c	
Precision				
Public contact				
Working with co-workers				
Working separately				

[a]Discriminant analysis of occupations grouped by educational level. [b]Discriminant analysis of occupations grouped by job clusters equated on educational level. [c]OA not included in analysis due to low reliability, as determined in 1994 field study. [d]Used in linkage procedure because of special considerations noted in text.

TABLE 10

Differentiation of Occupations Grouped by Educational Level

Occupational attribute	Correlation with discriminant function[a] 1st	2nd
Inventory of Work Preferences		
Making things	-.42	-.07
Project work	.75	-.16
Immediate response	.09	-.01
Certification	.62	-.08
Management	.71	.18
Authority	.23	.21
Influencing others	.77	-.09
Financial challenge	.69	.10
Physical activity	-.47	.14
Occasional travel	.86	.13
Routine travel	.00	.04
New ideas	.79	.16
Problem solving	.58	-.21
High income	.67	.07
Occupational opportunity	-.14	-.15
Safety	.25	-.07
Working in an office	.46	.04
Working inside	-.25	-.24
Working inside & outside	.01	.01
Working outside	-.20	.24
Easy reentry	-.25	-.23
Short training time	-.67	.33
Non-standard hours	-.40	-.05
40-hour week	-.79	-.11
Creating order	-.25	.20
Defined tasks	-.71	.14
Precision	-.11	.08
Public contact	.25	.02
Working with co-workers	.22	-.02
Working separately	-.13	.08
Marker attribute		
GED[b] Reasoning	.85	-.21
General Learning Ability	.85	-.12

Note. N = 497 occupations. Wilks' lambda = .18.
[a]Among group variance for two functions = 94% and 6%. [b]GED = General Educational Development.

TABLE 11

Differentiation of Occupations Grouped by Job Clusters Equated on Educational Level

Occupational attribute	*F*-to-remove rank[b]	Correlation with the first two discriminant functions[a]	
		1st	2nd
Inventory of Work Preferences			
Making things	3	.60	-.03
Project work	24	-.16	.03
Immediate response	18	-.30	.48
Certification	6	.09	.42
Management	14	-.21	.04
Authority	8	.00	.48
Influencing others	2	-.61	.28
Financial challenge	7	-.40	-.27
Physical activity	5	.51	.30
Occasional travel	12	-.28	.14
Routine travel	9	.25	-.34
New ideas	10	-.09	.28
Problem solving	13	-.07	-.14
High income	23	-.05	.00
Working in an office	26	-.42	-.34
Working inside & outside	19	.18	-.14
Working outside	25	.37	-.12
Easy reentry	15	-.09	.01
Short training time	17	-.16	-.06
Non-standard hours	21	.07	.15
40-hour week	11	.16	-.09
Creating order	1	-.38	.20
Precision	4	.48	.11
Public contact	19	-.46	.42
Working separately	16	.39	-.24
Marker attribute			
Educational level	22	-.09	.08

Note. $N = 180$ occupations equally distributed among the six job clusters. Wilks' lambda = .01.

[a]Among group variance for five functions: 36%, 22%, 20%, 11%, and 10%.

[b]Rank of unique contribution to variance (1 = highest)

TABLE 12

Differentiation of Occupations Grouped by Job Clusters

Occupational attribute	*F*-to-remove rank[b]	Correlation with the first three discriminant functions[a]		
		1st	2nd	3rd
Making things	4	.65	-.29	.04
Immediate response	11	-.51	-.03	.36
Certification	9	-.17	-.26	.46
Authority	6	-.36	.04	.42
Influencing others	1	-.75	-.47	.15
Financial challenge	5	-.50	-.32	-.38
Physical activity	7	.51	-.05	.39
Routine travel	10	.18	-.27	-.19
Problem solving	14	-.19	-.28	-.10
High income[c]	21	-.17	-.38	.02
Working in an office	20	-.37	.10	-.48
Working inside & outside	17	.11	-.08	-.03
Working outside	19	.38	-.06	.11
Easy reentry	13	.01	.21	.16
Short training time[c]	16	.12	.58	-.12
Non-standard hours	15	.11	.13	.17
40-hour week[c]	12	.40	.54	-.01
Creating order	2	-.21	.84	.13
Precision	3	.50	.43	.38
Public contact	18	-.65	-.01	.25
Working separately	8	.59	.06	-.01

Note. $N = 497$ occupations. Wilks' lambda = .02.
[a]Among group variance for five functions: 36%, 26%, 18%, 14%, and 7%.
[b]Rank of unique contribution to variance (1 = highest). [c]Education-related attribute used in linkage procedure because of special considerations noted in text.

TABLE 13

Occupational Attributes Used in the Linkage Procedure

Occupational attribute	Used in linkage procedure	Basis for selection	
		Third discriminant analysis[a]	Other[b]
Making things	X	X	
Immediate response	X	X	
Certification	X	X	
Authority	X	X	
Influencing others	X	X	
Financial challenge	X	X	
Physical activity	X	X	
Routine travel			
Problem solving			
High income	X		X
Working in an office	X	X	
Working inside & outside			
Working outside	X		X
Easy reentry			
Short training time	X		X
Non-standard hours			
40-hour week	X		X
Creating order	X	X	
Precision	X	X	
Public contact	X	X	
Working separately	X	X	

