Wagner, T. A., & Harvey, R. J. (2004, April). *Job-component validation using CMQ and O*NET: Assessing the additivity assumption.* Paper presented at the Annual Conference of the Society for Industrial and Organizational Psychology, Chicago.

Job-Component Validation Using CMQ and O*NET: Assessing the Additivity Assumption

Teresa A. Wagner & Robert J. Harvey
Virginia Tech

For over 30 years, job-component validation (JCV) models – often termed "synthetic validity" – have been used to statistically predict the levels of various worker-trait competencies needed to perform an occupation, using scores from structured job analysis surveys as predictors. To date, JCV models have typically assumed *additive* relations among the predictors. In this study, we predicted O*NET abilities from CMQ and O*NET GWA scores, finding significant *interaction effects* between the predictors and the percentage of females in an occupation; these findings suggest that main-effects-only models may not be adequate for modeling the true complexity of linkages between job-activities and worker-traits.

The *Uniform Guidelines* (1978) and subsequent court decisions require that organizations be able to document the *job-relatedness* of their selection decisions if challenged. Local criterion-related validity studies represent one method for demonstrating job-relatedness; however, such studies are not feasible in small samples (e.g., Schmidt, Hunter, & Urry, 1976). Methods such as validity generalization (VG) have been advanced as a solution (e.g., Schmidt & Hunter, 1977; Schmidt, Hunter, & Pearlman, 1980), and although VG may be useful in many situations, it may lack usefulness for many others (e.g., when one lacks an adequate prior distribution of validities for the test in question, or when the jobs in the prior bear little similarity to the one of interest).

Many organizations rely on panels of subject-matter experts (SMEs) to develop *worker specifications* by subjectively rating knowledge/skill (KS) and ability/"other" (AO) traits (e.g., Hughes & Prien, 1989; Lopez, Kesselman, & Lopez, 1981). However, such methods can be criticized on several grounds (e.g., Harvey, 1991a): for example, raters often demonstrate low agreement (e.g., Hughes & Prien, 1989, reported average *r*s of only .31 for Importance and .16 for Difficulty ratings). However, even if high agreement is achieved, evidence regarding the *validity* of the KS/AO specifications still rests entirely on subjective SME judgments.

Job-Component Validation (JCV)

We focused on an additional option for setting worker trait requirements: the *job-component validation* (JCV) or "synthetic validity" method developed by McCormick and colleagues (e.g., Cunningham, 1964; McCormick, DeNisi, & Shaw, 1979; McCormick, Jeanneret, & Mecham, 1972; Palmer & McCormick, 1961). Synthetic validity refers to an "inferring of validity in a specific situation from a logical analysis of jobs into their elements, a determination of test validity for these elements, and a combination of elemental validities into a whole" (Balma, 1959, p.395). Key to synthetic validation is the need for a thorough job analysis; this reliance on a quantitative job analysis separates JCV from both VG (which many apply in the absence of a detailed local job analysis, often to their peril; e.g., *EEOC v. Atlas Paper Box,* 1989) and SME-panel methods (i.e., although SMEs may review job analysis data prior to rating, the *linkage* between the job analysis and the KS/AO ratings relies on their subjective opinions).

Several synthetic validity variants have been developed, including the J-coefficient (Primoff, 1955) and Guion's method (e.g., Guion, 1965; Hollenbeck & Whitener, 1988); in this study, we focused on McCormick's approach (e.g., McCormick et al., 1972), which statistically links worker characteristics or competencies found among incumbents to the general work activities (GWAs) or *work dimensions* performed on the job (dimensions are quantified using job analysis surveys such as the Occupation Analysis Inventory, or OAI, of Cunningham, Boese, Neeb, & Pass, 1983; the Common-Metric Questionnaire, or CMQ, of Harvey, 1991b; the Position Analysis Questionnaire, or PAQ, of McCormick et al., 1972). As McCormick et al. (1972) noted:

> It can conceivably be argued that if a given kind of work activity occurs in two or several different jobs, the human requirements for such jobs would be comparable insofar as that common activity is concerned. Let us consider, for example, the aptitude requirements of jobs. If by hook or by crook one can identify -- in the case of a sample of jobs that do have a particular communality of work activities -- the corresponding aptitude(s) that are so required, it would then seem reasonable to assume that the corresponding aptitude(s) would likewise be required in other jobs that have the same communality of work activities. This analogy, repeated for other types of activities and their corresponding aptitudes, would then presumably make it possible to "build up" the total aptitude requirements for any given job synthetically (p.358).

The hallmark of JCV is that one is not synthesizing criterion-oriented validity coefficients per se, but rather, inferring employee aptitude requirements using a *statistical model* linking "the two worlds of human behavioral taxonomies" described by Dunnette (1976, p. 477) – i.e., the domain of worker KS/AO attributes and competencies versus the domain of GWA constructs.

This study focused on the process of *deriving* the JCV models that link the domains of work and worker-traits. When deriving a JCV model, the first step is to describe each job using a *common metric* of work dimensions, using dimensions that avoid being overly molecular or job-specific; these profiles are then matched with aggregated levels of the incumbents' scores on the worker traits of interest (e.g., McCormick et al., 1972, used the GATB ability tests). In JCV, the job analysis and ability/attribute results often are not collected using the same samples of raters or incumbents; rather, they are matched on the basis of similarity in job or occupational title. To derive JCV equations, multiple regression analyses are used; in McCormick et al. (1972), the PAQ work dimensions were used as the predictors, with GATB scores serving as the dependent variables (a separate analysis is conducted for each worker-trait requirement/test). By obtaining a job's profile of work dimension scores, practitioners can apply the JCV equations to predict the trait score that would be expected among incumbents. Thus, JCV can be applied in virtually any organization, regardless of size, once robust JCV equations have been derived.

JCV efficacy is assessed via correlations between the predicted worker-trait scores versus the actual scores (e.g., the *R* obtained in the derivation sample). For example, McCormick et al. (1972) *R*s ranged from .59 to .80 (median = .71). Mecham (1977, cited in McCormick, DeNisi, & Shaw, 1979) replicated the GATB results in a sample of 163 jobs, resulting in a wider range of *R*s (.30 to .83) but a similar median (.73). McCormick et al. (1979) used commercial tests; *R*s ranged from .52 to .75 (median=.71). Finally, in a sample of 460 titles, McCormick, Mecham, and Jeanneret (1989, cited in Jeanneret, 1992) reported GATB *R*s of .24-.78 (median=.69).

The Gravitational Hypothesis

Given its firm job analysis foundation, it is not surprising that JCV has withstood legal challenges (e.g., *Taylor v. James River Corporation,* 1989, in which the court affirmed the use of a PAQ-based JCV technique). However, at least two main concerns can be raised; the first involves a fundamental assumption underlying JCV termed the *gravitational hypothesis*. That is, JCV assumes that jobs differ in their ability requirements, and that people gravitate towards (and are retained in) jobs commensurate with their qualifications. As McCormick et al. (1979) noted:

> To put it another way, "survival" in a given job might be thought of as implying that the incumbents have performed at a reasonably satisfactory level and have found the job to be reasonably acceptable. Following this rationale, it is logical to consider significant mean differences in test scores of incumbents in various jobs as reflecting differences in the nature and level of the human characteristics or constructs that contribute to success on the jobs in question. For this purpose, "success" is considered the ability and willingness to survive in the jobs in question, presumably performing at an acceptable level. (p. 52)

Fortunately, empirical support exists for the gravitational hypothesis (e.g., Wilk, Desmarais, & Sackett, 1995; Wilk & Sackett, 1995). Wilk et al.'s (1995) study tracked movements of 4,000 people across jobs stratified by cognitive complexity; results indicated that people who moved to jobs lower in complexity had lower intelligence than those who remained, and that people who moved up in complexity had higher scores than the other groups. Thus, over time individuals gravitated towards jobs commensurate with their ability, consistent with JCV's assumptions.

The Present Study

Although additional research examining the gravitational hypothesis would be helpful, in our view it is far more important that research be conducted to examine a second JCV assumption dealing with the

statistical model used to link the domains of work-activity and worker-trait constructs. To date, applications of JCV have typically assumed *additive* relations among the predictors (i.e., regression models composed of "main-effect" predictors). Although the JCV studies reviewed above produced impressive *R*s for many criteria, in our view it is critical that the assumption of non-interactive relations also be subjected to empirical examination.

The additive-relations assumption that underlies typical uses of JCV parallels the situation in which regression models are used to conduct ANCOVA. That is, although multiple regression can easily deal with situations in which predictors interact by including the appropriate cross-product terms (e.g., Cohen & Cohen, 1985), in a traditional ANCOVA predictions are made using only additive effects (i.e., given its assumption that no interactions exist between predictors in the covariate set and the substantive predictors). If the ANCOVA assumption of regression homogeneity is untenable, it would be improper (and potentially highly misleading) to make predictions using only the additive effects. Similarly, in JCV, if the work dimension scores that serve as predictors are involved in significant interactions, it would likewise be potentially highly misleading to predict worker-trait requirements without including significant interaction terms.

