Combining Original "Analyst" O*NET™ Skill Questionnaire Constructs to Form More General Constructs for the Revised Incumbent Questionnaire

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This paper describes the rationale behind the steps that will be implemented to transition data collected using the prototype O*NET™ Skills Questionnaire into a data format compatible with the revised O*NET Skills Questionnaire.

Overview

There are two principal versions of the O*NET Skills Questionnaire. The first is the prototype questionnaire used in implementing the O*NET Content Model. For the development of the Content Model see *Development of Prototype Occupational Information Network (O*NET) Content Model* (Peterson, Mumford, Borman, Jeaneret, & Fleishman, 1995). The prototype instrument consists of 46 skill constructs rated on three types of scales: Level, Importance, and Job Entry Requirement. This version was completed by incumbents from about 50 Occupational Units (OUs) in a field test of the O*NET prototype instruments. It was also used by occupational analysts in rating the 1,122 OUs for the development of the initial O*NET database. The second is a revised version of the O*NET Skills Questionnaire. It consists of 35 skill constructs rated on two types of scales: Importance and Level. The revised version of the questionnaire is currently being used in the O*NET data collection effort, a national survey of job incumbents in O*NET-SOC occupations.

Experience gained in the prototype field test led to the recommended goal of shortening and simplifying all of the prototype questionnaires to reduce rater burden, to increase the response rate of incumbent raters, and to produce data that would be more accurate and user friendly to end-users. A panel of experts was formed to revise the questionnaires. The panel shortened and simplified the questionnaires primarily by removing rating scales, clarifying the text of all constructs, and removing those constructs for which there were insufficient theoretical or research grounds. In addition, there were theoretical grounds for forming new and more general construct composites. Fifteen constructs in the Skills Questionnaire were combined to form four new construct composites. Two of the new Skill construct composites result from combining two constructs each, one from combining three constructs, and one from combining eight constructs. The four new Skill construct composites replaced their constituent original constructs in the revised questionnaire. Note also that two constructs in the original Work Context Questionnaire were combined to form a new construct. Because no ratings exist in the O*NET 3.0 Database for the two Work Context constructs that were replaced in the revised questionnaire, they are of no further concern in this paper. For the process and specific results of the revision see *Revision of O*NET Data Collection Instruments* (Hubbard, et al., 2000).

The major purpose of the O*NET 4.0 Database is to present the ratings in the O*NET 3.0 Database collected using the original questionnaires in the form of the ratings to be collected with the revised questionnaires. Data exist in O*NET 3.0 for all fifteen of the Skill constructs that were replaced. Therefore, a recommendation was sought from the experts revising the questionnaires for combining the ratings in the O*NET 3.0 Database to form the new construct composite ratings. *The recommendation of the experts was to form the composite scores by* *simply averaging their constituent ratings from the O*NET 3.0 Database.*

Objective

The objective of this paper is to detail the constructs used in each of the new construct composites and to provide empirical evidence to support averaging the ratings of the same type (i.e., Level or Importance). The evidence comes from the factor analysis of ratings made on both types of scales by both incumbents and analysts (i.e., four sets of factor analyses were conducted for each of the four new construct composites). The factor analyses had three goals. The first goal was to demonstrate that a single factor underlies each of the new constructs. The second goal was to demonstrate that each of the constructs being combined has a majority of its variance (information) accounted for by the factor underlying the new construct composite. The third goal was to demonstrate that the constructs do not need to be differentially weighted before being averaged to form the composite Level and Importance scores.

Revised Construct Composites and Their Constituent Constructs

The number and name of the four new skill construct composites in the revised questionnaire and the number and name of their constituent constructs in the original questionnaire are:

17. Complex Problem Solving (Revised)
    17. Problem Identification (Original)
    18. Information Gathering (Original)
    19. Information Organizing (Original)
    20. Synthesis/Reorganization (Original)
    21. Idea Generation (Original)
    22. Idea Evaluation (Original)
    23. Implementation Planning (Original)
    24. Solution Appraisal (Original)

23. Quality Control Analysis (Revised)
    30. Testing (Original)
    33. Product Inspection (Original)

29. Systems Analysis (Revised)
    37. Visioning (Original)
    38. Systems Perception (Original)
    39. Identification of Downstream Consequences (Original)

30. Systems Evaluation (Revised)
40. Identification of Key Causes (Original)
42. Systems Evaluation (Original)

Method and Results

Two sources of Skill Questionnaire data exist that can be used to meet the goals of this paper. Four or more incumbents in 41 occupations rated their job on both the Importance Scale and Level Scale in the prototype questionnaire producing 915 sets of importance and level ratings (Peterson, et al., 1997). In addition, 25 occupational analysts and 32 industrial/organizational psychology graduate students, usually in groups of five or six, independently rated the 1,122 O*NET Occupational Units using the prototype questionnaire producing 6,605 sets of importance and level ratings (U.S. Department of Labor, 1998).

The factor analyses of the constructs combined to form each of the new construct composites were conducted using the four different types of data (two types of rater by two types of scales). A total of sixteen factor analyses were conducted.

To determine if a single factor underlies a construct composite, the average of the eigenvalues of the second factor across its four analyses were examined. Given that a value around 1.00 is generally considered the lower bound for factors that are meaningful, an average below .75 was selected as the criterion for demonstrating that only a single meaningful factor underlies one of the new construct composites.

To determine if a construct has a majority of its variance in common with the factor underlying a new construct composite, an average communality of .50 across the four analyses was selected as the criterion. This is a straightforward demonstration that a majority of a construct's variance is accounted for by the factor underlying the composite.

To determine if the constructs could be averaged without differential weighting in forming the level and importance scores, the criterion selected was that the smallest loading should be at least 75% as large as the largest loading within the construct composite's two analyses for the given type of scale (i.e., Importance or Level). This is a stricter criterion than the one commonly used in forming factor composite scores. The common criterion for averaging the scores of variables loading on a factor is simply that each has a substantial loading on the factor, given the variables have equivalent or equated standard deviations (Nie, Hull, Jenkins, Steinbrenner, & Bent,1975).

The results of the four factor analyses for each of the four new construct composites were similar. The average of the eigenvalues of the second factor across the four analyses for each new construct composite ranged from .34 to .63 (mean .47). The average of the communalities for the constructs ranged from .56 to .83 (mean .70). That is, at least 56% of the variance of any given construct is accounted for by the factor underlying the new construct composite. The smallest of the eight loadings for Complex Problem Solving measured on the Level Scale is 90% as large as the largest in the incumbent data and 89% as large as the largest in the analyst data, while for the Importance Scale these values are 86% and 80%. For Systems Analysis, these four values are 96% and 98% for Level and 96% and 98% for Importance. Because the constructs have the same loading in a factor analysis consisting of only two variables (constructs), the loadings did not differ for Quality Control Analysis and Systems Evaluation (however, all loadings exceeded .83).

These results provide ample evidence that each of the four new composites which were formed on theoretical and conceptual grounds also have an empirical basis. There is little reason to believe that a second factor underlies any of the four composites. A majority of the information (variance) in each of the constituent constructs is accounted for by the factor underlying them. *Finally, and most importantly, the low variation in the size of the factor loadings within each analysis supports the experts' recommendation that the constituent ratings in the O*NET 3.0 Database simply be averaged to form the new construct composites in the O*NET 4.0 Database.*

References

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