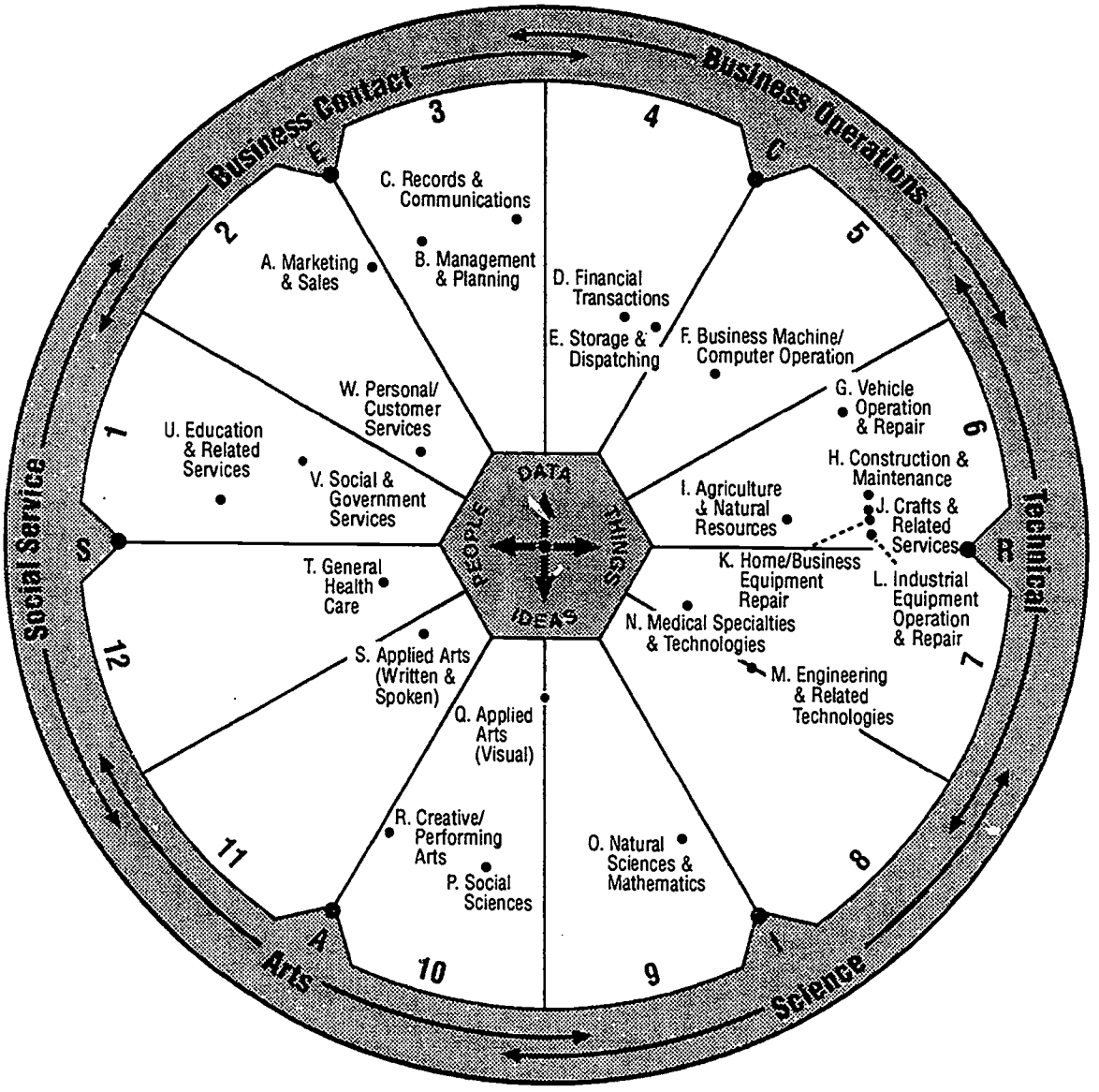
[a]Non-education-related occupational attributes differentiating job clusters. [b]Used in linkage procedure because of special considerations noted in text.

TABLE 14

Expected Utilities (Degree-of-Fit Scores) for Combinations of Occupational Attribute Ratings and Counselee Preferences

Counselee IWP[a] response (attribute preference)	Attribute rating for occupation		
	No	Maybe	Yes
Very important	0	2	4
Somewhat important	0	1	2
Not important	0	0	0
Don't want	4	0	0

[a]Inventory of Work Preferences.



ABOUT THE MAP

- The World-of-Work Map arranges job families (groups of similar jobs) into 12 regions. Together, the job families cover nearly all U.S. jobs. Although the jobs in a family differ in their locations, most are located near the points shown.
- A job family's location is based on its primary work tasks. The four primary work tasks are working with—
  - DATA: Facts, numbers, files, accounts, business procedures.
  - IDEAS: Insights, theories, new ways of saying or doing something—for example, with words, equations, or music.
  - PEOPLE: People you help, serve, inform, care for, or sell things to.
  - THINGS: Machines, tools, living things, and materials such as food, wood, or metal.
- Six general areas of the work world and related Holland types are indicated around the edge of the map. Job Family Charts (available from ACT) list over 500 occupations by general area, job family, and preparation level. They cover more than 95% of the labor force.