In view of the lack of prior published research on the topic of whether multiplicative models are necessary in JCV, the objective of this study was to examine the degree to which interactive relations involving work dimension predictors are empirically present. To aid generalizability, we examined two very different methods for quantifying work dimensions: (a) the 42 single-item *holistic* rating scales used in the *General Work Activity* survey in the *Occupational Information Network* (O*NET; e.g., Peterson, Mumford, Borman, Jeanneret, Fleishman, 1999; Peterson, Mumford, Borman, Jeanneret, Fleishman, Levin, Campion, Mayfield, Morgeson, Pearlman, Gowing, Lancaster, Silver, & Dye, 2001) that was developed to replace the *Dictionary of Occupational Titles* (DOT); and (b) the statistically derived work dimension scores produced using the *Common-Metric Questionnaire* (CMQ; Harvey, 1991b), a structured job analysis survey that uses a decomposed-judgment strategy to compute work dimension scores from ratings of over 1,200 individual work characteristics. Ratings of the O*NET work dimensions were obtained from the national O*NET database, using occupations matching the titles rated using the CMQ for this study; thus, each occupation was rated by different raters for the O*NET GWAs versus the CMQ, a fact that should enhance generalizability (i.e., if interactions are seen for GWAs collected using these very different job analysis surveys, there can be no question that such consistency of findings might be an artifact due to using the same raters for both surveys).

On the criterion side, the CMQ and O*NET GWA ratings were matched by title to the averaged scores for each occupation on (a) the 52 Fleishman ability traits measured by the O*NET *Ability Questionnaire* (e.g., Fleishman & Mumford, 1991; Fleishman & Reilly, 1992; Peterson et al., 1999); and (b) the median compensation rate based on national wage surveys (although compensation rates would of course not be used in a JCV study, given that they do not reflect a trait-based property of the incumbent, they nevertheless have been found to be highly predictable from work dimension scores, and they are also relevant to the interaction term we chose to investigate). JCV models were derived for each of the 53 criteria using the CMQ versus O*NET work dimension predictors, and we examined the degree to which interactions could be found between the GWA predictors and the percentage of female workers in each occupation. The percentage-female variable has been of considerable interest in past policy-capturing studies predicting compensation rates from work dimensions (e.g., see Harvey, 1991a), and we viewed it as being useful here for the GWA-based models in the sense that if interaction effects are found involving work dimensions and gender-dominance, significant practical questions might arise.

Although the presence of multiplicative effects per se does not cause difficulties for JCV (i.e., the cross-product terms can simply be added), a potentially much more complex situation would result if the multiplicative effects involve demographic factors forbidden under Title VII of the *Civil Rights Act* (1964) for employee selection (e.g., sex). However, regardless of what type of factor is involved in the interaction, if significant multiplicative relations are seen in realistic situations the adequacy of past JCV implementations based on an additive-model (e.g., Jeanneret, 1992; McCormick et al., 1972) would be called into question. That is, it *may* be possible to find that JCV-based worker-trait predictions obtained from an additive model yield acceptable "consequential validity" (e.g., Harvey & Wilson, 2000; Morgeson & Campion, 2000) even if interactions are present. However, if significant interaction effects are consistently observed for instruments as diverse as the O*NET GWA survey and the CMQ, such an outcome would make it essential that subsequent research be conducted to determine the degree to which additive JCV models are robust with respect to violations of this fundamental assumption.

In view of the sizable magnitude of the model R^2s produced in prior policy-capturing studies (e.g., Harvey, 1993; Harvey & Lozada-Larsen, 1993; McCormick et al., 1972, 1979, 1989), one might hypothesize that significant interaction effects would not be observed (e.g., in Harvey & Lozada-Larsen,

1993, *R*s predicting pay ranged from .83 – .98, presumably leaving little leftover reliable variance to be predicted using the cross-products). However, in JCV analyses using CMQ scores to predict personality traits measured by the Myers-Briggs Type Indicator (MBTI), Brown and Harvey (1996) found significant gender-based interactions for two criteria (i.e., ones corresponding to Agreeableness and Extraversion in the five-factor model). Although there are obvious differences between personality-trait versus ability-trait criteria, and in the population as a whole we would not expect to find appreciable covariance between the ability traits rated in the O*NET survey versus the major dimensions of personality, it is nevertheless the case that at the occupational level there is ample evidence suggesting that significant associations exist between personality and occupational choice (e.g., Myers & McCaulley, 1985), and between personality and specific work dimensions (e.g., with Extraversion and Agreeableness being associated with GWAs involving interpersonal contacts, especially external contacts with clients, the public, etc.). Thus, given the Brown and Harvey (1996) finding that gender moderates the relationship between GWAs and Extraversion and Agreeableness, plus the potentially strong covariance that exists between those personality traits and many of the GWAs in the CMQ and O*NET, one might hypothesize that significant interactions would be found in this study (particularly involving GWAs that correlate with Extraversion and Agreeableness).

However, in light of the admittedly exploratory nature of this initial investigation into the question of whether JCV's additivity assumption is tenable predicting ability-trait criteria, we did not deem it necessary to offer definitive hypotheses for or against the existence of gender-based interactions. From our perspective, the important research questions centered on (a) the *number* of ability trait criteria that show significant multiplicative effects using these two very different GWA-rating instruments; and (b) the *magnitude* of the interaction effects. If we find substantial interactions using both the O*NET and CMQ, such a result would raise significant questions regarding the correctness of past JCV applications based on additive models; conversely, if few interactions are found, or if they are of only modest size, such results would provide welcome empirical support for the tenability of the additivity assumption underlying past JCV studies.

Method

Data and Raters

Teams of trained raters (typically 3 per title) rated 129 occupations with which they had familiarity using the web-based version of the CMQ (see Table 1 for titles); ratings were edited for accuracy and consistent application of the item definitions by the first author. For these same occupations, rater-level O*NET GWA profiles were taken from the national O*NET database (teams of 4-6 analysts rated each; see Hubbard, McCloy, Campbell, Nottingham, Lewis, Rivkin, & Levine, 2000; Levine, Nottingham, Paige, & Lewis, 2000). We used Level ratings (0-7 scale) for each GWA (see Figure 1). The 42 O*NET GWA ratings required no additional scoring; to produce the CMQ predictor profiles, we used a custom factor-scoring procedure based on the first 42 factors from a 43-factor oblique solution (the last was deemed too narrow to be useful, dealing with operating aircraft) based on statistical combination of 1,222 item ratings from the national CMQ database (to enhance comparability, we desired identical numbers of predictors in the CMQ and O*NET models). A total of 411 profiles were obtained for CMQ, 747 for O*NET. Ratings for the 52 O*NET ability traits (Figure 1) were obtained from the O*NET database for each occupation; given that the ratings could not be matched rater-to-rater, means were used for O*NET ability scales. The percentage of females holding each occupation was determined using the 1990 Census, with median market wage data taken from the Bureau of Labor Statistics.

We used O*NET ratings as criteria given their availability, and the claim (e.g., Hubbard et al., 2000; Levine et al., 2000; Peterson et al, 1999, 2001) that they should serve as the nation's primary source of occupational data, replacing the *Dictionary of Occupational Titles* (DOT). However, we remain sensitive to concerns regarding holistic rating quality (e.g., Butler & Harvey, 1988), and we do not intend our use of O*NET to imply that we make any assumptions regarding the quality or consequential validity of its ratings. In practice, we would prefer to derive JCV equations using criteria obtained via decomposed-judgment processes (e.g., multi-item ability tests); however, we deemed O*NET ratings to be adequate for our purposes, given that our goal was to determine whether interactions were present, *not* to produce equations for practitioners to apply (for such uses, we would prefer the higher degree of confidence regarding criterion psychometric quality that decomposed-judgment measurement strategies offer).

Procedure

JCV equations were computed by predicting each criterion in a 3-step hierarchical multiple regression process in which the 42 main-effect GWA predictors were entered first, followed by the addition of the female-percentage variable, and finally the 42 cross-product terms between each GWA and the female-

percentage variable. Analyses were conducted separately for CMQ versus O*NET predictors. To assess rater convergence within title, median pairwise interrater *r*s were computed in each title using the rater profiles of 42 O*NET versus CMQ work dimensions.

Results and Discussion

Table 1 presents the criterion data for each occupation, Figure 2 summarizes the interrater *r*s, Figure 3 presents the R^2s for the JCV models, and Table 2 presents the *F* tests of the hierarchical regressions. Consistent with studies that have raised concerns regarding the O*NET database due to highly variable (and often quite low) levels of rater agreement (e.g., Harvey & Hollander, 2002; Hollander & Harvey, 2002), the results in Figure 2 show that for the occupations rated here, O*NET raters exhibit sharply lower levels of agreement than CMQ raters. That is, although a few jobs showed strong rater disagreement in the CMQ, only approximately 15% of CMQ titles received average interrater *r*s in the .70's and below, whereas over 90% of O*NET titles lie in the .70's and below. Although rater disagreement does *not* necessarily imply rater error (i.e., substantial true within-occupational differences in work activity are often present), strong within-title disagreement argues against forming aggregate profiles (e.g., James, 1982). In our view, the Figure 2 results suggest (especially for the O*NET ratings) that aggregation is not appropriate; the small subjects-to-predictors ratios that would result from the use of aggregate profiles further supports our decision to conduct the JCV regressions at the rater level-of-analysis.

The Table 2 and Figure 3 results indicate unambiguously that sizable interaction effects are the norm for JCV models using both CMQ and O*NET GWAs; although for many criteria a significant main-effect for gender was not observed, large and statistically significant increases in R^2s were produced by the interaction terms for all 53 criteria. However, the dimensions that tended to be associated with the significant interaction effects were not necessarily the ones that one might assume would correlate most strongly with Agreeableness and Extraversion. For example, Tables 3 (CMQ) and 4 (O*NET) present the results for the *Oral Comprehension* criterion; these results show that the important GWAs with respect to the interactions tend to be ones associated with mechanical/physical demands and supervisory/managerial decisions (similar patterns were seen for the non-cognitive ability traits).

