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A Developmental Theory of Job Performance: Applications in Two Navy Ratings

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1. This research and development was conducted within the exploratory development project RF63-521-804 (Manpower and Personnel Technology), work unit 040-03.01 (Dimensions of Job Performance). The purpose of the work unit is to define general dimensions that describe the global construct of human performance at work and to identify measures of such dimensions. Such dimensions will provide a framework for estimating how effective a single measure may be in predicting job performance. This exploratory development was conducted under contract DAAG 29-81-D-0100, delivery order 1907.

2. Enclosure (1) is the fifth in a series produced under this work unit. The previous reports described (1) factors that made it inappropriate to try to use personnel record data to develop a surrogate measure of job performance that would generalize across ratings and grades; (2) a model of the principal dimensions that comprise human performance at work; (3) a model of specific work-related social interactions and the factors affecting such interactions; and (4) the results of a task analysis demonstrating the contribution that the inclusion of social interactions makes to job analysis.

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**A Developmental Theory of Job Performance:
Applications in Two Navy Ratings**

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SUMMARY

Problem

Theories that link human abilities and traits to job performance are generally static, in that no provision is made for changes over time in the relationships among important variables. Research suggests that the relationships between measures of cognitive abilities, psychomotor abilities, and personality traits and measures of performance on a wide variety of tasks change over time. In particular, research suggests that cognitive abilities are most important when an incumbent is new to a job, and that personality traits affect performance only after the basic tasks that comprise the job are mastered. A theory of job performance that accounts for these changes is needed.

Purpose

The purpose of this research is to develop and apply a theory of job performance that takes into account changes over time in the relative contribution of cognitive abilities and dispositional variables (e.g., personality traits, social skills) to performance on the job. The research described here comprised two separate activities: (a) description of the theory itself, including the major variables referred to by the theory, the stages that define the theory, and the relationships among these variables for each stage described by the theory, and (b) field interviews with incumbents in two Navy ratings to assess the potential applicability of the theory.

Approach

Semi-structured interviews were conducted with groups of Machinist's Mates and Radiomen who were near the beginning, near the middle, or near the end of their first enlistment. Thirty-one incumbents from these three cohorts were interviewed to determine: (a) the extent to which they were required to learn new duties at different points in time, (b) the types of decisions required by their jobs, (c) the level of thought or concentration required by their jobs, and (d) the perceived importance of job knowledge, skills, motivation, social knowledge and skills, and personality traits as causes of effective performance. These data allowed us to test the hypothesis that the cause of performance would vary systematically as a function of time on the job.

Results

Data from the interviews suggest that individual differences within cohort were larger than differences between cohorts. Although data did indicate systematic differences in the amount of thought or concentration required on the job, there were few other significant differences between cohorts. The hypotheses suggested by the theory were not supported.

Conclusions

Although it is possible to derive a theory of performance that accounts for the changing roles of cognitive ability and personality variables as causes of job performance, the applicability of this theory is not yet established. The data obtained here suggest that the theory may be more useful in simpler jobs than in more complex ones, and may be more useful when incumbents have many years of experience than when they are relatively new to the job. In addition, longitudinal designs may be preferable to cross-sectional research designs in assessing the validity of this theory.

Recommendations

Further research is needed to assess the applicability of this theory in a broader range of ratings, and for incumbents with a broader range of job tenure. Further theoretical development is needed to specify more clearly the variables involved in this theory, and to guide the development of better measures of these variables. Further research is also needed to determine whether the theory can be applied to groups, or only to individuals. Finally, applications of this theory in individual job-related counseling and assessment should be explored.

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INTRODUCTION

This report describes a theory of job performance that proposes that the determinants of job performance change systematically over time, and applies that theory to two Navy ratings. The central assumption of the theory is that the relative importance of cognitive ability is greatest during transitional periods, when the incumbents are learning to do their jobs, and that the relative importance of dispositional factors (e.g., personality, motivation) is greatest during stable periods, when job skills are well learned and job tasks have become routine. Research suggesting that the determinants of job performance change over time is reviewed below. Next, the developmental theory is described in detail. Finally, the theory is applied to predict the determinants of job performance among first-term enlisted personnel in the Machinist's Mate and Radioman ratings.

Cognitive Ability and Job Performance

Measures of cognitive ability have shown consistent evidence of validity in predicting performance in a wide variety of jobs (Hunter & Hunter, 1984; Schmitt, Gooding, Noe, & Kirsch, 1984). Furthermore, the validity of cognitive ability measures is consistently greater than or equal to that of available alternatives, such as interviews, simulations, and biographical information blanks (Reilly & Chao, 1982). This line of research leads to the conclusion that general cognitive ability is an important cause of individual differences in job performance. However, despite the extensive body of research on cognitive ability and performance (e.g., Schmidt & Hunter, 1981; Hunter & Hunter, 1984), there has been comparatively little thought given to the question of how cognitive ability is translated into performance (see, however, Fleishman & Quaintance, 1984; Hunter, 1983; Schmidt, Hunter, & Outerbridge, 1986).

Schmidt et al. (1986) suggest that cognitive ability is a causal variable in attaining job knowledge, which in turn is the major cause of performance on work samples (see also Hunter, 1983). Their analysis suggests that job experience is also a major cause of job knowledge, but that the influence of individual differences in experience decreases after approximately five years on the job. Additional analyses suggest that incumbents continue to learn their jobs well after the five-year mark, and that cognitive ability is the major cause of job knowledge among more senior incumbents (Schmidt & Hunter, 1986).

In addition to its role in determining the ease of acquisition of job knowledge, cognitive ability may be an important determinant of effective judgment and decision making on the job (Vernon, 1960). Decision making is regarded as an important facet of managerial performance (Cascio, 1982); this dimension may also be important in lower-level jobs. In particular, employees may have to exercise judgment when performing new or unfamiliar tasks; when tasks are overlearned or routine, fewer judgments will be needed to perform the job effectively.