Figure 1. World-of-Work Map

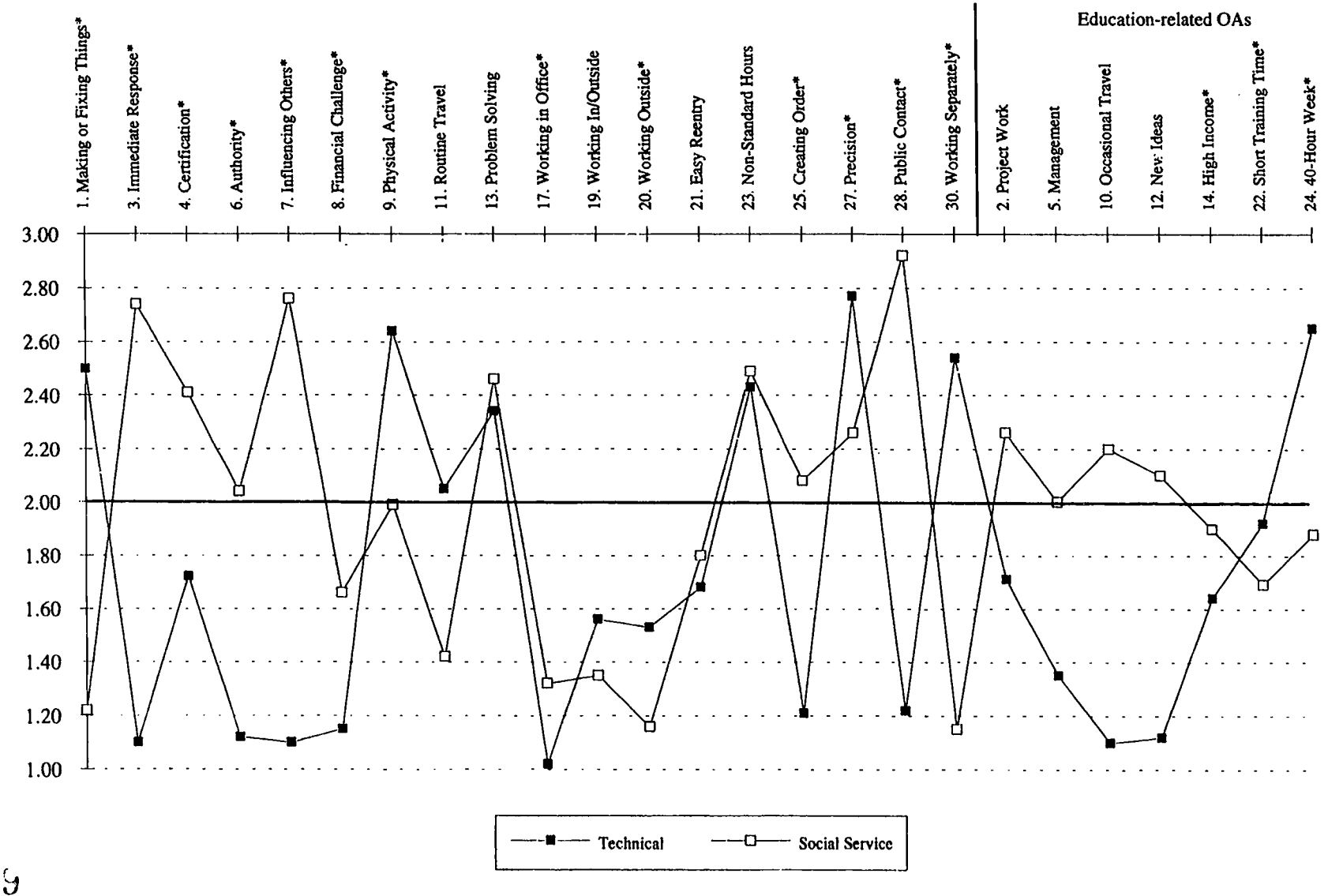


Figure 2. Profiles of mean occupational attribute (OA) ratings for the Technical and Social Service Job Clusters. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

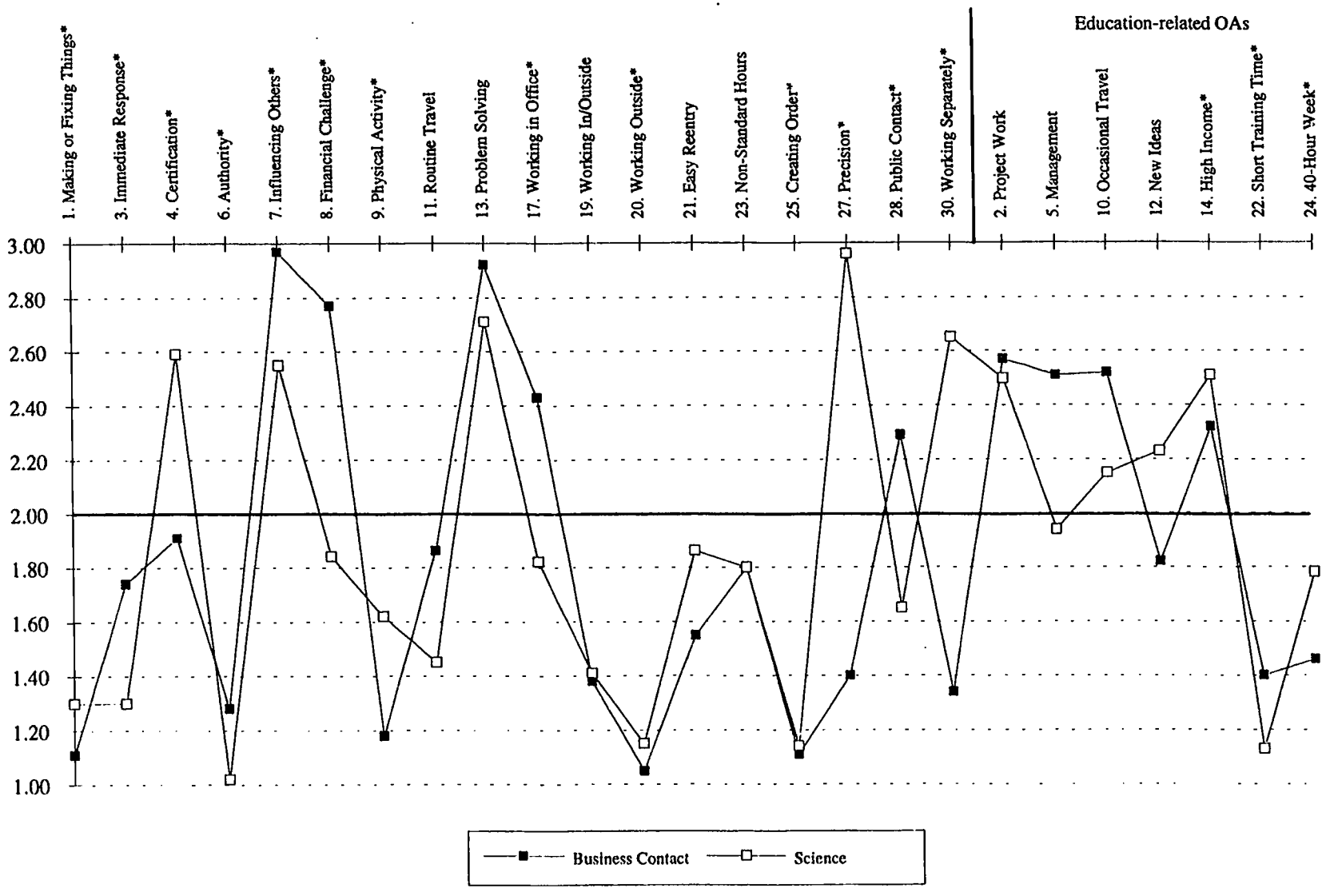


Figure 3. Profiles of mean occupational attribute (OA) ratings for the Business Contact and Science Job Clusters. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