Interestingly, for the market-pay criterion, the percent-female variable did not show a significant regression coefficient in the second stage (main effects including female-percent) or third stage (interaction) using CMQ dimensions (indicating that statistically significant gender-based pay differences were removed after controlling for differences in work activities); however, using O*NET GWAs, a significant (and negative, as expected given the higher male wage average) gender-based coefficient is seen for main-effects and interactions. This finding is consistent with the conclusion (Harvey & Lozada-Larsen, 2003) that the work dimensions measured by the CMQ (even the abbreviated 42-scale profile used here, which is much smaller than the usual 78- and 80-GWA profiles) more comprehensively span of the domain of work-activity constructs than the GWAs in the O*NET.

In summary, our results amplify the concerns that were raised by earlier research (Brown & Harvey, 1996) regarding the presence of interaction effects in JCV models predicting worker-trait requirements; the fact that sizable and consistent interactions were found using GWAs produced using two entirely different methods for quantifying work, and two entirely different groups of raters, suggests that significant additional research is needed to determine *why* these interactions are found. Rather than indicating a fundamental flaw in the JCV approach, we speculate that these interactions reflect the fact that the gender variable functioned (a) as a proxy for another factor (e.g., occupational preference, Agreeableness) on which significant gender differences exist, and/or (b) as an indicator of the need to model interactions *among* the GWA dimensions (e.g., Gutenberg, Arvey, Osburn, & Jeanneret, 1983, found that PAQ decision-making dimensions moderated test validities; cross-product terms involving decision-making GWAs may likewise be needed in JCV). Research in large samples (i.e., given the very large number of possible cross-product terms with 42 GWAs) is needed to address this issue.

On more practical grounds, our results also indicate the need for additional research that focuses on determining whether the interaction effects reported here, and in Brown and Harvey (1996), are of *practical* importance to applied psychologists who use JCV methods to set employee competency requirements. In short, studies are needed to assess the robustness of JCV models with respect to violations of the additivity-assumption of the magnitude seen in this study and Brown and Harvey (1996); such research can offer a defensible, data-based answer to the question of whether different "bottom line" outcomes are likely to result in practice when JCV predictions are made with versus without interaction terms. If such studies find that the presence or absence of interaction effects does not lead to sizable *practical* differences in the values of the specific JCV predictions and/or the consequential validity of the JCV predictions in specific personnel applications, the practical aspects of using JCV would be simplified considerably.

References

Balma, M. J. (1959). The concept of synthetic validity. *Personnel Psychology, 12*, 395-396.

Brown, R. D., & Harvey, R. J. (1996, April). *Job-component validation using the MBTI and the Common-Metric Questionnaire (CMQ).* Paper presented at the Annual Conference of the Society for Industrial and Organizational Psychology, San Diego.

Butler, S. K., & Harvey, R. J. (1988). A comparison of holistic versus decomposed rating of Position Analysis Questionnaire work dimensions. *Personnel Psychology, 41*, 761-771.

Cohen, J., & Cohen, P. (1985). *Applied multiple regression and correlation analysis for the behavioral sciences* (2nd ed.). Lawrence Erlbaum Associates.

Cunningham, J. W. (1964). *Worker-oriented job variables: Their factor structure and use in determining job requirements.* Unpublished doctoral dissertation, Purdue University.

Cunningham, J. W., Boese, R. R., Neeb, R. W., & Pass, J. J. (1983). Systematically derived work dimensions: Factor analyses of the Occupation Analysis Inventory. *Journal of Applied Psychology, 68*, 232-252.

Guion, R. M. (1965). Synthetic validity in a small company: A demonstration. *Personnel Psychology, 18*, 49-63.

Gutenberg, R. L., Arvey, R. D., Osburn, H. G., Jeanneret, P. R. (1983). Moderating effects of decision-making/information processing job dimensions on test validities. *Journal of Applied Psychology, 68*, 602-608.

Harvey, R. J. (1991a). *Job analysis*. In M. D. Dunnette & L. Hough (Eds.), *Handbook of industrial and organizational psychology* (second edition). Palo Alto, CA: Consulting Psychologists Press.

Harvey, R. J. (1991b. *The Common-Metric Questionnaire (CMQ): A job analysis system* (first edition). San Antonio, TX: The Psychological Corporation.

Harvey, R. J. (1993). *Research monograph: The development of the CMQ*. San Antonio, TX: The Psychological Corporation

Harvey, R. J., & Hollander, E. (2002, April). *Assessing interrater agreement in the O*NET*. In Wilson, M. A. (Chair), *The O*NET: Mend it, or end it*? Symposium presented at the Annual Conference of the Society for Industrial and Organizational Psychology, Toronto.

Harvey, R. J. & Lozada-Larsen, S. R. (1993, May). *Predicting pay and exempt status using higher-order factors of the Common-Metric Questionnaire*. Paper presented at annual conference of the Society for Industrial and Organizational Psychology, San Francisco.

Harvey, R. J., & Lozada-Larsen, S. R. (2003). The dimensionality of work activities: *Data, People*, and *Things* revisited. Manuscript under review.

Harvey, R. J., & Wilson, M. A. (2000). Yes Virginia, there *is* an objective reality in job analysis. *Journal of Organizational Behavior, 21,* 829-854.

Hollenbeck, J. R. & Whitener, E. M. (1988). Criterion-related validation for small sample contexts: an integrated approach to synthetic validity. *Journal of Applied Psychology, 73*, 536-544.

Hollander, E., & Harvey, R. J. (2002, April). *Generalizability theory analysis of item-level O*NET database ratings.* In Wilson, M. A. (Chair), *The O*NET: Mend it, or end it*? Symposium presented at Society for Industrial and Organizational Psychology, Toronto.

Hughes, G. L., & Prien, E. P. (1989). Evaluation of task and job skill linkage judgments used to develop test specifications. *Personnel Psychology, 42*, 283-292.

James, L. R. (1982). Aggregation bias in estimates of perceptual agreement. *Journal of Applied Psychology, 67*, 219-229.

Jeanneret, P. R. (1992). Applications of job component validity/synthetic validity to construct validity. *Human Performance, 5*, 81-96.

Lopez, F. M., Kesselman, G. A., & Lopez, F. E. (1981). An empirical test of a trait-oriented job analysis technique. *Personnel Psychology, 34*, 479-502

McCormick, E. J., DeNisi, A. S., & Shaw, J. B. (1979). Use of the Position Analysis Questionnaire for establishing the job component validity of tests. *Journal of Applied Psychology, 64*, 51-56.

McCormick, E. J., Jeanneret, P. R., & Mecham, R. C. (1972). A study of job characteristics and job dimensions as based on the Position Analysis Questionnaire. *Journal of Applied Psychology, 56*, 347-368.

McCormick, E. J., Mecham, R. C., & Jeanneret, P. R. (1989). *Technical Manual for the Position Analysis Questionnaire* (PAQ; 2nd ed.). Logan, UT: PAQ Services. Palo Alto, CA: Consulting Psychologists Press Inc.

Myers, I. B., & McCaulley, M. H. (1985). *Manual: A guide to the development and use of the Myers-Briggs type indicator.* Palo Alto, CA: Consulting Psychologists Press.

Palmer, G. J., & McCormick, E. J. (1961). A factor analysis of job activities. *Journal of Applied Psychology, 45*, 289-294.

Peterson, N. G., Mumford, M. D., Borman, W. C., Jeanneret, P. R., Fleishman, E. A.(1999). *An occupational information system for the 21st*

*Century: The development of O*NET*. APA Books.

Peterson, N. G., Mumford, M. D., Borman, W. C., Jeanneret, P. R., Fleishman, E. A., Levin, K. Y., Campion, M. A., Mayfield, M. S., Morgeson, F. P., Pearlman, K., Gowing, M., Lancaster, A. R., Silver, M., & Dye, D. (2001). Understanding work using the Occupational Information Network (O*NET): Implications for practice and research. *Personnel Psychology, 54,* 451-492.

Primoff, E. S. (1955*). Test selection by job analysis: the J-coefficient*. Washington, D. C.: U. S. Civil Service Commission, Assembled Test Technical Edition.

Schmidt, F. L., & Hunter, J. E. (1977). Development of a general solution to the problem of validity generalization. *Journal of Applied Psychology, 62*, 529- 540.

Schmidt, F. L., Hunter, J., & Pearlman, K. (1981). Task differences as moderators of aptitude test validity in selection: A red herring. *Journal of Applied Psychology, 66*, 166-185.

Schmidt, F. L., & Hunter, J. E., & Urry, V. W. (1976). Statistical power in criterion related validity studies. *Journal of Applied Psychology, 61*, 473- 485.

Taylor v. James River Corporation. (1989). WL 165953, 1 (SD Ala.).

Wilk, S. L., Desmarais, L. B., & Sackett, P. R. (1995). Gravitation to jobs commensurate with ability: longitudinal and cross-sectional tests. *Journal of Applied Psychology, 80*, 79-85.

Wilk, S. L., & Sackett, P. R. (1995). *A longitudinal analysis of ability-job complexity fit and job change*. Paper presented at annual conference of the Society for Industrial and Organizational Psychology, Orlando.