Consideration of the roles that cognitive ability might play in determining job performance leads to the hypothesis that cognitive ability is most important when job duties are ill-defined, poorly understood, or new to the incumbent. That is, individual differences in cognitive ability are likely to be most relevant when incumbents are still learning to do their jobs. In higher level jobs which require unstructured judgments and adaptation to unpredictable environments, incumbents may never "learn" their jobs. However, in many lower-level, unskilled jobs, the tasks that comprise the job are eventually learned by all incumbents; once these tasks are learned, task performance may be a matter of routine. As a result, individual differences in cognitive ability may no

longer be relevant in predicting job performance. This line of reasoning suggests that the predictive validity of measures of cognitive ability may vary over time for an individual or a cohort of individuals. Specifically, it is possible that the validity of tests of cognitive ability is highest in periods of transition, when individuals are learning to do their jobs, and lowest in periods of stability, when major job tasks are sufficiently overlearned to become routine.

Temporal Variation in Causes and Correlates of Performance

The hypothesis that the validity of different classes of predictors varies systematically over time has been the subject of extensive research. This research suggests that the nature of tasks that make up a job changes over time, that the abilities related to job performance change as tasks change, that the abilities related to performance on a specific task change with practice, and that orientations to the job change over time.

Changes in the Job

The tasks, responsibilities, and expectations of individuals working in a particular job change systematically as a function of job tenure. In general, a worker's first few months on the job are assumed to represent an initiation phase, in which the worker learns critical job tasks (Berlew & Hall, 1966) and develops stable attitudes and expectations concerning the job (Katz, 1978a, 1978b, 1980; Mowday, Porter, & Steers, 1982). Graen (1976) notes that employees' perceptions of their work roles are ill defined when they start their jobs, and that the job is not fully understood by employees (or possibly their supervisors) during their first few months on the job.

Helmreich, Sawvin, and Carrsud (1986) note that a "honeymoon effect" may exist during an employee's first few months on the job. During this period, the job may be seen as novel and challenging, resulting in an unusually high level of output and job commitment. Their data suggest that personality measures show higher levels of validity after six to eight months on the job than during the first three months (presumably the "honeymoon" period), when there is less variability in job performance.

Experienced workers not only differ from new workers in terms of their attitudes, expectations, and work-role perceptions, they also differ in terms of the tasks they perform. In jobs that involve significant decision making, experienced workers are likely to have the responsibility for these decisions. However, in jobs that involve routine tasks, the opposite is likely to be the case. That is, newer workers are likely to be assigned to training functions, while experienced workers devote their time to the most routine tasks. There is considerable evidence that the abilities needed for successful performance change as the tasks performed by workers in the same job change.

Tasks and Ability Requirements

A program of research by Fleishman (1975) and his associates has shown that minor changes in the tasks performed by subjects can lead to significant changes in the validity of different ability measures (Fingerman, Eisner, Rose, Wheaton, & Cohen, 1975; Rose, Fingerman, Wheaton, Eisner, & Kramer, 1974; Wheaton, Eisner, Mirabella, & Fleishman, 1976. See also, Zimmerman, 1954). For example, Fleishman (1975) varied the degree of display-control compatibility in a simple psychomotor task. As the position of the control switches was rotated relative to the configuration of the stimuli, he observed systematic changes in the correlations between spatial, perceptual, and psychomotor reference tests and task performance. Rose et al. (1974) showed similar results when minor facets of an

electrical troubleshooting task were varied. For example, the correlations between ability measures and performance changed as the difficulty of the task was manipulated in minor ways (e.g., by reversing some wires).

There are also indirect indications that relatively small changes in tasks lead to changes in the validity of ability tests. For example, Humphreys (1968) showed that high school rank in class is a better predictor of grades in the first year of college than in the fourth.¹ One interpretation of this result is that, while the general nature of the student's "job" does not change over the years, specific changes in the nature of the courses and tasks performed lead to a change in the predictive ability of rank in class measures. In a study using cross-sectional design, Kozlowski and Hultz (1986) suggest systematic changes in the determinants of engineers' performance over time; these changes may in part be due to temporal variation in the complexity of this job.

Practice Effects

Even when the task does not change over time, there is evidence that extensive practice on a task changes the correlation between a variety of measures of cognitive ability and task performance. In a widely cited study, Fleishman and Hemphill (1955) demonstrated changes in the validity of cognitive and psychomotor ability measures for predicting performance in a visual task as a function of practice. Fuchs (1962) obtained similar results with more complex tasks.

Two models have been put forth to explain the effects of task practice on the validity of ability measures, the changing-task model, and the changing-subject model. The changing-task model suggests that the structure of the task itself changes with practice; the changing-subject model suggests that the abilities and characteristics of individuals that determine task performance change over time. Available research casts doubt on the changing-task model (Jones, Dunlap, & Bilodeau, 1984); the changing-subject model has received more consistent support (Alveres & Hulin, 1972, 1973; Dunham, 1974). In general, this research suggests that the abilities and characteristics that account for performance on a well-learned, well-practiced task are different than those that account for performance on similar tasks that are new to the incumbent.

The concept of a "dynamic criterion" (Ghiselli & Haire, 1960) is often cited in conjunction with research on practice effects and on the effects of small changes in job tasks. Dynamic criterion research implies that both the nature of the job and the predictors of job performance change continually over a person's tenure in the job. However, Barrett, Caldwell, and Alexander (1985) caution that much of the evidence that appears to support the dynamic nature of criteria may, in fact, reflect random variation in validity coefficients obtained from small samples. They suggest that changes in the validity of ability measures occur for relatively new workers, but that the abilities that contribute to the performance of experienced workers are remarkably stable over time. Their review does not specify the level of job tenure that discriminates new from experienced workers.

¹These results are adjusted for differences in range restriction.

Work-Role Orientation

Although research on dynamic criteria suggests that changes in the ability-based determinants of job performance may be restricted to an employee's early months or years on the job, research on job attitudes suggests that longer-term changes in the impact of dispositional variables may be possible. For example, Rønen (1978) suggests that a U-shaped function is needed to describe the relationship between job tenure and job commitment and satisfaction. Commitment is high for new workers, then goes through an extended period of decline, but then rises again for experienced workers who are well established in their jobs. Buchanan (1974) and Kopelman (1977) document long-term changes in the levels and the predictors of motivation and work-role commitment. Thus, even if the abilities that contribute to job performance stabilize over time, it is possible that the attitudinal and motivational variables that also contribute to performance are less stable.