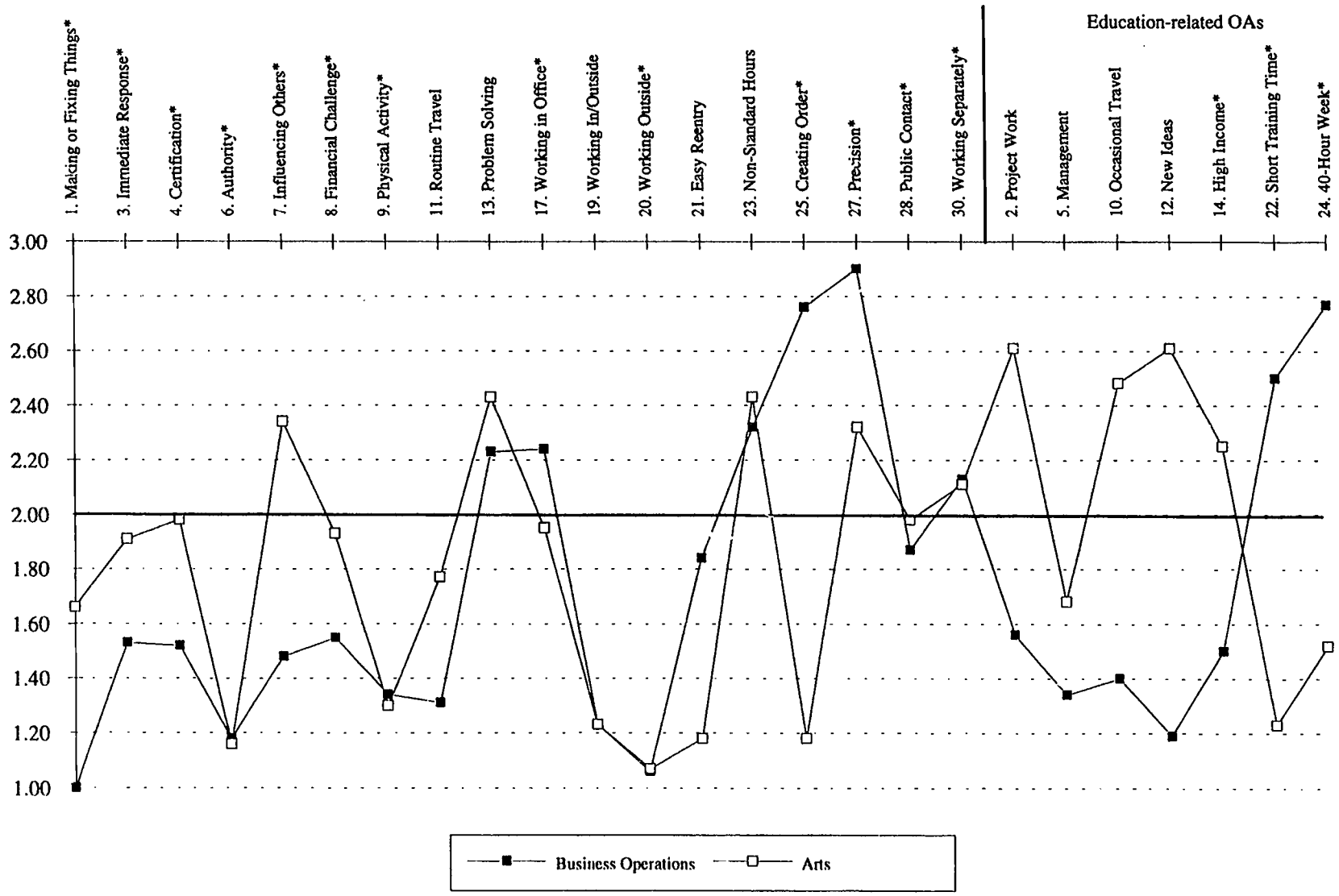


Figure 4. Profiles of mean occupational attribute (OA) ratings for the Business Operations and Arts Job Clusters.
* = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