Table 1. *Rated Occupational Titles and Criterion Variables*

Occu-pation	SOC Title	CMQ Raters	ONET Raters	Median Income	% Female
1	Accountants and Auditors	3	6	45400	52.7198
2	Administrative Services Managers	3	6	49800	50.2560
3	Advertising Sales Agents	2	6	36600	51.6801
4	Amusement and Recreation Attendants	3	6	14600	37.1155
5	Automotive Body and Related Repairers	3	6	32500	2.0633
6	Bartenders	3	6	14600	49.6145
7	Bill and Account Collectors	3	5	20600	66.1809
8	Bookkeeping. Accounting. and Auditing Clerks	3	6	26500	89.5549
9	Bus Drivers. School	3	6	22000	58.0747
10	Bus Drivers. Transit and Intercity	3	6	28100	39.0789
11	Bus and Truck Mechanics and Diesel Engine Specialists	3	6	33600	0.8777
12	Butchers and Meat Cutters	1	6	24800	19.6467
13	Cabinetmakers and Bench Carpenters	3	6	23500	6.4282
14	Cashiers	3	6	15000	79.1166
15	Cement Masons and Concrete Finishers	3	6	29600	1.3181
16	Chefs and Head Cooks	7	5	26800	26.3699
17	Child Care Workers	3	6	16000	89.1498
18	Child. Family. and School Social Workers	3	6	32900	68.9249
19	Civil Engineers	3	5	58400	6.9800
20	Cleaners of Vehicles and Equipment	3	6	16500	12.3798
21	Combined Food Preparation and Serving Workers. Including Fast Food	3	6	14100	66.6674
22	Computer Operators	3	6	28900	61.6677
23	Computer Programmers	3	6	60100	32.5382
24	Computer Systems Analysts	3	6	62000	30.6518
25	Computer and Information Systems Managers	3	6	82500	36.5607
26	Construction Laborers	3	5	24100	4.0267
27	Construction Managers	3	6	61000	2.8266
28	Cooks. Fast Food	3	6	13900	45.5627
29	Cooks. Institution and Cafeteria	3	6	17700	50.0003
30	Cooks. Restaurant	3	6	18500	47.6238
31	Cooks. Short Order	3	6	15700	3.3847
32	Correctional Officers and Jailers	3	5	32000	18.8615
33	Cost Estimators	3	6	47000	13.8798
34	Counter Attendants. Cafeteria. Food Concession. and Coffee Shop	3	6	14800	72.3059
35	Counter and Rental Clerks	3	6	16700	34.5332
36	Couriers and Messengers	9	6	19100	24.6004
37	Data Entry Keyers	3	6	22000	87.0096
38	Dental Assistants	3	6	26700	97.1186
39	Dental Hygienists	3	6	54700	98.3783
40	Dining Room and Cafeteria Attendants and Bartender Helpers	3	6	14100	42.5618
41	Dishwashers	3	6	14500	23.5695
42	Dispatchers. Except Police. Fire. and Ambulance	3	5	28000	47.4269
43	Driver/Sales Workers	3	6	20200	10.0563
44	Educational. Vocational. and School Counselors	3	6	43500	61.5303
45	Electrical Engineers	3	5	66900	9.9678
46	Electrical and Electronic Equipment Assemblers	3	6	22300	1.4048
47	Electricians	3	5	40800	2.4659
48	Electronics Engineers. Except Computer	3	5	68300	8.7910

49	Elementary School Teachers. Except Special Education	3	6	41100	78.4400
50	Emergency Medical Technicians and Paramedics	3	6	23200	19.3115
51	Executive Secretaries and Administrative Assistants	3	6	32400	71.6338
52	File Clerks	3	6	19500	80.6215
53	Financial Analysts	3	6	55100	45.7750
54	First-Line Supervisors/Managers of Food Preparation and Serving Workers	3	5	23600	57.5277
55	First-Line Supervisors/Managers of Helpers. Laborers. and Material Movers. Hand	2	5	36100	10.7097
56	First-Line Supervisors/Managers of Mechanics. Installers. and Repairers	3	5	46300	8.3823
57	First-Line Supervisors/Managers of Police and Detectives	9	6	59300	11.5367
58	First-Line Supervisors/Managers of Production and Operating Workers	2	5	42000	17.7075
59	First-Line Supervisors/Managers of Transportation and Material-Moving Machine and Veh	3	5	41100	15.7335
60	Fitness Trainers and Aerobics Instructors	3	6	23300	21.0873
61	Flight Attendants	8	6	40600	79.4231
62	Food Preparation Workers	3	6	15900	75.3272
63	Food Servers. Nonrestaurant	3	6	15300	49.7198
64	Food Service Managers	3	6	33600	57.5264
65	Graduate Teaching Assistants	3	6	22200	38.0184
66	Graphic Designers	3	6	36000	18.7287
67	Hairdressers. Hairstylists. and Cosmetologists	3	5	18300	54.0478
68	Helpers--Installation. Maintenance. and Repair Workers	3	5	21200	5.7519
69	Highway Maintenance Workers	3	5	27500	1.4559
70	Home Health Aides	3	6	17600	79.7898
71	Hosts and Hostesses. Restaurant. Lounge. and Coffee Shop	3	6	14900	76.9677
72	Hotel. Motel. and Resort Desk Clerks	3	6	16900	71.9836
73	Human Resources Assistants. Except Payroll and Timekeeping	3	6	29500	85.4487
74	Industrial Truck and Tractor Operators	3	6	25400	6.2982
75	Insurance Sales Agents	3	6	38900	35.3339
76	Interviewers. Except Eligibility and Loan	3	5	21900	55.8563
77	Janitors and Cleaners. Except Maids and Housekeeping Cleaners	3	6	17900	31.4546
78	Kindergarten Teachers. Except Special Education	3	6	38700	97.8020
79	Landscaping and Groundskeeping Workers	3	5	19100	7.4383
80	Lawyers	3	6	88800	24.4613
81	Legal Secretaries	3	6	34600	72.8239
82	Librarians	3	6	42700	81.3213
83	Licensed Practical and Licensed Vocational Nurses	3	6	30700	56.5692
84	Maids and Housekeeping Cleaners	3	6	16000	80.7325
85	Maintenance and Repair Workers. General	3	6	28700	4.4830
86	Management Analysts	3	5	58000	33.7362
87	Marketing Managers	3	6	74400	31.8002
88	Meat. Poultry. and Fish Cutters and Trimmers	3	6	17300	16.3526
89	Medical Assistants	3	6	23600	61.8606
90	Medical Secretaries	3	6	24700	75.9020
91	Medical and Clinical Laboratory Technicians	3	6	28800	75.0822

92	Medical and Health Services Managers	3	5	59200	66.5702
93	Mobile Heavy Equipment Mechanics. Except Engines	9	6	35200	1.0991
94	Network Systems and Data Communications Analysts	3	6	57500	29.6600
95	Nursing Aides. Orderlies. and Attendants	2	6	19300	87.2176
96	Order Clerks	3	5	24300	71.8059
97	Packaging and Filling Machine Operators and Tenders	3	6	20800	59.9829
98	Packers and Packagers. Hand	3	5	16300	64.6569
99	Painters. Construction and Maintenance	3	6	28400	7.7508
100	Paralegals and Legal Assistants	3	6	36700	75.9154
101	Parts Salespersons	3	6	23300	9.9377
102	Payroll and Timekeeping Clerks	3	6	28200	88.6656
103	Personal and Home Care Aides	1	6	16100	76.2279
104	Pharmacists	3	6	74900	36.7710
105	Pharmacy Technicians	3	6	21600	71.0346
106	Physical Therapists	3	6	56600	75.5059
107	Postal Service Mail Carriers	3	6	38700	26.7946
108	Preschool Teachers. Except Special Education	3	6	18600	97.8217
109	Production. Planning. and Expediting Clerks	3	6	32400	21.4517
110	Property. Real Estate. and Community Association Managers	3	5	36300	46.1377
111	Public Relations Specialists	3	6	41000	58.7523
112	Purchasing Agents. Except Wholesale. Retail. and Farm Products	3	6	43200	53.1298
113	Real Estate Sales Agents	9	6	28600	50.4261
114	Refuse and Recyclable Material Collectors	3	6	23900	4.1763
115	Roofers	8	6	29500	1.5645
116	Sales Managers	3	6	71600	34.8434
117	Sales Representatives. Wholesale and Manufacturing. Except Technical and Scientific	3	6	41500	22.8062
118	Secretaries. Except Legal. Medical. and Executive	3	6	24600	98.6938
119	Security Guards	3	6	18600	16.5968
120	Sheet Metal Workers	3	6	33200	5.6171
121	Shipping. Receiving. and Traffic Clerks	2	6	22700	28.9734
122	Social and Human Service Assistants	3	6	23100	89.5972
123	Switchboard Operators. Including Answering Service	3	6	20700	87.2801
124	Taxi Drivers and Chauffeurs	2	5	17900	10.8227
125	Teacher Assistants	3	5	18100	89.2351
126	Tellers	2	6	19800	89.8075
127	Truck Drivers. Light or Delivery Services	3	6	23300	5.8655
128	Waiters and Waitresses	2	6	13700	80.4625
129	Word Processors and Typists	3	6	26000	94.3525

Table 2. *Hierarchical JCV Regressions for CMQ and O*NET Predicting Ability and Pay*