Summary

Research reviewed here suggests that the abilities and dispositional variables that predict the performance of an incumbent who is new to the job may be different from those that predict the performance of experienced workers. First, the specific tasks, duties, and responsibilities of workers with the same job title may vary as a function of job tenure, and this may in turn lead to variation in the abilities required for successful performance. Second, even if the tasks and duties remain the same over long periods of time, individual differences in the amount of practice with each task may affect the relative contribution of different abilities to performance. Finally, work role perceptions and job attitudes may change as a function of job tenure; these changes may also affect the causal structure of job performance.

The section that follows outlines a Developmental Theory of Job Performance that proposes systematic changes in the cause of job performance as a function of levels of job experience or tenure. The mechanisms assumed to account for these changes, the stages that characterize the theory and the general predictions generated by the theory are described. The final section of this report applies the theory to predict the determinants of job performance for personnel in their first enlistments in the Machinist's Mate and Radioman ratings.

DESCRIPTION OF THE THEORY

All theories of job performance begin by identifying sets of input variables and outcome variables. Input variables are characteristics of the person (and perhaps the situations) that are regarded as causes of job performance; variables such as ability, motivation, and personality are identified as input variables in many theories. Outcome variables such as task accomplishment, interpersonal relations, and absenteeism are often identified as outcome variables. A static theory of job performance is one that identifies relationships between input and outcome variables that are assumed to be essentially invariant over time. Research on validity generalization, for example, implies a static model, in which cognitive ability is a major determinant of performance for all workers in all jobs (Hunter & Hunter, 1984; Schmidt & Hunter, 1981. See, however, Hunter, 1983; Schmidt et al., 1986). The theory described here is dynamic, in the sense that the relationships between input and outcome variables are assumed to change as an incumbent progresses through well-defined stages of his or her tenure on the job. Thus, the key

concern of the theory is with the identification of stages and of the changes in the causal structure of job performance as an incumbent moves from one stage to another.

The basic components of the theory include the stages themselves, the input and outcome variables, and the relationships among these variables. These are described below, and then an outline of the theory describing how input-outcome relationships change across stages is presented.

Stages

There is extensive research on the stages that may characterize a person's career (see, for example, Katz, 1980; Van Maanen, 1982). This research is typically concerned with changes in the job and in the worker's orientation to the job over a very long time span (i.e., the entire career). Less research exists concerning the stages that may describe a person's transition from his or her first day on the job to the point where he or she is regarded as an experienced worker. Research reviewed earlier in this report suggests that the causal structure of performance is probably different for new workers than for experienced workers.² To date there have been few attempts to describe in a systematic way these differences.

Research on practice effects and on task changes over time suggests the causes of job performance may vary over two distinct stages, a transition stage and a stable stage.

Transition Stage

Transitions occur when an employee is new to a job, or when the major duties or responsibilities of a job change. In periods of transition, job duties procedures and methods of operation are new or undefined, and the workers must learn new skills and new tasks, and must make decisions about unfamiliar topics. During transition stages, performance on specific, concrete tasks will depend heavily on cognitive ability since (a) during transitions, workers must acquire new information, and (b) workers cannot rely on past experience, but rather must rely on sound judgment to perform their jobs.

Stable Stage

Between periods of transition, workers in many jobs will enter stable stages in which major job tasks are well-learned, and can be performed with minimal mental effort. During stable stages, job performance is a matter of routine; at this point, individual differences in job performance are probably more a function of differences of personality and motivational factors than of differences in cognitive ability. The distinguishing characteristic of the stable stage is that the worker has learned to perform all major job tasks, and is no longer confronted with situations that present novel or unpredictable demands.

Progression Through Stages

The duration of each stage, as well as the frequency with which transition stages occur, will vary as a function of the person and the job. Assembly line jobs represent one

²Research in artificial intelligence on the differences between expert and novice decision strategies has reached similar conclusions (Chi, Glaser, & Rees, 1982).

extreme, in which the job does not change substantially over time, and is relatively simple. Here, the transition stage would be relatively short; once the worker had learned his or her job, performance would be a matter of executing well-learned, routine tasks. The opposite extreme is represented by some managerial jobs which change so quickly and so often that workers are constantly in a stage of transition.

It is assumed here that most jobs feature multiple transition phases that vary in length, both across occasions and across individuals. First, it is assumed that all new workers start off in a transition stage, and that some workers reach a stable stage more quickly than others. The length of the initial transition stage will depend on both individual characteristics (e.g., ability, motivation) and situational characteristics (e.g., quality of training, informal instruction). Second, it is assumed that in most jobs there are occasional changes in the nature of the job that require further learning, thus triggering additional transition stages. Some of these changes will be due to external events (e.g., change in the technology), and will have a uniform effect on all workers. Other changes will reflect strictly local events (e.g., a new supervisor who introduces different procedures) or will be a direct function of the worker himself. An example of the latter occurs when a worker receives additional duties, responsibilities, etc., as a result of mastering his or her present duties. As a result, transition stages cannot be uniquely identified with external events or formal milestones (e.g., promotions); some transitions will occur even though the job title and description have not changed.

Because transitions can occur as the result of both structural changes in the job itself (e.g., introduction of new technology, promotion into new job) and changes in the worker or the work environment (e.g., duties or expectations changing as new skills are mastered), full implementation of the theory would require a longitudinal approach in which individuals were tracked over significant periods; this approach would make it possible to identify transition and stable periods for each individual. In general, the relative predictive power of ability and dispositional measures may depend on the proportion of workers who were in transition vs. stable stages at the time their performance is measured. Application of the theory in a cross-sectional design, in which the performance of workers with different levels of experience is measured at a single point in time, is most feasible in jobs that feature predictable changes in job duties as a function of job tenure.

Input and Outcome Variables

The variables that define the domain of job performance, as well as those thought to explain performance, are described in detail in a report entitled "Dimensions of Job Performance" (Murphy, 1986a). A brief summary of these variables is included here to help orient the reader.

Inputs

Five types of individual difference variables can be identified, and can be classified as either fluid or fixed. Fluid variables are those that are susceptible to change over short periods of time, and include Training and Experience. Fixed variables are those that are unlikely to change over reasonably short periods, and include Cognitive Ability, Psychomotor and Information-Processing Skills, and Personality.

