

DEVELOPMENT OF THE GENERAL WORK INVENTORY

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The services have a sophisticated task-based job analysis system which provides invaluable training and job descriptive information within occupational areas. Increasingly, however, requests are made for the comparison of related work functions or variables (e.g., skills) across occupational areas. A practical quantitative measure for comparing work activities in different career fields would facilitate broad description, comparison, and classification of such occupational information. This paper outlines a study to develop a structured questionnaire consisting of work activity/condition descriptors applicable to the entire occupational spectrum. In addition to outlining the potential applications of such a system, we will describe plans to rate a sample of enlisted Air Force jobs, assess instrument reliability and validity, and group jobs based on their work dimension profiles.

INTRODUCTION TO WORK STUDY

Historically, the idea of man's work has religious, ethical, social, and economic implications. Work is either a burdensome necessity, a means to an end, or a creative and valued act of man (Prien & Ronan, 1971). In this discussion, work is viewed as a process whereby one exerts effort to transform various inputs into prescribed outcomes. Since the turn of the century, job analysis has been synonymous with work study, as explained by McCormick and Tiffin (1974): "Job analysis can be considered as embracing the collection and analysis of any type of job-related information, by any method, for any purpose. Perhaps it can be defined more generally as the study of human work" (p. 49).

The field of job analysis includes both qualitative (conventional) and quantitative (structured) methods for collecting worker attribute and work performance information. The conventional approach is useful for describing specific jobs; however, such information is not generalizable. On the other hand, the structured approach provides a consistent framework for data collection and therefore the ability to compare and numerically classify the units of analysis. Frequently confusion in this area of investigation results from inconsistently defined and applied terminology. In an effort to reduce further confusion and assist the reader, several terms pertinent to this discussion are defined below.

A work element is a description of various kinds of work activities or conditions on which positions or jobs can be rated. Typically, such elements are general enough to be applicable to a wide variety of jobs.

A work dimension is a statistically derived construct representing work elements which commonly occur together in positions/jobs.

A job is a group of positions in which major tasks are similar enough to justify a single analysis within or across organizations.

A job family/cluster is a group of jobs or occupations which have common characteristics.

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The quantitative approach promotes more objective and systematic investigation of the relationship between work units. Commonly tasks, duties, and work elements/dimensions are used to analyze positions, jobs, or occupations. Molecular analysis of task and duty similarity between positions or jobs is typically done within the same organization, whereas more molar analysis of work element/dimension similarity between jobs and occupations is typically done across organizations. The relationship between these units of job analysis form a hierarchy for the study of work (Pearlman, 1980). Individuals performing tasks represent positions, positions containing similar tasks are grouped to form jobs, and jobs with common work elements/dimensions are grouped to form job families. A pictorial representation of these levels of work and descriptive measures, adapted from Pearlman (1980), is presented in Figure 1.

QUANTITATIVE WORK TAXONOMIC RESEARCH

Prien and Ronan (1971) drew two conclusions from a review of job analytic research. First, they found that few studies provide basic and generally useful information about work, workers, and occupations. Second, data from various job taxonomic efforts were not comparable because of procedural and measurement differences. Jones and DeCoths (1969) conducted a national survey of firms about their use of job analysis and attributed management dissatisfaction with these programs to a lack of standard quantitative techniques for gathering, recording, and presenting job information. Pearlman (1980) echoed the importance of systematic job analytic procedures in the development of a taxonomy of work performance:

The development of strategies for classifying and grouping jobs in some systematic fashion thus appears to be an essential step in the effort to devise a unified taxonomy of work performance, that is, one that addresses the relevant characteristics of both people and jobs. (p.3)