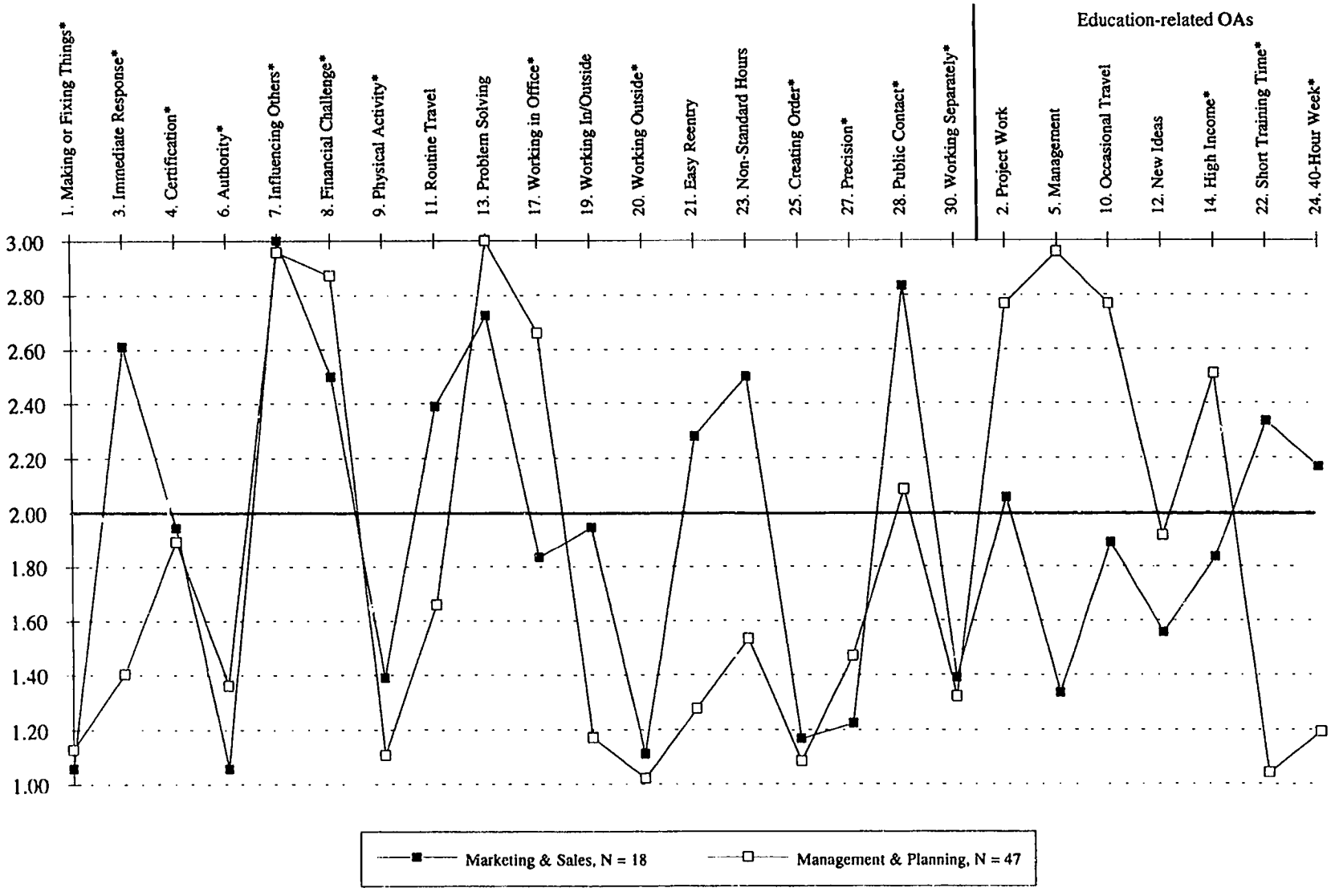


Figure 5. Profiles of mean occupational attribute (OA) ratings for job families in the Business Contact (Enterprising) Job Cluster. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

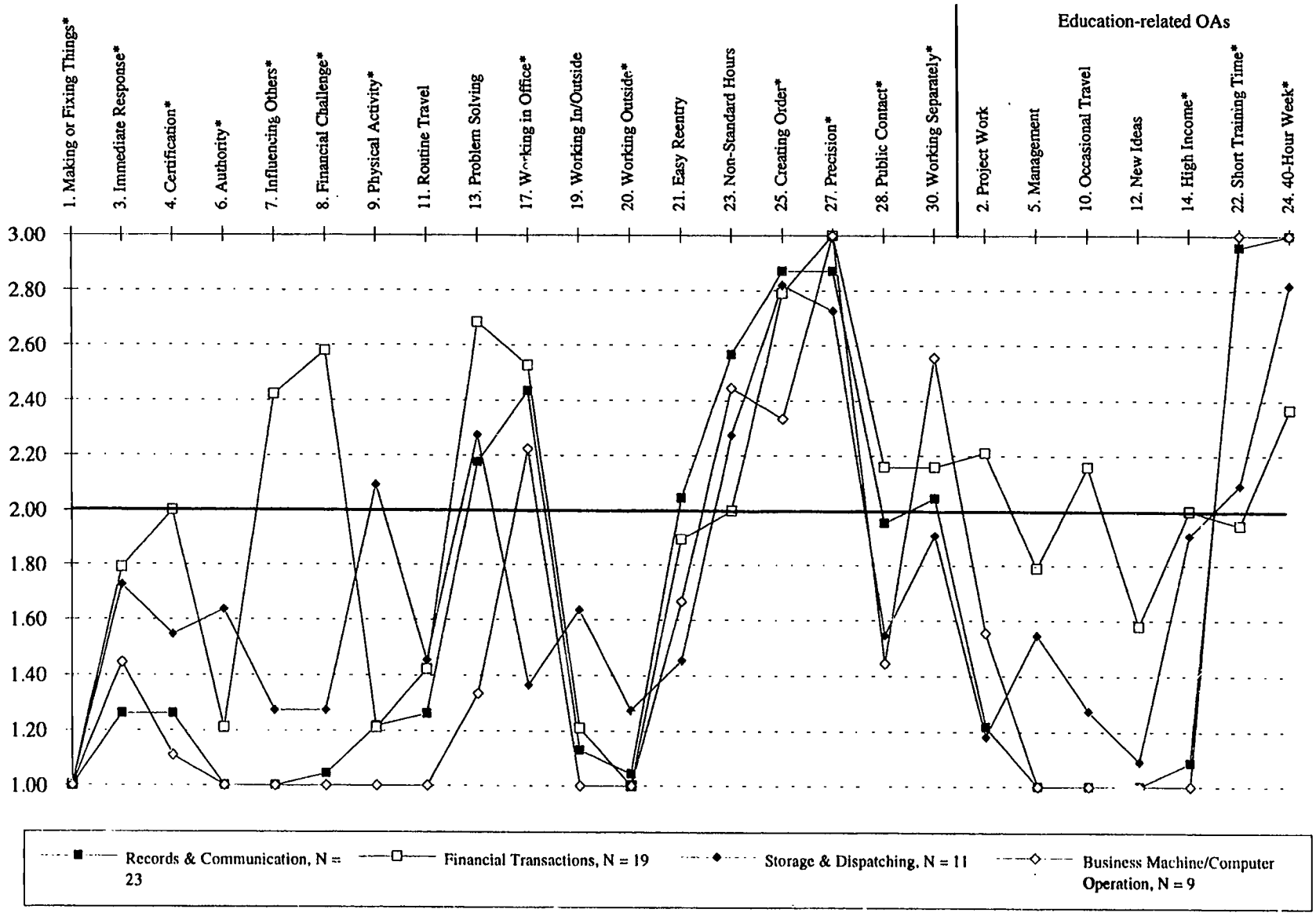


Figure 6. Profiles of mean occupational attribute (OA) ratings for job families in the Business Operations (Conventional) Job Cluster. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