Training refers specifically to participation in structured programs designed to teach well-defined skills or knowledge bases, and includes both Navy courses and academic coursework. Experience refers to previous work experience, both within and outside the

Navy; this variable is relevant for understanding the development of both job skills and job attitudes (e.g., satisfaction, expectancy beliefs). Cognitive ability refers to the domain covered by traditional IQ tests. Psychomotor/Information Processing skills refer to the specific domain of skills involving elemental mental processes and/or the coordination of such processes with body movements. Personality refers to relatively stable differences in reactions to a broad range of situations.

Outcomes

Three levels of outcomes can be identified: (a) motivational states, (b) work behavior, and (c) value to the organization (Navy) which is a product of what one does and how well one does it.

The focus of the current paper is on explaining work behavior; the work behavior domain will therefore be described in some detail. As noted in "Dimensions of Job Performance," this domain can be classified into task vs. non-task behaviors and into on-site vs. off-site behaviors. Off-site task behaviors include the acquisition and exercise of job-related skills and knowledge. Skills refer to basic behavioral components of task performance, such as tool use, troubleshooting, or typing. Knowledge refers to both factual and procedural knowledge which is directly related to performing a specific task. Skills and knowledge combine to form the final off-site task behavior, referred to as job proficiency. Proficiency refers to the ability to perform tasks under ideal, controlled conditions.

A distinction is made between job proficiency (what a person can do) and actual task performance on the job site (what a person does). On-site task behaviors are broken down into individual task performance and task performance as a member of a work team. There are other behaviors which take place on the work site which do not directly or uniquely involve task performance, but which, nevertheless, affect job performance. On-site, non-task behaviors include (a) Interpersonal Relations, (b) Down-Time behaviors, and (c) Destructive/Hazardous behaviors. Interpersonal Relations refer primarily to relations with supervisors and co-workers, although relations with others which affect work performance (e.g., with superior officers) would also be relevant.³ Although several tasks require interpersonal interactions, this domain of behaviors is not uniquely tied to any particular task. Down-Time behaviors are those which result in the physical absence from, or in reduced levels of functioning in, the work site. This class of behaviors includes absenteeism, lateness, and drug and alcohol abuse. Destructive/Hazardous behaviors include those that are likely to lead to accidents, work stoppages, or equipment failures, as well as breaches of safety and security regulations.

An individual's Overall Effectiveness in Position depends on a combination of task and non-task behaviors. The relative contribution of these two classes of behavior will vary from position to position, and will also vary across different stages of an individual's tour of duty.

Relating Input and Outcome Variables

In "Dimensions of Work Performance," a general model was presented describing the relationships among input and outcome variables. This model is presented, in slightly modified form, in Figure 1. Several facets of this model require some elaboration.

³Interpersonal relations also affect task accomplishment in ratings where tasks include interpersonal components (e.g., HM's must work with patients).

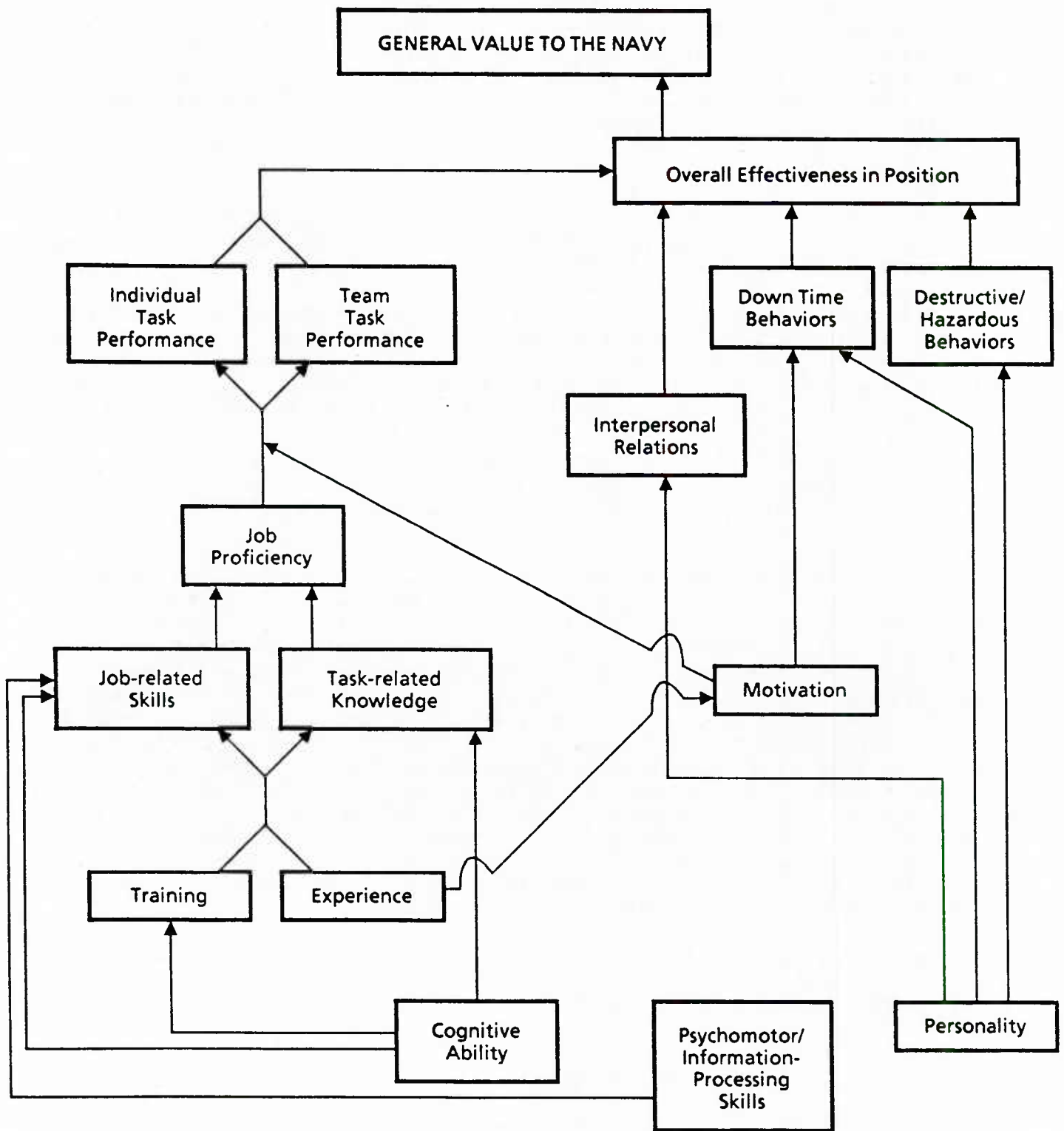


Figure 1. General model.