Scale	Label	CMQ F_{1-2}	P	CMQ F_{2-3}	p	O*NET F_{1-2}	P	O*NET F_{2-3}	p
0	Median Income	2.167	0.142	3.193	0.000	34.321	0.000	3.923	0.000
1	Oral Comprehension	0.000	1.000	1.980	0.001	0.514	0.474	2.325	0.000
2	Written Comprehension	0.860	0.354	2.362	0.000	1.901	0.168	1.433	0.040
3	Oral Expression	0.141	0.708	2.222	0.000	0.520	0.471	2.239	0.000
4	Written Expression	0.684	0.409	2.369	0.000	8.766	0.003	1.951	0.000
5	Fluency of Ideas	8.419	0.004	1.876	0.001	1.002	0.317	2.105	0.000
6	Originality	5.246	0.023	2.511	0.000	1.785	0.182	2.500	0.000
7	Problem Sensitivity	0.603	0.438	2.020	0.000	0.000	1.000	2.630	0.000
8	Deductive Reasoning	16.526	0.000	2.696	0.000	2.514	0.113	1.870	0.001
9	Inductive Reasoning	17.661	0.000	2.260	0.000	12.358	0.000	1.734	0.003
10	Information Ordering	0.899	0.344	1.844	0.002	0.137	0.711	2.079	0.000
11	Category Flexibility	0.342	0.559	3.701	0.000	6.936	0.009	1.923	0.001
12	Mathematical Reasoning	6.118	0.014	3.091	0.000	0.000	1.000	2.427	0.000
13	Number Facility	0.183	0.669	3.180	0.000	1.278	0.259	2.446	0.000
14	Memorization	2.311	0.129	2.785	0.000	7.425	0.007	3.289	0.000
15	Speed of Closure	5.814	0.016	3.171	0.000	0.959	0.328	2.383	0.000
16	Flexibility of Closure	11.216	0.001	2.380	0.000	1.467	0.226	2.344	0.000
17	Perceptual Speed	0.224	0.636	3.105	0.000	6.370	0.012	3.232	0.000
18	Spatial Orientation	2.063	0.152	3.473	0.000	1.883	0.170	3.408	0.000
19	Visualization	7.550	0.006	2.832	0.000	7.629	0.006	2.580	0.000
20	Selective Attention	0.140	0.708	2.741	0.000	4.012	0.046	2.358	0.000
21	Time Sharing	0.628	0.429	2.492	0.000	1.441	0.230	2.376	0.000
22	ArmHand Steadiness	1.866	0.173	1.921	0.001	0.897	0.344	3.208	0.000
23	Manual Dexterity	0.097	0.756	3.889	0.000	3.998	0.046	2.564	0.000
24	Finger Dexterity	0.663	0.416	3.474	0.000	4.123	0.043	3.414	0.000
25	Control Precision	0.000	1.000	2.470	0.000	0.277	0.599	2.538	0.000
26	Multilimb Coordination	14.649	0.000	2.866	0.000	18.542	0.000	2.593	0.000
27	Response Orientation	0.523	0.470	2.511	0.000	0.311	0.577	3.631	0.000
28	Rate Control	12.628	0.000	2.962	0.000	20.507	0.000	2.776	0.000
29	Reaction Time	0.434	0.510	2.828	0.000	1.348	0.246	3.466	0.000
30	Wrist-Finger Dexterity	15.267	0.000	4.974	0.000	25.578	0.000	3.221	0.000
31	Speed of Limb Movement	20.085	0.000	2.874	0.000	17.544	0.000	2.631	0.000
32	Static Strength	20.279	0.000	2.283	0.000	42.293	0.000	1.840	0.001
33	Explosive Strength	49.227	0.000	2.802	0.000	85.601	0.000	2.468	0.000
34	Dynamic Strength	35.880	0.000	2.812	0.000	86.931	0.000	2.066	0.000
35	Trunk Strength	7.680	0.006	2.510	0.000	5.293	0.022	2.203	0.000
36	Stamina	49.485	0.000	3.195	0.000	73.579	0.000	1.632	0.008
37	Extent Flexibility	22.771	0.000	2.381	0.000	10.326	0.001	2.108	0.000

38	Dynamic Flexibility	21.203	0.000	2.623	0.000	21.132	0.000	1.731	0.003
39	Gross Body Coordination	14.717	0.000	1.610	0.013	27.633	0.000	1.999	0.000
40	Gross Body Equilibrium	10.251	0.001	3.632	0.000	18.737	0.000	2.098	0.000
41	Near Vision	0.390	0.533	2.968	0.000	10.886	0.001	3.033	0.000
42	Far Vision	11.139	0.001	2.850	0.000	2.903	0.089	3.055	0.000
43	Visual Color Discriminat	2.740	0.099	2.776	0.000	0.000	1.000	3.193	0.000
44	Night Vision	9.312	0.002	1.917	0.001	6.789	0.009	2.957	0.000
45	Peripheral Vision	8.144	0.005	2.982	0.000	3.864	0.050	3.774	0.000
46	Depth Perception	15.589	0.000	2.477	0.000	23.793	0.000	3.313	0.000
47	Glare Sensitivity	22.099	0.000	2.734	0.000	25.885	0.000	4.091	0.000
48	Hearing Sensitivity	5.435	0.020	1.831	0.002	0.622	0.430	2.717	0.000
49	Auditory Attention	1.237	0.267	2.353	0.000	0.000	1.000	1.755	0.003
50	Sound Localization	4.676	0.031	2.128	0.000	0.203	0.652	2.514	0.000
51	Speech Recognition	0.803	0.371	2.378	0.000	4.005	0.046	2.163	0.000
52	Speech Clarity	0.106	0.744	3.966	0.000	2.428	0.120	2.506	0.000

Note. Entries represent *F* statistics (and corresponding *p* values) for *R*2 increments comparing content main-effects versus content-plus-female-dominance ($F_{1\text{-}2}$) and comparing content-plus-female-dominance versus full model with female-by-content interactions. $N = 411$ raters for CMQ, 747 for O*NET; 129 SOC occupational titles were rated.

Table 3. *JCV Regression Results for CMQ Predicting Oral Comprehension*

Variable	Label	Estimate	Std Error	t	p
Intercept	Intercept	4.50925	0.87356	5.16	<.0001
Fact1	MDM: implementing	0.06477	0.39565	0.16	0.8701
Fact2	Hazardous/unpleasant work environment	-0.02525	0.37508	-0.07	0.9464
Fact3	EC: Regulators, Govt	0.36333	0.64266	0.57	0.5722
Fact4	Physical activity	-0.14341	0.15502	-0.93	0.3556
Fact5	EC: mid-level, info/decide/supervise	0.77143	0.89823	0.86	0.3911
Fact6	High-level: info/decide/resolve	-0.34401	0.42797	-0.80	0.4221
Fact7	Prof/tech: info/decide/resolve	0.13543	0.31132	0.44	0.6638
Fact8	**Lower-level: info/decide/resolve**	**-1.35152**	**0.65557**	**-2.06**	**0.0400**
Fact9	**MDM: POM/HR, lower-impact**	**0.79272**	**0.24004**	**3.30**	**0.0011**
Fact10	Stationary machines	-0.15557	0.15602	-1.00	0.3195
Fact11	Treatment/therapy/safety	0.33612	0.91746	0.37	0.7143
Fact12	**Enforcement/demanding conditions**	**0.49282**	**0.20972**	**2.35**	**0.0194**
Fact13	Negotiation	-0.27372	0.82821	-0.33	0.7412
Fact14	Take info, orders, interview	0.35457	0.25683	1.38	0.1684
Fact15	Powered tools/equipment	0.09177	0.15901	0.58	0.5643
Fact16	Persuade/sell	0.15738	0.50721	0.31	0.7565
Fact17	**MDM: Acquire/start/sell businesses**	**1.72193**	**0.86240**	**2.00**	**0.0467**
Fact18	EC: public/customers/clients info	0.19082	0.15618	1.22	0.2227
Fact19	**IC: mid-level info/decide**	**0.50205**	**0.23487**	**2.14**	**0.0333**
Fact20	**Heavy/offroad vehicles**	**-0.44732**	**0.10986**	**-4.07**	**<.0001**
Fact21	EC: Entertain/persuade	0.43034	0.63921	0.67	0.5013
Fact22	Safety/damage to others	-0.09506	0.20218	-0.47	0.6386
Fact23	EC: mid-level exchange info	0.45423	0.43275	1.05	0.2947
Fact24	EC: press/media	0.23405	0.34464	0.68	0.4976
Fact25	MDM: products/services, lower-impact	0.04727	0.37140	0.13	0.8988
Fact26	EC: students/children/civic	0.09297	0.21313	0.44	0.6630
Fact27	**MDM: POM/HR higher-level**	**-1.01652**	**0.40036**	**-2.54**	**0.0116**
Fact28	MDM: prods/services, higher impact	-0.04763	0.33363	-0.14	0.8866
Fact29	**Tech/scientific/computers-machines**	**0.88255**	**0.22262**	**3.96**	**<.0001**
Fact30	Processing/moving machines	-0.15554	0.10391	-1.50	0.1354
Fact31	Stationary machines	0.13193	0.16436	0.80	0.4228
Fact32	**Office equipment**	**0.43662**	**0.12663**	**3.45**	**0.0006**
Fact33	**EC: delegating/supervising**	**1.09171**	**0.30014**	**3.64**	**0.0003**
Fact34	MDM: financial	0.20617	0.24216	0.85	0.3952
Fact35	**IC: lower-level supervision**	**-0.56017**	**0.21211**	**-2.64**	**0.0087**
Fact36	IC: middle-level supervision	0.24925	0.23048	1.08	0.2803
Fact37	**IC: sales/service supervision**	**0.49593**	**0.23963**	**2.07**	**0.0393**
Fact38	Language use/programming	-0.11271	0.19517	-0.58	0.5640
Fact39	**Language use/foreign**	**1.38324**	**0.60733**	**2.28**	**0.0234**
Fact40	EC: PT/mid-level conflicts	-0.21306	0.21964	-0.97	0.3327
Fact41	EC: projects/people superv	0.04510	0.30677	0.15	0.8832
Fact42	MDM: strat planning, entire org	-0.04995	0.43882	-0.11	0.9094