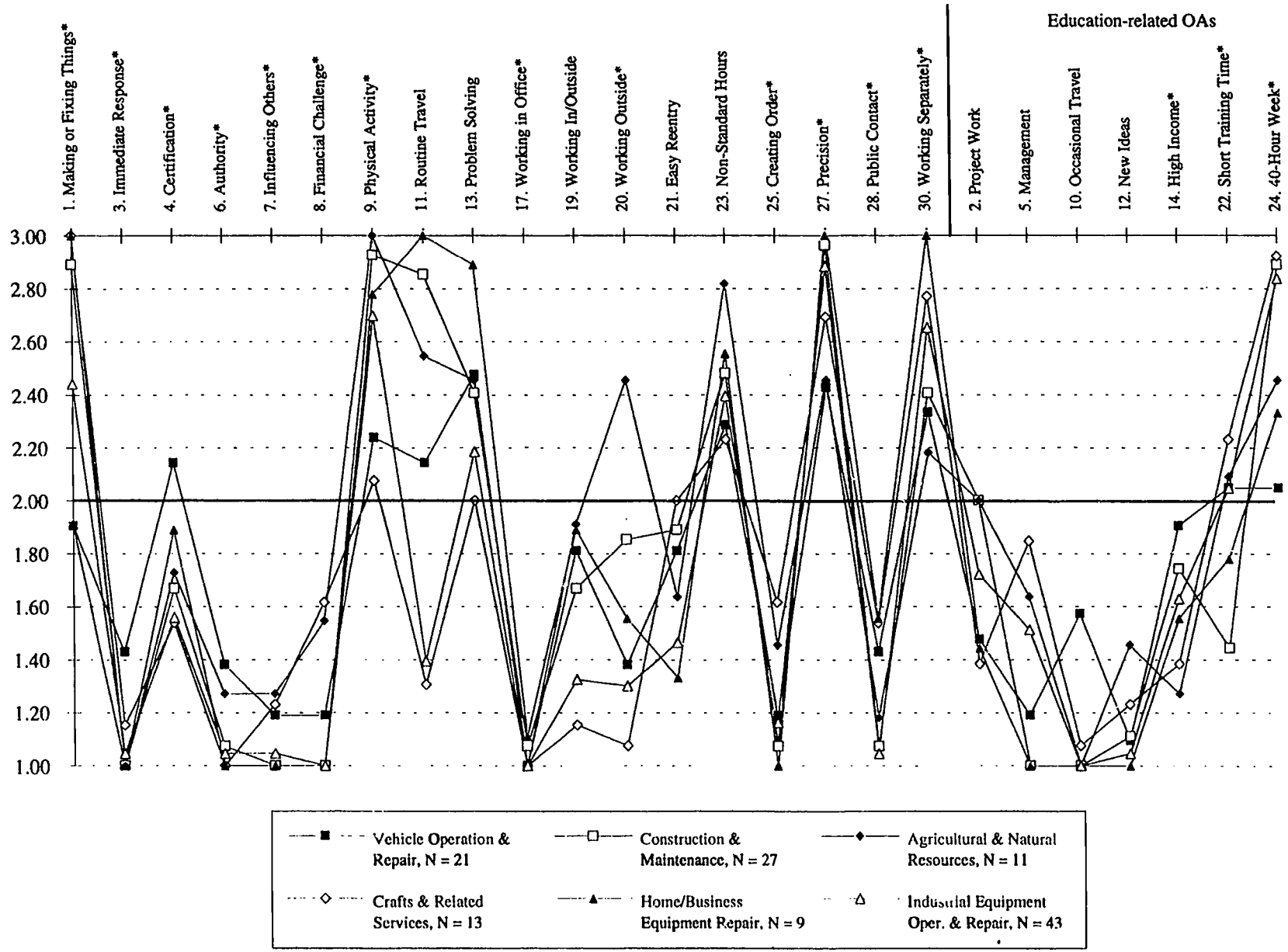


Figure 7. Profiles of mean occupational attribute (OA) ratings for job families in the Technical (Realistic) Job Cluster. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