First, the spatial organization of Figure 1 corresponds roughly with the causal sequence of the model. That is, causation always flows upward from fixed inputs to the person's value to the organization. Second, the model is concerned almost exclusively with main effects. There is one exception: motivation is thought to moderate the relationship between job proficiency and on-site task performance. Third, no attempt is made here to estimate the relative or absolute strength of the proposed linkages. In part, this is a reflection of the fact that these relationships are not invariant across time. The focus of the developmental theory outlined here is on the way in which the relative strength of each link changes as an individual progresses through the stages described earlier.

Outline of Theory

In the sections that follow, relationships among input and outcome variables are described as either weak, moderately strong, or strong. The focus of a developmental theory is necessarily on the way in which the strength of different relationships changes over time. Some of these relationships, however, are thought to be invariant across all stages of a person's career. These will be described first; the remaining relationships will be described separately for each stage.

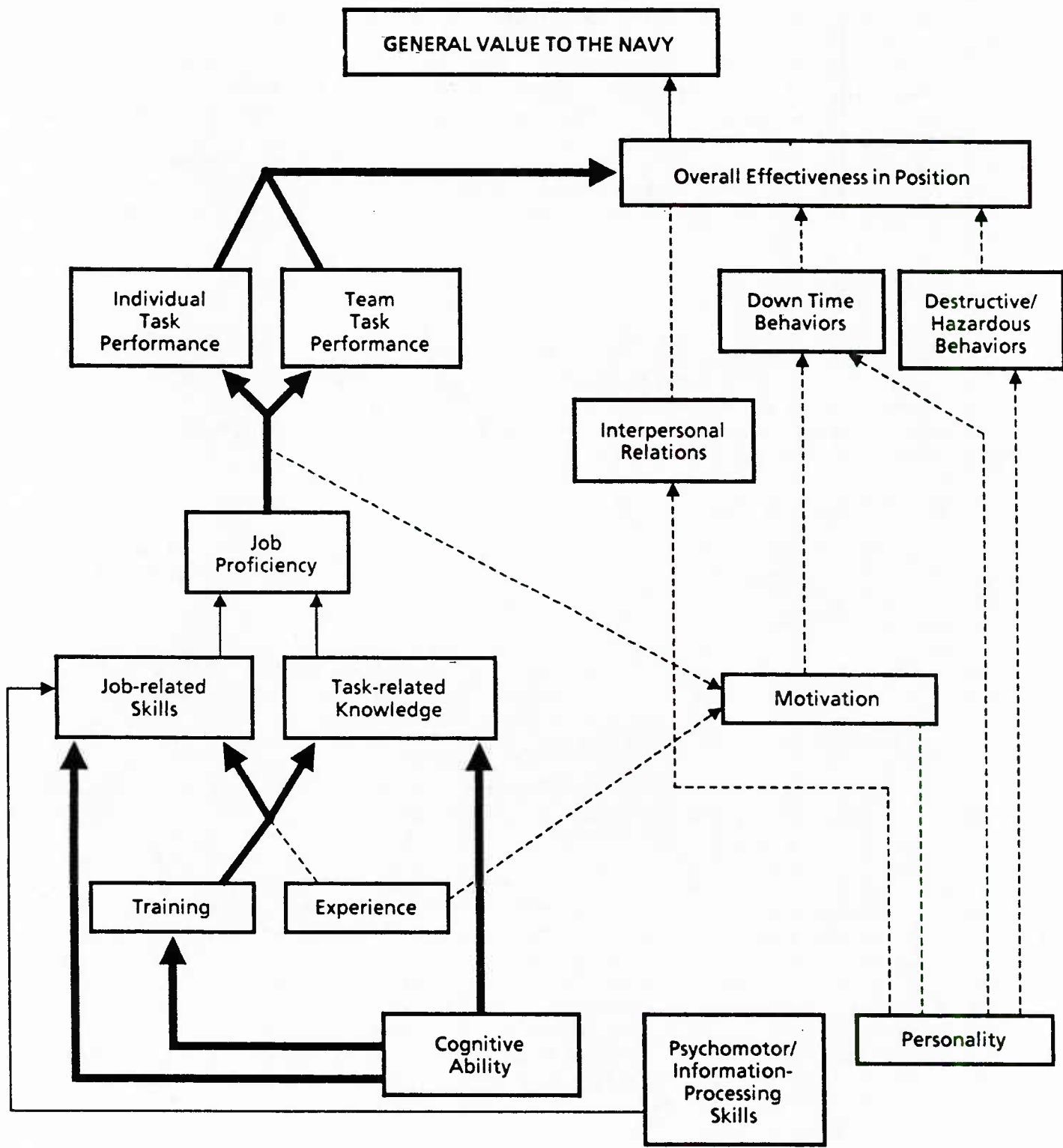
Invariant Relationships

Two relationships are assumed to remain stable throughout the individual's first enlistment. First, Overall Effectiveness in Position always has a moderately strong effect on the individual's General Value to the Navy. This is a reflection of the fact that a person's value depends both on what he does and on how well he does it; Overall Effectiveness speaks only to the latter of these. Second, Psychomotor and Information-Processing Skills are moderately related to Job-Related Skills, reflecting the fact that job skills are by definition broader than their elemental perceptual and cognitive bases.