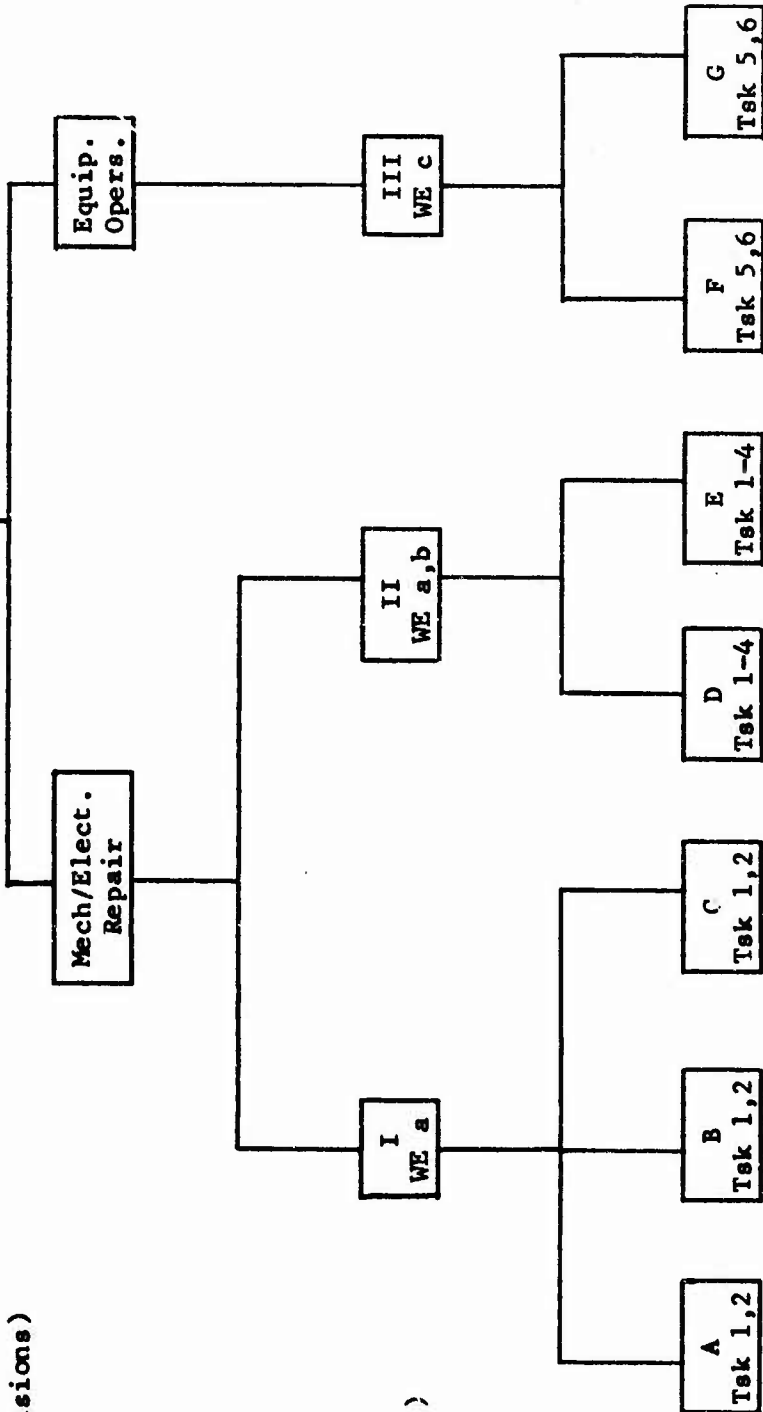
From both the theoretical and applied standpoint, standard quantitative work measurement procedures are important in the study of work.

Systematic procedures for studying jobs are available from quantitative job analytic research. These methods most often employ structured job questionnaires to gather information about the work accomplished in jobs within specified occupational areas. Probably the best example of this methodology is the task-inventory approach developed by the USAF and other services (Christal, 1974). Overall, the structured job analysis questionnaire has proven to be an economical and reliable tool for collecting job information. Taxonomic research to define common work denominators suggest new uses for this data collection technology.

Paralleling these improvements in data collection are conceptual advances promoting theoretical and practical interest in work taxonomic research (Cunningham, 1974; McCormick, 1979; McKinlay, 1976; Pearlman, 1980). Cunningham (1974) called the required technology for taxonomic definition and measurement of work "Ergometrics," and defined it as "the application of psychometric principles and procedures to the study of human work" (p. 7). Both McCormick and Cunningham have identified work activity/condition descriptors to serve as common denominators in job description and classification. These descriptive statements, applicable to jobs throughout the occupational spectrum, are promising variables for a comprehensive work taxonomic system. Moreover, job elements can be linked to defined human

Mech/Elect. Repair & Equip. Opers.
WD ABC

JOB FAMILIES:
(Elements/Dimensions)



JOBS:
(Tasks/Elements)

POSITIONS:
(Tasks)

Tasks (Tsk)

- 1. Diagnose engine problem } }
- 2. Service/adjust engine } }
- 3. Isolate malfunction } }
- 4. Remove or install wires } }
- 5. Start-up equipment } }
- 6. Control equipment } }

Work Elements (WE)

- a. Mechanical repair }
- b. Electrical repair }
- c. Equipment operations }

Work Dimensions (WD)

ABC. Mech/Elect repair & equip. opers.

Figure 1. An example of work analysis within an organization. Adapted from Pearlman (1980).

attributes for which there are tests (McCormick, Jeanneret, & Mecham, 1972; Pass & Cunningham, 1975), and can be used to cluster jobs with similar activity or attribute requirements (Pass & Cunningham, 1978; Shaw, DeNisi, & McCormick, 1977).