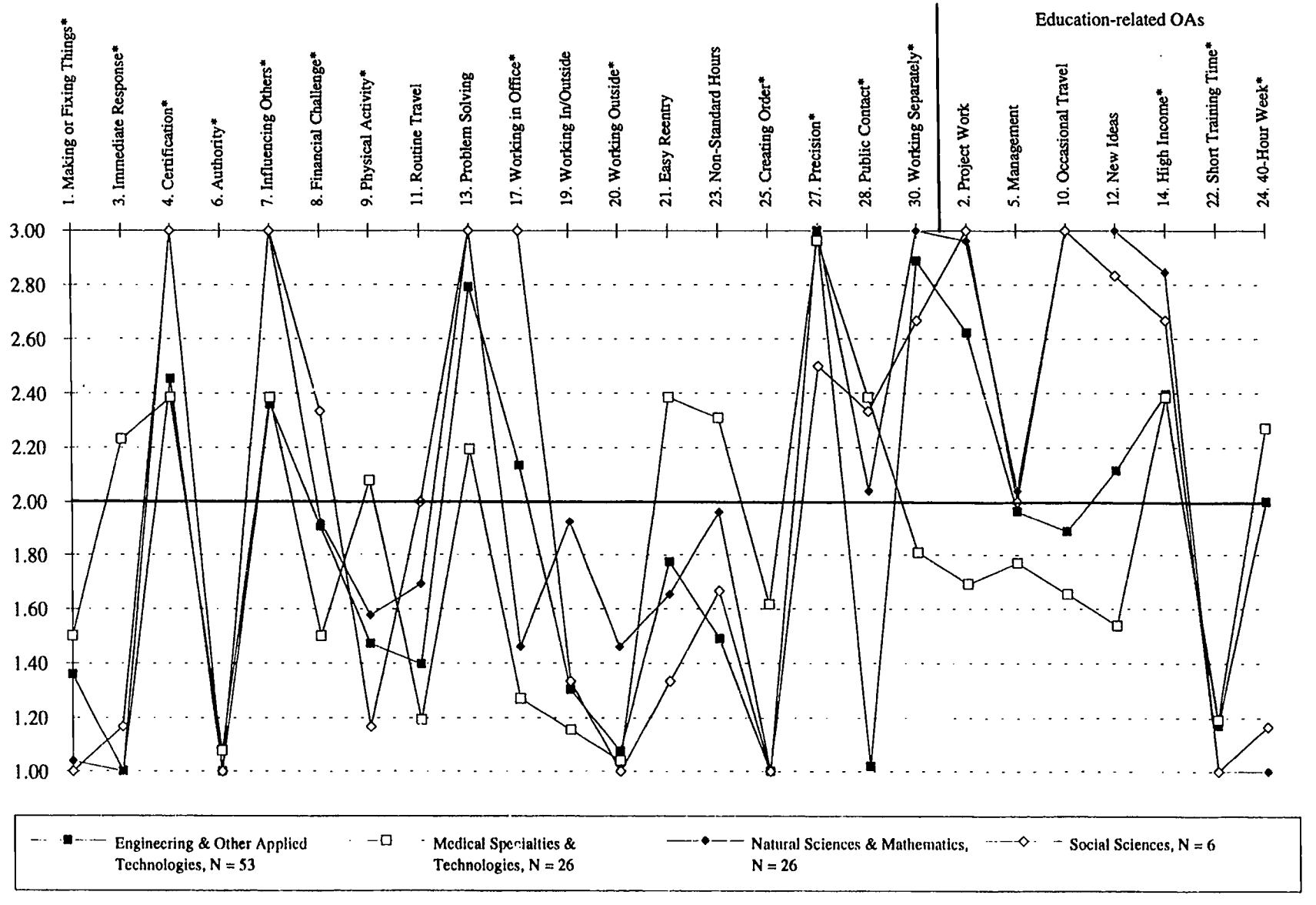


Figure 8. Profiles of mean occupational attribute (OA) ratings for job families in the Science (Investigative) Job Cluster. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

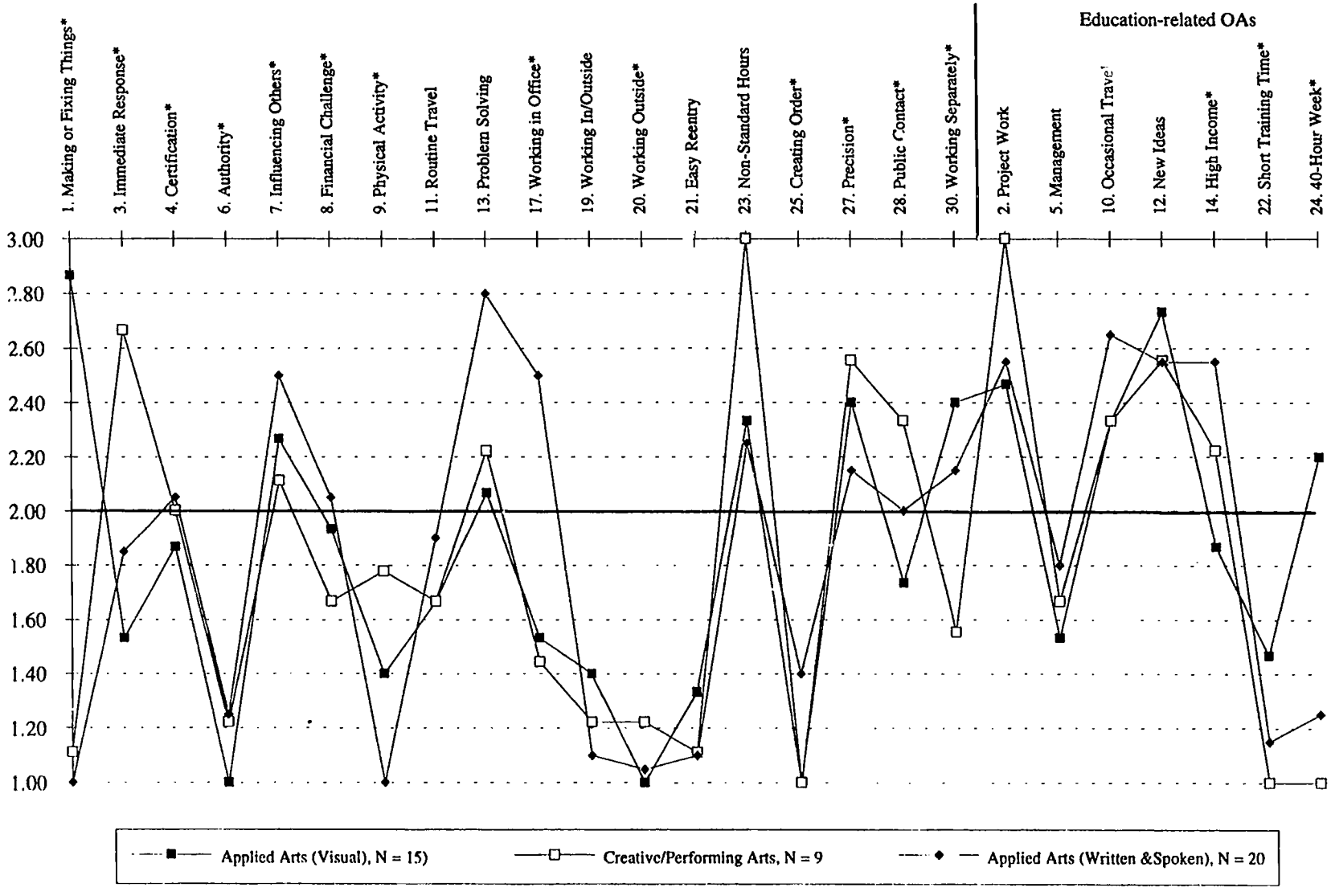


Figure 9. Profiles of mean occupational attribute (OA) ratings for job families in the Arts (Artistic) Job Cluster. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