Relationships During Transition Stage

Two assumptions are made concerning the transition stage. First, since new information must be acquired and new tasks performed during this stage, cognitive and information-processing ability are highly important. Second, since the job contains novel and unfamiliar tasks, workers are more interested and motivated than during stable periods, leading to a lower incidence of interpersonal problems, down-time behaviors, and destructive/hazardous behaviors.⁴ These two assumptions are clearly reflected in Figure 2, which illustrates the hypothesized relationships between input and outcome variables during stages of transition. First, all of the direct and indirect links between cognitive ability (and information processing ability) and task performance are hypothesized to be strong or moderately strong. Second, the effects of individual differences in motivation and personality are hypothesized to be weak, and outcome variables that are linked to these dispositional inputs are hypothesized to have a weak impact on overall effectiveness. The rationale here is that during transition periods the job itself is a significant source of motivation, which overwhelms whatever influences individual differences in dispositional variables might have.

⁴For reviews of the motivational and behavioral consequences of novelty and variety in job tasks, see Hackman & Oldham (1976), Helmreich et al. (1986) and Katzell et al. (1975).



——— STRONG
 - - - WEAK
 — MODERATE

Figure 2. Relationships during transition stages.

It should be noted that although experience has only a weak effect on performance during transition stages, experience is nevertheless a very important variable. In general, individual differences in experience should be correlated with the relative length of each transition period. The more experience a worker has in his or her present job (or similar jobs), the shorter the transition period is likely to be. Except in unusual cases where stable periods are extremely long (e.g., some assembly line jobs), experienced workers will more quickly adapt to changes in the technology, in duties, or in their job routine.

Relationships During Stable Stage

The key assumption that characterizes the stable stages is that workers have mastered the skills and knowledge needed to achieve full job proficiency. As a result, there are at this stage few meaningful differences in ability to do the job; differences in performance are thus more a function of motivation and personality during stable stages than during transition stages. The relationship between input and outcome variables during transition stages is shown in Figure 3.

During stable stages, the relative importance of task proficiency as a determinant of overall effectiveness declines, and the relative importance of non-task behaviors such as absenteeism or interpersonal problems increases. This, in turn, reflects the assumption that the base rates for these behaviors are higher during stable stages than during transition stages. During stable stages, the job no longer presents novel demands, and is thus no longer a source of motivation. As a result, individual differences in dispositional variables will have a larger effect on behavior at this stage than during transition stages.

In comparing Figures 2 and 3, it is useful to note the differences in the status of motivation, both as a cause of different outcome variables and as an outcome variable itself (i.e., an outcome of individual differences in personality and experience). This difference reflects the assumption that novelty in the job itself is a source of considerable motivation during the transition phase. As a result, there are few individual differences in motivation during transition phases. During stable phases, motivation will be a product of both personality variables and the worker's experience (e.g., reinforcement history, previous effort-reward contingencies), and will vary from individual to individual. These individual differences in motivation will in turn be reflected in both task and non-task behaviors.

Formal Statement of Theory

The Developmental Theory of Job Performance outlined here can be described in terms of four postulates and six corollaries.

Postulate 1 - There are distinct stages that characterize a worker's performance on the job. Periods during which workers are learning new skills, tasks, or duties are referred to as transition stages. Periods during which workers are performing familiar, well-learned tasks are referred to as stable stages.

Postulate 2 - The causes of performance are different during transition stages than during stable stages.

Corollary 1 - During transition stages the relative importance of cognitive and information-processing abilities as causes of performance is maximized, and the relative importance of dispositional variables, such as personality and motivation is minimized.

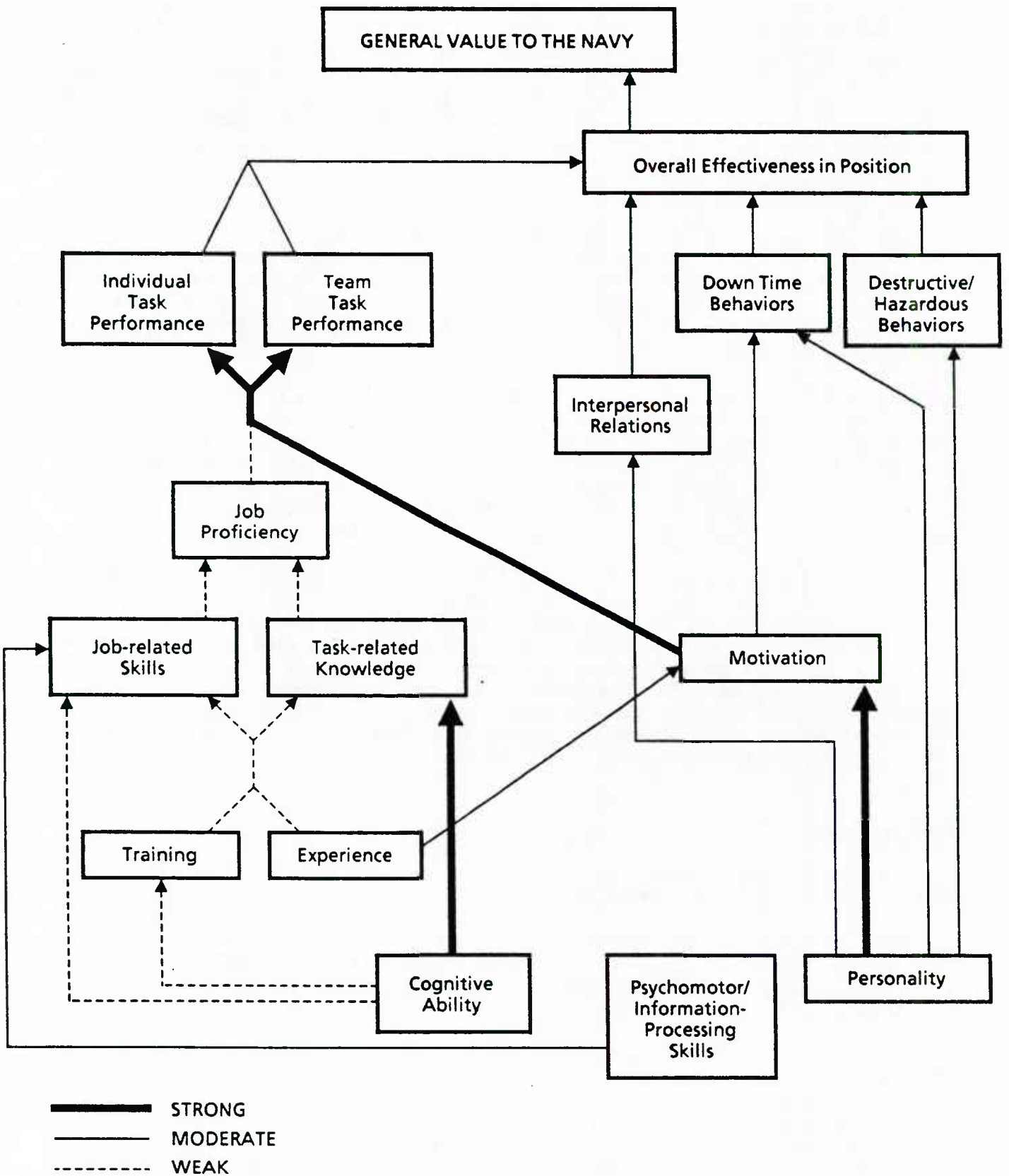


Figure 3. Relationships during stable stages.