FemalePercent		-0.00683	0.01996	-0.34	0.7323
cp1	MDM: implementing	-0.00219	0.01139	-0.19	0.8475
cp2	Hazardous/unpleasant work environment	0.00607	0.00979	0.62	0.5353
cp3	EC: Regulators, Govt	0.00723	0.01411	0.51	0.6088
cp4	Physical activity	-0.00444	0.00356	-1.25	0.2138
cp5	EC: mid-level, info/decide/supervise	-0.01174	0.01850	-0.63	0.5262
cp6	High-level: info/decide/resolve	0.00764	0.00995	0.77	0.4433
cp7	Prof/tech: info/decide/resolve	0.00313	0.00714	0.44	0.6612
cp8	**Lower-level: info/decide/resolve**	**0.03305**	**0.01443**	**2.29**	**0.0226**
cp9	MDM: POM/HR, lower-impact	-0.00759	0.00595	-1.28	0.2026
cp10	**Stationary machines**	**-0.01390**	**0.00526**	**-2.64**	**0.0087**
cp11	Treatment/therapy/safety	-0.01910	0.01857	-1.03	0.3047
cp12	Enforcement/demanding conditions	-0.01201	0.00719	-1.67	0.0960
cp13	Negotiation	0.00766	0.01655	0.46	0.6437
cp14	Take info, orders, interview	-0.00170	0.00513	-0.33	0.7414
cp15	Powered tools/equipment	0.00158	0.00536	0.30	0.7677
cp16	Persuade/sell	-0.00261	0.01049	-0.25	0.8034
cp17	MDM: Acquire/start/sell businesses	-0.03174	0.01938	-1.64	0.1025
cp18	EC: public/customers/clients info	-0.00238	0.00292	-0.82	0.4152
cp19	**IC: mid-level info/decide**	**-0.01142**	**0.00524**	**-2.18**	**0.0301**
cp20	Heavy/offroad vehicles	0.00154	0.00611	0.25	0.8007
cp21	EC: Entertain/persuade	-0.00886	0.01275	-0.69	0.4878
cp22	Safety/damage to others	0.00635	0.00435	1.46	0.1457
cp23	EC: mid-level exchange info	-0.00820	0.00890	-0.92	0.3579
cp24	EC: press/media	-0.00499	0.00724	-0.69	0.4915
cp25	MDM: products/services, lower-impact	-0.00210	0.01193	-0.18	0.8605
cp26	**EC: students/children/civic**	**0.01042**	**0.00380**	**2.74**	**0.0065**
cp27	**MDM: POM/HR higher-level**	**0.02674**	**0.00990**	**2.70**	**0.0073**
cp28	MDM: prods/services, higher impact	0.00390	0.00808	0.48	0.6299
cp29	Tech/scientific/computers-machines	-0.00799	0.00414	-1.93	0.0547
cp30	Processing/moving machines	-0.00279	0.00304	-0.92	0.3584
cp31	Stationary machines	0.00317	0.00557	0.57	0.5698
cp32	Office equipment	-0.00269	0.00252	-1.07	0.2862
cp33	**EC: delegating/supervising**	**-0.01369**	**0.00540**	**-2.53**	**0.0118**
cp34	MDM: financial	0.00033222	0.00531	0.06	0.9502
cp35	IC: lower-level supervision	0.01029	0.00543	1.90	0.0589
cp36	IC: middle-level supervision	-0.00701	0.00556	-1.26	0.2080
cp37	**IC: sales/service supervision**	**-0.01038**	**0.00445**	**-2.33**	**0.0202**
cp38	Language use/programming	0.00903	0.00491	1.84	0.0669
cp39	Language use/foreign	-0.00805	0.01494	-0.54	0.5905
cp40	EC: PT/mid-level conflicts	0.00138	0.00468	0.30	0.7682
cp41	EC: projects/people superv	0.00080171	0.00617	0.13	0.8967
cp42	MDM: strat planning, entire org	0.00613	0.01033	0.59	0.5532

Table 4. *JCV Regression Results for O*NET Predicting Oral Comprehension*

Variable	Label	Estimate	Std Error	t	p
Intercept	Intercept	2.85445	0.19455	14.67	<.0001
gwlvl_1	getting information	0.09428	0.05358	1.76	0.0789
gwlvl_2	identifying objects	-0.04972	0.04502	-1.10	0.2698
gwlvl_3	monitoring processes	0.01462	0.04230	0.35	0.7298
gwlvl_4	inspecting equipment	0.05687	0.03995	1.42	0.1551
gwlvl_5	estimating characteristics	0.02073	0.04887	0.42	0.6716
gwlvl_6	**judging the qualities**	**-0.11466**	**0.04492**	**-2.55**	**0.0109**
gwlvl_7	evaluating information	-0.03430	0.04906	-0.70	0.4846
gwlvl_8	processing information	0.05550	0.04706	1.18	0.2387
gwlvl_9	analyzing data	0.05870	0.05545	1.06	0.2901
gwlvl_10	making decisions	0.07805	0.05631	1.39	0.1662
gwlvl_11	thinking creatively	-0.02631	0.03683	-0.71	0.4752
gwlvl_12	using job knowledge	0.04556	0.04180	1.09	0.2761
gwlvl_13	developing objectives	0.00711	0.04899	0.15	0.8847
gwlvl_14	scheduling work	-0.01620	0.04175	-0.39	0.6981
gwlvl_15	organizing and planning	0.07049	0.04452	1.58	0.1138
gwlvl_16	perform physical work tasks	-0.01441	0.03489	-0.41	0.6797
gwlvl_17	**handling objects**	**-0.14775**	**0.03549**	**-4.16**	**<.0001**
gwlvl_18	**controlling machines**	**-0.13424**	**0.03419**	**-3.93**	**<.0001**
gwlvl_19	**interacting with computers**	**0.14005**	**0.03565**	**3.93**	**<.0001**
gwlvl_20	**operating vehicles**	**-0.08435**	**0.03021**	**-2.79**	**0.0054**
gwlvl_21	specifying equipment	-0.01357	0.03194	-0.42	0.6710
gwlvl_22	implementing ideas	0.02021	0.04058	0.50	0.6186
gwlvl_23	repairing, mechanical	-0.00960	0.03105	-0.31	0.7573
gwlvl_24	repairing, electronic	-0.01453	0.02951	-0.49	0.6226
gwlvl_25	documenting information	-0.01809	0.04927	-0.37	0.7136
gwlvl_26	**interpreting information**	**0.13834**	**0.04599**	**3.01**	**0.0027**
gwlvl_27	communicating, internal	-0.01287	0.04709	-0.27	0.7847
gwlvl_28	**communicating, external**	**0.07449**	**0.03654**	**2.04**	**0.0419**
gwlvl_29	establishing relationships	0.07498	0.04277	1.75	0.0800
gwlvl_30	assisting others	-0.05980	0.03348	-1.79	0.0746
gwlvl_31	selling or influencing	0.02228	0.03710	0.60	0.5484
gwlvl_32	resolving conflicts	-0.02637	0.04091	-0.64	0.5193
gwlvl_33	working with the public	-0.00585	0.02974	-0.20	0.8440
gwlvl_34	cordinating others work	-0.02499	0.04285	-0.58	0.5599
gwlvl_35	developing teams	-0.04166	0.04539	-0.92	0.3590
gwlvl_36	teaching others	0.00274	0.04210	0.07	0.9481
gwlvl_37	directing subordinates	0.04607	0.04788	0.96	0.3362
gwlvl_38	**developing others**	**0.10333**	**0.04460**	**2.32**	**0.0208**
gwlvl_39	providing consultation	0.01845	0.04320	0.43	0.6694
gwlvl_40	performing administrative tasls	-0.07975	0.04617	-1.73	0.0846
gwlvl_41	staffing organizational units	0.06379	0.04781	1.33	0.1826
gwlvl_42	monitoring resources	-0.01652	0.03184	-0.52	0.6042
FemalePercent		**-0.00773**	**0.00362**	**-2.13**	**0.0332**
cp1	getting information	-0.00068685	0.00096768	-0.71	0.4781
cp2	identifying objects	0.00119	0.00085576	1.39	0.1655
cp3	monitoring processes	0.00004251	0.00079130	0.05	0.9572
cp4	**inspecting equipment**	**-0.00152**	**0.00076456**	**-1.99**	**0.0468**
cp5	estimating characteristics	-0.00071023	0.00089416	-0.79	0.4273
cp6	judging the qualities	0.00151	0.00087055	1.74	0.0829
cp7	evaluating information	0.00125	0.00092623	1.35	0.1775
cp8	processing information	-0.00150	0.00092179	-1.63	0.1035