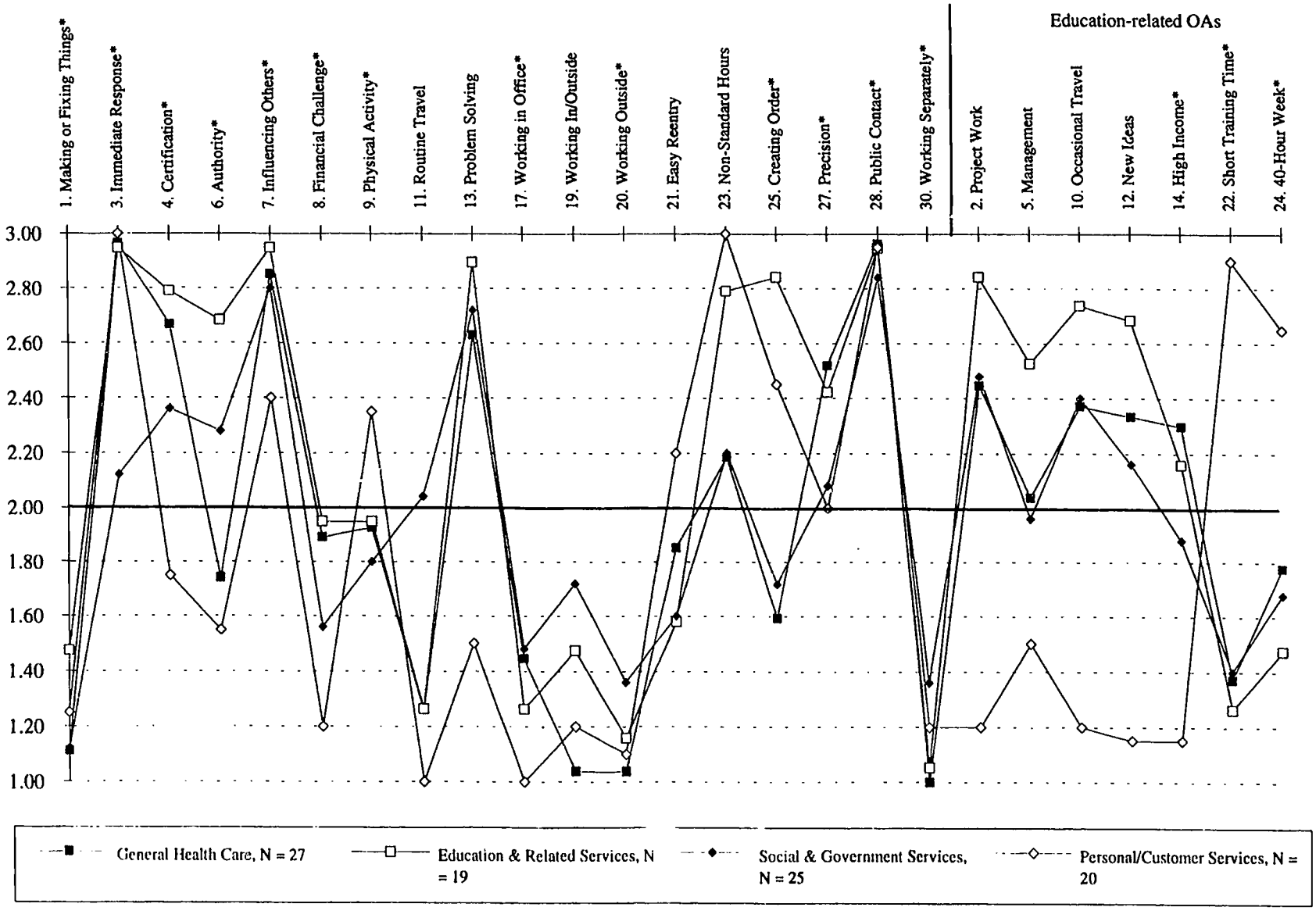


Figure 10. Profiles of mean occupational attribute (OA) ratings for job families in the Social Service (Social) Job Cluster. * = OAs used in linkage procedure. Score scale: 3 = *Yes*; 2 = *Maybe*; 1 = *No*.

BUSINESS CONTACT JOB CLUSTER

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

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

BUSINESS OPERATIONS JOB CLUSTER

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

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

E. STORAGE AND DISPATCHING
Shipping and receiving clerks; mail carriers; truck, cab, and airline dispatchers; cargo agents; air traffic controllers

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

TECHNICAL JOB CLUSTER

G. VEHICLE OPERATION AND REPAIR
Bus, truck, and cab drivers; auto, bus, and airplane mechanics; forklift operators; merchant marine officers; airplane pilots

H. CONSTRUCTION AND MAINTENANCE
Carpenters; electricians; painters; custodians (janitors); bricklayers; sheet metal workers; bulldozer and crane operators; building inspectors

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

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

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

L. INDUSTRIAL EQUIPMENT OPERATION AND REPAIR
Machinists; printers; sewing machine operators; welders; industrial machinery repairers; production painters; laborers and machine operators in factories, mines, etc.; firefighters

SCIENCE JOB CLUSTER

M. ENGINEERING AND OTHER APPLIED TECHNOLOGIES
Engineers and engineering technicians in various fields; biological and chemical lab technicians; computer programmers; computer service technicians; drafters; surveyors; technical illustrators; food technologists

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

O. NATURAL SCIENCES AND MATHEMATICS
Agronomists; biologists; chemists; ecologists; geographers; geologists; horticulturists; mathematicians; physicists

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

ARTS JOB CLUSTER

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

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

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

SOCIAL SERVICE JOB CLUSTER

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

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

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

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

Figure 11. Job families arranged by job clusters paralleling Holland's (1985) types.