It is our thesis that the required tools for a comprehensive work description and classification system are psychometrically based job activity questionnaires (Cunningham, 1974). Two such questionnaires have been constructed with consideration of the "job-oriented" and "worker-oriented" dichotomy in work activity descriptors proposed by McCormick (McCormick, Cunningham & Gordon, 1967). The Position Analysis Questionnaire (PAQ) is primarily made up of worker-oriented activity statements (McCormick et al., 1972), while the Occupation Analysis Inventory (OAI) is both job- and worker-oriented (Cunningham, Tuttle, Floyd, & Bates, 1974). Both instruments portray work through an information-processing model with similar item categories. These inventories are representative of the state of the art in collection of quantified job activity information, and their descriptive taxonomies reflect job- and worker-oriented activities common to the world of work. However, widespread data collection with both of these instruments is somewhat limited by their complexity and the demands they place on the rater.

PROPOSED STUDY

Existing job activity inventories are often impractical because trained personnel or highly educated raters are required to collect job data with them. This study has two primary goals. First, we plan to develop a generally applicable structured work questionnaire which is simple enough to be completed by job incumbents. This instrument should be brief, clear to the typical job holder, and present a straightforward job rating task. Secondly, we hope to demonstrate how the questionnaire can be used to define activity/condition dimensions of jobs and how these dimensions can be used to meaningfully classify jobs. A practical questionnaire would not only facilitate the collection of quantitative information about jobs, but would also promote the use of a common language between employer and employee. A description and classification system based on such an instrument could find use in both personnel management and employment counseling.

In the proposed study, we plan to apply the previous OAI research to the following objectives:

- a. Develop a set of work descriptors based on factor analyses of the original OAI items by Boese and Cunningham (1976).
- b. Incorporate the resulting work variables into a structured questionnaire which can be administered to job incumbents. This instrument will be referred to as the General Work Inventory (GWI).
- c. Apply the GWI to a sample of Air Force jobs performed by skilled personnel. Different rater groups will analyze the same and different jobs. The resulting ratings will be used to determine item reliabilities within groups and rater agreement across groups.
- d. Determine the factor structure of the GWI elements and investigate the construct validity of the resulting GWI dimensions. Dimension validity will require evidence of factor stability and relevance to human attribute and job content criteria. For example, relationships between the GWI dimensions and worker aptitudes will be determined by regressing the GWI factor scores and aptitude-requirement estimates for a sample of jobs against their mean incumbent aptitude test scores. (Established aptitude-requirement

indices for jobs, such as relative learning load or cutoff scores, might also serve as criteria in the regression analyses.) In addition, it will be determined if existing Air Force job categories (i.e., content groups and groups based on the principal aptitude requirement) are significantly discriminable in terms of their mean GWI factor scores and aptitude-requirement estimates.

e. Apply the GWI dimensions to the development of a job taxonomy by grouping the sample jobs on their factor-score profiles. The obtained cluster structure will be checked for stability and meaningfulness. The Air Force classification scheme and overall job-similarity groupings will be used as criteria for comparison to the GWI-based job taxonomy. Additionally, if the GWI dimensions are relevant to aptitude requirements, the mean aptitude test scores of job incumbents should differ significantly across clusters.

The GWI is designed as a short version of the OAI which can be administered to job incumbents and experts. "Man is viewed as an information processing system which transforms information input into prescribed outcomes" (Cunningham et al., 1974, p. 8). This framework is suited to the process view of work (i.e., input-throughout-output) described earlier and relates to existing inventories as presented in Figure 2. The GWI elements are generated primarily from the OAI work dimensions, which represent types of tasks and conditions commonly occurring in the world of work. These elements should be suitable for job description and relevant to measured human attributes. The dimensions derived from GWI elements will cover broader aspects of related work which can be used to profile jobs for description, comparison, and classification purposes.

The target population in this study consists of the jobs performed by skilled (i.e., 5-level) enlisted personnel in the USAF. The Air Force Military Personnel Classification System groups positions in which related work is performed into specialties. (Jobs and specialties will be used interchangeably in this discussion.) The underlying principle of specialty formation is that the positions included have similar work requirements and therefore require similar abilities. The specialty will be the primary unit of analysis in this study. A sample of at least 200 5-level jobs (specialties) will be selected to represent the existing classification scheme. This sample should provide a reasonable representation of the ability and other work requirements in the target population.