Corollary 2 - During stable stages, the relative importance of dispositional variables is maximized, and the relative importance of cognitive variables is minimized.

Postulate 3 - Workers enter transition phases whenever the job changes, either through introduction of new technology or processes or through the addition of new duties or responsibilities.

Corollary 1 - The frequency of new transition stages will vary across jobs and individuals.

Corollary 2 - The proportion of time spent by a worker in transition vs. stable stages will vary across jobs and individuals.

Corollary 3 - At any given point in time for a set of incumbents in the same job, some workers may be in transition stages and others may be in stable stages. This holds true even if differences in job tenure are partialled out.

Corollary 4 - The proportion of workers who are in stable vs. transition stages at any given point in time will vary across jobs and organizational units.

Postulate 4 - When not in transition stages, workers are in a stable stage.

PRELIMINARY APPLICATION OF THEORY TO TWO NAVY RATINGS

To determine the applicability of the theory outlined above, as well as the barriers to application of the theory (e.g., aspects of the theory that are not sufficiently detailed to allow easy application), the theory was applied to predict the determinants of performance in three cohorts of personnel who were in their first enlistments in the Machinist's Mate and Radioman ratings. Field interviews were conducted with incumbents in these two ratings, and data from these interviews were used in an attempt to apply the theory. The interviews, and their results are described below; implications of the data collected in these interviews for the theory outlined here are discussed in the final sections of the report.

Approach

Selection of Ratings for Study

In the Navy, a rating represents a cluster of jobs that involve similar activities. The present study examined two ratings, Machinist's Mate and Radioman. These ratings were chosen for study for two reasons. First, in an earlier report (Murphy, 1986b), it was noted that these two ratings represent two of the three distinct clusters in a predictor-based taxonomy of Navy ratings. In particular, Machinist's Mate is a member of a group of ratings that emphasizes information-processing and psychomotor abilities as major causes of job performance. Radioman is a member of a group of ratings that emphasizes training and experience as determinants of job performance. Sampling from different groups within this taxonomy of ratings will allow us to determine whether differences in the general causes of performance should be taken into account when applying the theory outlined in this report. Second, both of these ratings contain large numbers of incumbents who are centrally located, making field interviews less expensive and less difficult to arrange than would otherwise be the case.

Selection of Cohorts

The theory, as outlined in this report, does not specify the duration or the frequency of transition and stable stages. As a result, no clear guidelines existed for the choice of cohorts for our field interviews. As an initial application of this theory, we therefore chose to interview individuals who differed significantly in terms of their job tenure. In particular, we chose to interview individuals in their first enlistment who were new to the rating, who had been working in the rating for one year or more, and who had been working in the rating for more than two years. Our rationale here is that incumbents who are new to the rating are most likely to be in transition stages; incumbents who have been on the job longer are more likely to be in stable stages.

The cohorts we chose to interview were those who had been on their first ship for 4-10 months, 15-21 months, and 30+ months. Since the first three months (approximately) are typically spent doing mess duty, or some other menial tasks, these cohorts have 1-7 months, 12-18 months, and 27+ months of experience in the rating itself (i.e., working as Radiomen or Machinist's Mates). Therefore, the individuals could have been constantly changing jobs even though they worked within the rating. Our sampling plan called for interviewing five Radiomen and five Machinist's Mates in each cohort. In addition, we attempted to interview five Chiefs (E7, E8, or E9) in each rating.

Design of Interviews

A semi-structured interview protocol was designed to assess (a) the extent to which incumbents were required to learn new duties at different points in time, (b) the types of decisions involved in carrying out these duties, (c) the level of thought or concentration required in carrying out these duties, and (d) the perceived importance of job knowledge, skills, motivation, and personality/attitude as causes of job performance. Incumbents were asked to describe the major duties of their jobs, how and when they had learned to perform those duties, and then were asked to indicate, for each duty, which of several types of decisions were required and how much concentration or mental effort was required to perform the duty. Finally, they responded to a structured questionnaire, asking them to indicate the relative importance of several possible causes of good and poor performance. This interview protocol and questionnaire is shown in Appendix A.

A similar protocol was designed for Chiefs, except that Chiefs were asked to respond to each question three times, once for each of the cohorts in the study. For example, they were asked to indicate the importance of job knowledge (and four other variables) as a cause for good and poor performance for incumbents with 4-10 months, 15-21 months, and 30+ months experience in their first shipboard assignment.

One week before conducting the interviews, research assistants were trained in the administration of interview protocols and the coding of responses to open-ended questions. Because the interview protocols designed for Chiefs were more lengthy and complex than those designed for incumbents, all interviews with Chiefs were conducted by the author.

Sample

A total of 40 individuals were interviewed. This group included two Chiefs, both Radiomen (5 Chiefs were expected in each rating), and 38 enlisted personnel in the E3-E6 pay grades. Although we requested to interview incumbents who were in their first enlistment, seven of the incumbents interviewed had been in the Navy for six or more

years. Data from these seven incumbents were discarded from the study.⁵ In addition, because we were unable to obtain any data from Chiefs in the Machinist's Mate rating, and very little data from Chiefs in the Radioman rating, data from the two Chiefs was also discarded. The composition of the remaining sample is shown in Table 1.