cp9	analyzing data	-0.00012131	0.00103	-0.12	0.9059
cp10	making decisions	-0.00123	0.00108	-1.13	0.2568
cp11	thinking creatively	0.00055365	0.00077251	0.72	0.4738
cp12	using job knowledge	0.00044309	0.00079972	0.55	0.5797
cp13	developing objectives	-0.00018760	0.00093598	-0.20	0.8412
cp14	**scheduling work**	**0.00167**	**0.00073139**	**2.28**	**0.0231**
cp15	**organizing and planning**	**-0.00192**	**0.00079142**	**-2.42**	**0.0158**
cp16	perform physical work tasks	-0.00085658	0.00067549	-1.27	0.2052
cp17	**handling objects**	**0.00192**	**0.00064392**	**2.98**	**0.0030**
cp18	**controlling machines**	**0.00188**	**0.00070613**	**2.66**	**0.0079**
cp19	interacting with computers	-0.00141	0.00076611	-1.83	0.0670
cp20	**operating vehicles**	**0.00145**	**0.00070620**	**2.05**	**0.0403**
cp21	specifying equipment	0.00015620	0.00072360	0.22	0.8292
cp22	implementing ideas	-0.00056732	0.00078008	-0.73	0.4673
cp23	repairing, mechanical	0.00014215	0.00079126	0.18	0.8575
cp24	repairing, electronic	0.00047361	0.00074495	0.64	0.5252
cp25	documenting information	0.00022521	0.00095648	0.24	0.8139
cp26	**interpreting information**	**-0.00208**	**0.00086825**	**-2.39**	**0.0171**
cp27	communicating, internal	0.00096546	0.00081956	1.18	0.2392
cp28	communicating, external	-0.00033766	0.00075174	-0.45	0.6535
cp29	establishing relationships	-0.00005506	0.00075575	-0.07	0.9419
cp30	**assisting others**	**0.00158**	**0.00059385**	**2.66**	**0.0080**
cp31	selling or influencing	-0.00125	0.00070683	-1.77	0.0766
cp32	resolving conflicts	0.00128	0.00077600	1.65	0.0985
cp33	working with the public	0.00029827	0.00054212	0.55	0.5824
cp34	cordinating others work	0.00029767	0.00078504	0.38	0.7047
cp35	developing teams	-0.00021532	0.00089675	-0.24	0.8103
cp36	teaching others	0.00097650	0.00082430	1.18	0.2366
cp37	directing subordinates	-0.00105	0.00085546	-1.22	0.2221
cp38	developing others	-0.00146	0.00086476	-1.69	0.0914
cp39	providing consultation	0.00051608	0.00078109	0.66	0.5090
cp40	performing administrative tasks	0.00148	0.00090081	1.64	0.1019
cp41	staffing organizational units	-0.00051045	0.00088721	-0.58	0.5653
cp42	monitoring resources	0.00020889	0.00063903	0.33	0.7439

Figure Captions

Figure 1. Sample O*NET rating scales from the GWA survey (top) and Abilities survey (bottom). A zero rating for the Level scale is given if the rater judges the job to be a '1' on the Importance scale, creating an effective 0-7 Level scale.

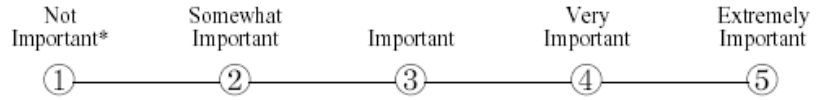
Figure 2. Frequency distributions of rater agreement *r*s for CMQ (left) and O*NET (right); values are based on the median interrater profile *r* across the 42 job dimensions in each OU.

Figure 3. R^2 values for CMQ (squares) and O*NET (circles) JCV equations; light solid lines denote equations with 42 job-content main-effects, dashed lines denote addition of female-percentages, and heavy solid lines denote models with sex-by-content interactions. Scale 0 reflects the median wage criterion, and scales 1-52 reflect the O*NET *Ability Survey* criteria (see Table 1 for labels).

4. Inspecting Equipment, Structures, or Materials

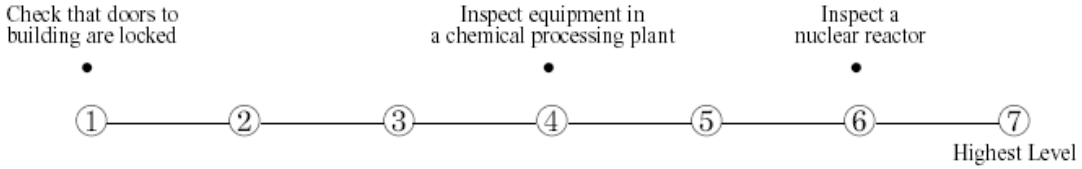
Inspecting equipment, structures, or materials to identify the cause of errors or other problems or defects.

A. How <u>important</u> is INSPECTING EQUIPMENT, STRUCTURES, OR MATERIALS to the performance of *your current job*?



* If you marked Not Important, skip LEVEL below and go on to the next activity.

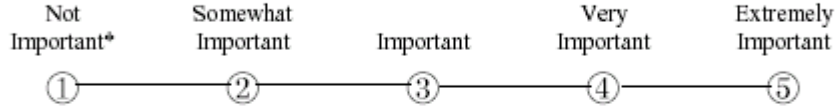
B. What <u>level</u> of INSPECTING EQUIPMENT, STRUCTURES, OR MATERIALS is needed to perform *your current job*?



1. Oral Comprehension

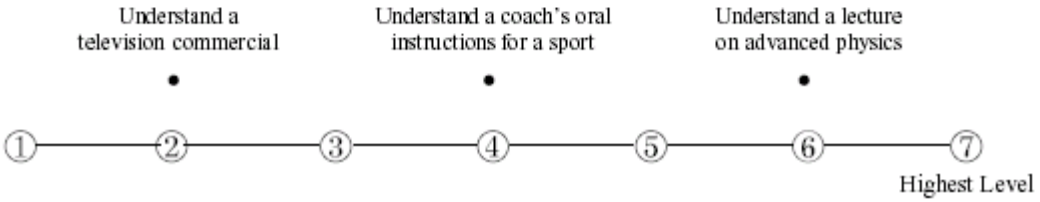
The ability to listen to and understand information and ideas presented through spoken words and sentences.

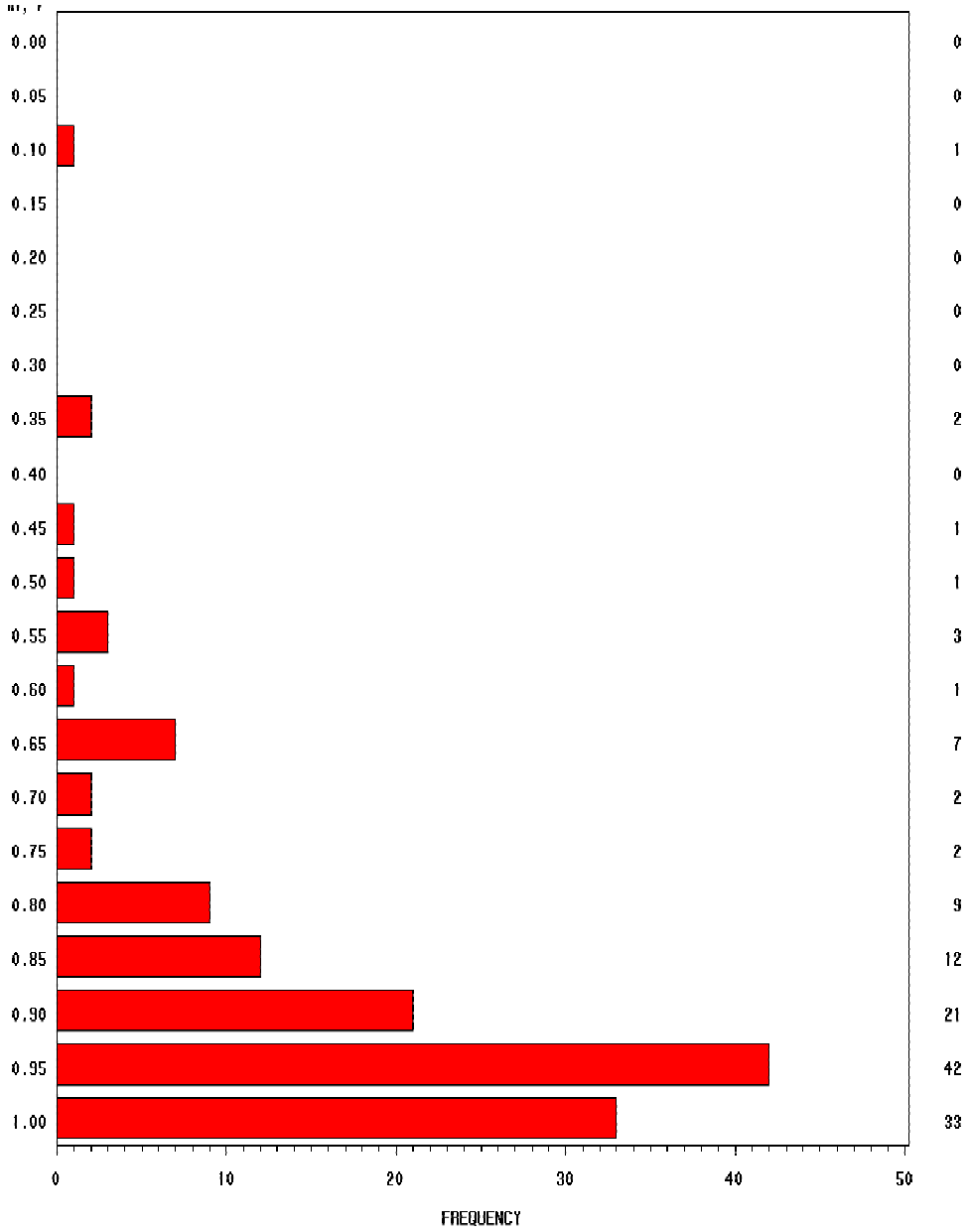
A. How <u>important</u> is ORAL COMPREHENSION to the performance of *your current job*?