Participants in this study will perform one of the following tasks: rate a position or job with the GWI, judge the pairwise similarity within a job subsample or rate the relevance of Armed Services Vocational Aptitude Battery (ASVAB) composite areas to GWI elements. Four different groups of personnel will rate enlisted 5-level specialties: Job incumbents (INC), their supervisors (SUP), occupational analysis specialists (OAS), and promotion test development personnel (PTD). Ratings by non-INC groups will be obtained to determine the reliabilities of different rater sources and agreement among these sources. Senior promotion test reviewers and occupational analysis personnel from the Occupational Measurement Center and career field functional representatives from the Manpower and Personnel Center will each judge the pairwise similarities of approximately 25 jobs. (All non-INC/SUP job raters and similarity judges will review formal job descriptions and relevant occupational analysis information when completing their respective rating task.) The pairwise job similarity ratings will be used to create a job similarity matrix as a basis for grouping jobs. Several ASVAB test development psychologists from the Human Resources Laboratory and personnel

<u>Position Analysis</u>	<u>Occupation Analysis</u>
<u>Questionnaire (PAQ)</u>	<u>Inventory (OAI)</u>
Information Input	Information Received
	--Information Content
	--Sensory Channel
Mediational Processes	
	Mental Activities
Work Output	
	Work Behavior
	--Physical
	--Representational
	--Interpersonal
Interpersonal Activities	
Work Situation & Job Context	Work Goals
Miscellaneous Aspects	Work Context

General Work Inventory (GWI)

What is Worked on

Behavioral Processes

What is Accomplished

Contextual Conditions

Figure 2. Work analysis frameworks.

psychology graduate students and staff from North Carolina State University will rate the relevance of major ASVAB areas to GWI elements. The mean relevance ratings for each element will be used as weights to derive aptitude-requirement estimates for jobs, according to McCormick's job component validity procedure (McCormick, Cunningham, & Thornton, 1967).

The process of collecting GWI job ratings is relatively straightforward. Questionnaires will be mailed to INC and their SUP, and ratings by OAS and PTD will be controlled by a liaison at the Occupational Measurement Center. Several INC in each job will rate their positions with or without the assistance of their SUP. A subset of 40-50 jobs, in career ladders undergoing Staff Sergeant promotion test revision during the administration period, will be rated by all groups. For these commonly rated jobs, INC and their SUP will independently rate the INC's position; whereas in all the other 150-160 jobs INC and SUP may work together to rate the INC's position. In order to collect three ratings for each job from non-INC/SUP groups, we will ask each OAS to rate about four of the common jobs and each PTD to rate the 5-level job for the career ladder in which they are developing the promotion test.

The following analyses will be performed:

- a. Interrater item reliability analyses. These analyses will be carried out within each of the four rater groups (INC, SUP, OAS, and PTD), and ratings will be compared for agreement across the four groups.
- b. Computation of GWI aptitude-requirement estimates for jobs, following McCormick's job component procedure. These estimates will be derived by combining job ratings on the GWI elements with those elements' aptitude-requirement weights.
- c. Factor analyses of the GWI elements. These will include factor analyses of sections (or groups) of GWI elements, as well as an overall analysis of the entire set of elements. A factorial stability analysis will involve: (1) dividing the job sample into two equivalent subsamples, (2) performing independent factor analyses with both subsamples, and (3) comparing the results for replication across the subsamples.
- d. Cluster analyses of jobs. The jobs in the sample will be cluster analyzed on two bases: (1) similarities among their GWI factor-score profiles and (2) analysts' pairwise job similarity judgments. The clusters derived from these two data bases will be compared for agreement with each other and with the Air Force classification scheme.
- e. Several construct validation analyses will be carried out, including: (1) regression analyses of jobs' GWI factor scores and ability-requirement estimates against the ability test scores of job incumbents (and possibly against the established test cutoff and relative learning load scores for the jobs); (2) analyses to determine the discriminability of GWI-derived job clusters in terms of the ability test scores of incumbents in the jobs comprising the clusters; (3) analyses to determine the discriminability of existing Air Force job categories (both content and aptitude groupings) in terms of the GWI factor scores and ability-requirement estimates of the jobs comprising those categories; and (4) the cluster comparisons mentioned in paragraph d above.

WORK CLASSIFICATION SYSTEM UTILITY

Successful performance of the GWI in this study would support continued research of this general approach in Air Force work analysis. An effective occupational information system would cover a range of descriptive specificity,

from task statements (applicable to restricted groups of positions), to more general work elements and dimensions (applicable to the broad occupational spectrum). The utility of the system would also depend on its ability to interrelate the different types of descriptive variables (e.g., tasks, work elements/dimensions, and human attributes). The task inventory would remain the major methodological component in such a system, supplemented by one or more instruments containing descriptors of a more general nature.

A quantitative work taxonomy would have numerous applications for describing, relating, and researching the characteristics of jobs and workers. The identification of work variables applicable to the entire occupational domain could provide a basis for describing and classifying a wide variety of jobs within the same system. The linkage of these work descriptors to measurable human attributes would permit determination of relationships between people and jobs. In a sense, this relational mapping could serve as a table of contents for understanding commonalities in the work activities and human requirements of jobs and job families. Such a system could facilitate a variety of human resource development efforts. For example, applications might be found in such areas as occupational exploration and guidance, recruitment, job transfer, career development, training, test development, and selection/assignment.

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