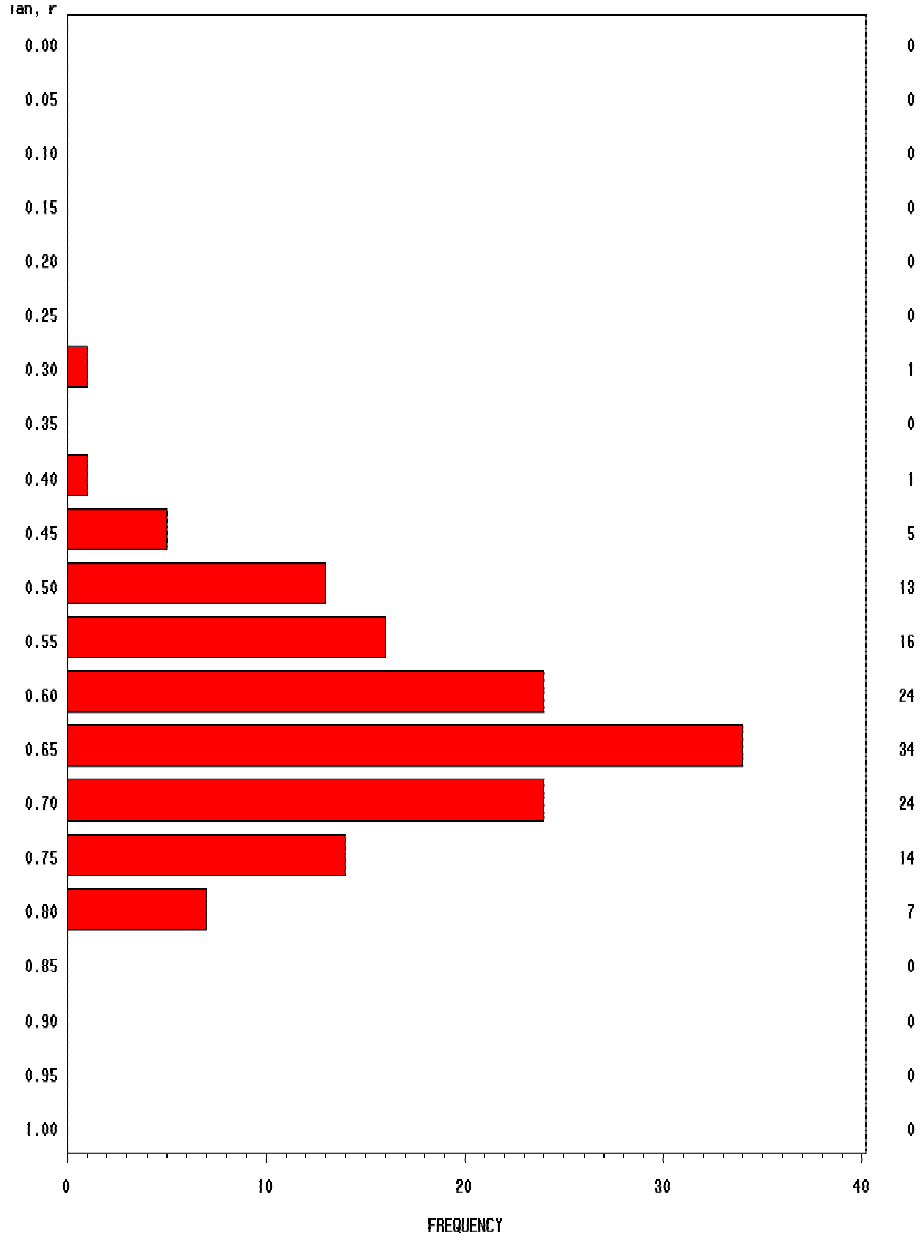


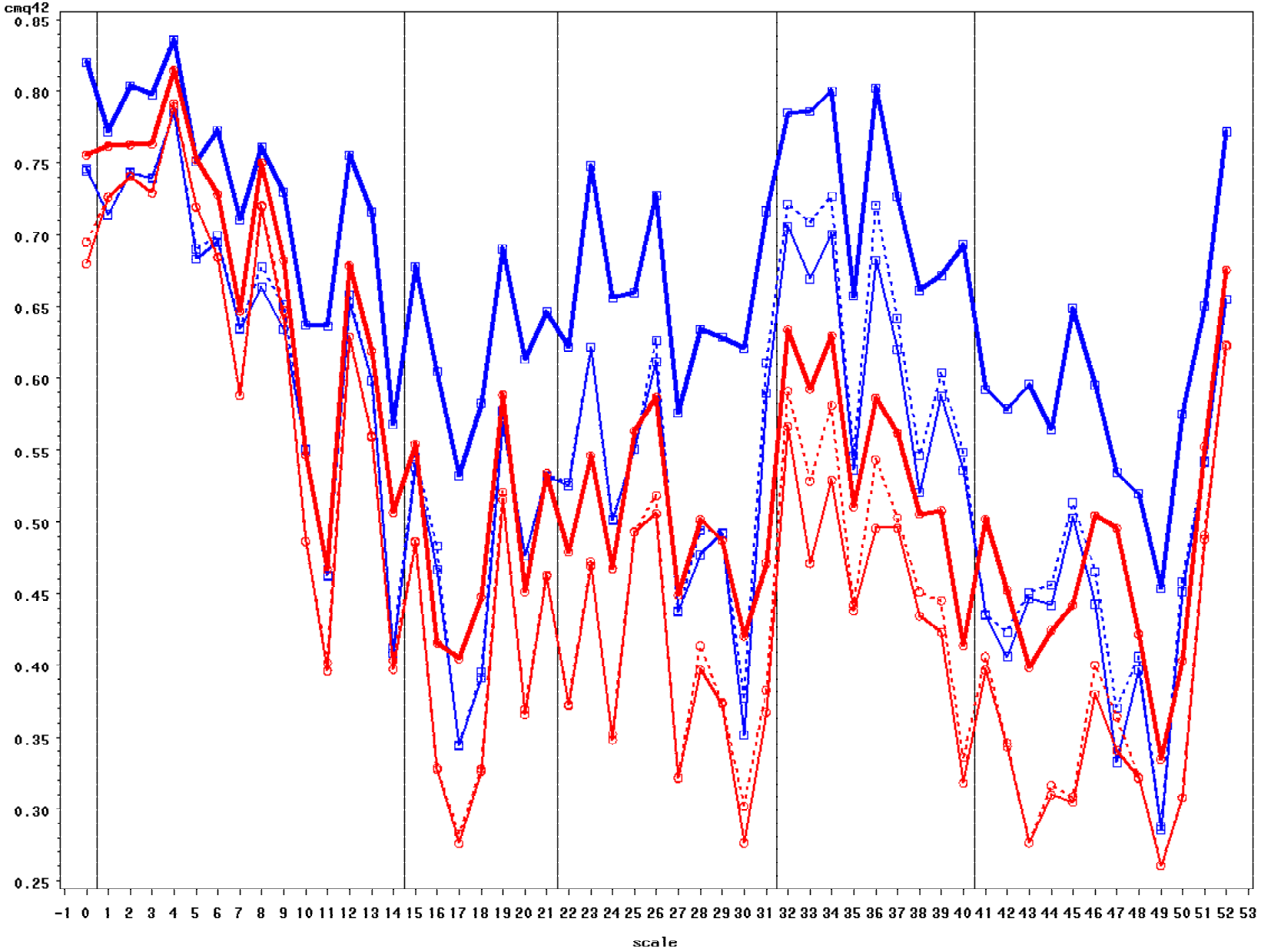
* If you marked Not Important, skip LEVEL below and go on to the next ability.

B. What <u>level</u> of ORAL COMPREHENSION is needed to perform *your current job*?




0.00 0
0.05 0
0.10 1
0.15 0
0.20 0
0.25 0
0.30 0
0.35 2
0.40 0
0.45 1
0.50 1
0.55 3
0.60 1
0.65 7
0.70 2
0.75 2
0.80 9
0.85 12
0.90 21
0.95 42
1.00 33
0
10
20
30
40
50
FREQUENCY


0.00 0
0.05 0
0.10 0
0.15 0
0.20 0
0.25 0
0.30 1
0.35 0
0.40 1
0.45 5
0.50 13
0.55 16
0.60 24
0.65 34
0.70 24
0.75 14
0.80 7
0.85 0
0.90 0
0.95 0
1.00 0
0
10
20
30
40
FREQUENCY


cmq12
0.85
0.80
0.75
0.70
0.65
0.60
0.55
0.50
0.45
0.40
0.35
0.30
0.25
-1 0 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53
scale