Table 1
Sample of Incumbents Interviewed

Rating	Cohort		
	4-10 months	15-21 months	30+ months
RM	E3=2	E3=3 E4=3	E4=5
MM	E3=2	E3=1 E4=5	E4=5 E5=5

As is shown in Table 1, the number of incumbents interviewed in each rating with 4-10 months of job experience was quite small (i.e., two incumbents in each rating). Care must therefore be taken in interpreting results from this group. In contrast, there were sufficient numbers of incumbents in all remaining cells to provide interpretable data about the applicability of the theory outlined in this report to these two ratings.

Results of Interviews

Because of the semi-structured format used for these interviews, much of the data collected does not lend itself to a simple quantitative summary. However, three general themes can be identified that underlie the open-ended questions: (a) on-the-job learning, (b) changes in the job due to experience, and (c) decision-making requirements. Interview responses are summarized with reference to these three themes. A questionnaire that included rating scales was used to assess the perceived importance of job knowledge, job skills, motivation, social knowledge, and personality and attitude as causes of job performance. Quantitative summaries of these responses are provided for each cohort.

⁵On the whole, data from these seven individuals were comparable to data obtained from the 30+ cohort.

On-the-Job Learning

A major assumption behind our decision to interview the three cohorts chosen here was that individuals who had been on the job for a long period would have learned more of their duties, and would be learning fewer duties on the job itself than would individuals who had only been on the job a few months. Response to open-ended questions in our interviews did not support this assumption. In general, there was more variability within cohorts than between cohorts. That is, individuals with equivalent amounts of job experience often gave sharply different accounts of the amount and nature of on-the-job learning they had experienced.

In general, all three cohorts indicated that (a) basic skills and techniques are learned in A-school, (b) practical application of A-school training to perform the basic duties of their rating is learned on the job, generally within the first two years, (c) new duties and responsibilities are continually learned throughout the first enlistment, (d) these new duties are learned on the job itself, (e) administrative and supervisory duties are learned only in the later stages of the first enlistment, and (f) the number and type of new duties learned varies as a function of pay grade. The results summarized above suggest that transition stages may occur at several points of an enlisted man's first tour, especially if that person advances in pay grade during his or her first enlistment. Individual differences in responses suggest further that the frequency and timing of transition stages may vary from person to person, even when differences in job tenure are taken into account.

Changes with Experience

It was assumed that as job experience increased, incumbents would indicate that fewer changes in the job were occurring, and that workers would be more likely to regard their duties as routine. This assumption was not supported. As noted above, incumbents in all three cohorts indicated that duties and responsibilities were constantly being added to their jobs. There were qualitative differences across cohorts. Members of the 4-10 month cohort described job changes primarily in terms of new technical tasks, whereas members of the 30+ month cohort described job changes primarily in terms of new supervisory and administrative responsibilities. However, none of the cohorts described their jobs as routine. While it is possible that some stable stages exist for these incumbents, our data suggests that most incumbents are probably in transition stages during most of their first enlistment.

Decisions Required by the Job

We assumed that as job experience increased, the decisions required by the job would become more routine and that task performance would require less concentration and mental effort. With regard to the types of decisions required by the job, we once again found more variability within cohorts than between cohorts. There were no clear differences, across cohorts, in the types of decisions required by the job. However, we did find consistent differences in subjects' descriptions of the concentration and mental effort required by their job duties. Most incumbents in the 4-10 month and 15-21 month cohorts indicated that considerable thought and mental effort was required to perform their job duties, whereas most members of the 30+ month cohort indicated that little thought was required to perform their duties. Once again, however, individual differences within cohorts were substantial. Thus, although the data concerning thought and concentration required were consistent with our assumptions regarding the effects of job experience, individual differences were too large to allow valid comparisons between cohorts.

General Summary - Open-Ended Questions

Our interviews suggest that the cohorts were not homogeneous, nor were they different from one another with regard to the variables measured by the open-ended questions in our interviews. Individual differences were so large that comparisons between different ratings did not show systematic differences in the extent to which new tasks, duties, or decisions are required as incumbents become more experienced. In general, comparison between cohorts did not support the predictions of the theory outlined in this report. Possible shortcomings of the method used to apply the theory here will be discussed later in this report.

Questionnaire Response

A Likert-type rating scale was used to assess the perceived importance of job knowledge, job skills, motivation, social knowledge, and personality and motivation as causes of good and poor job performance. Mean ratings of the importance of each of these factors are shown in Table 2.⁶ We expected that the relative importance of job knowledge and job skill as causes of job performance would decrease with experience, and that the relative importance of motivation and experience would increase as causes of job performance would increase with experience. These patterns were not evident in the data shown in Table 2. Once again, within-cohort variability was so large, relative to differences between cohorts or between ratings, that none of the comparisons between means reached statistical significance. Thus, there were no clear effects of job experience on the relative importance of the five factors shown in Table 2.

Table 2
Importance of Five Causes of Job Performance^a

Rating	Cohort	Job Knowledge	Job Skill	Motivation	Social Knowledge	Personality & Attitude
MM	4-10	4.25	5.75	7.00	6.75	5.75
	15-21	4.91	5.41	6.25	5.33	5.00
	30+	5.0	6.36	6.04	5.63	5.22
RM	4-10	3.75	4.75	5.75	4.00	5.50
	15-21	5.91	6.75	5.76	6.58	6.00
	30+	4.75	5.56	6.56	6.12	6.00

^aImportance is measured on a seven-point scale where 4 = average importance, 7 = very important.

⁶Ratings of the importance of each of the five variables as causes of poor performance were averaged. Means shown in Table 2 are based on these average ratings.

DISCUSSION

Data from the field interviews suggest that the theory outlined in this report cannot be applied to describe differences in the causes of job performance as a function of job experience in the two ratings studied. Contrary to expectations, there were no clear differences across cohorts in any of the variables that are thought to be tied to existence of transition vs. stable stages. It was assumed that incumbents with extensive job experience would have learned the major tasks that make up their job, and would no longer be required to make novel judgments or decisions in performing their job, and thus would be more likely to be in stable stages than in transition stages. It was also assumed that incumbents who were new to the job would be more likely to be learning new tasks, duties, and responsibilities, and thus would be more likely to be in transition stages than in stable stages. Our data suggest that essentially all incumbents interviewed were in transition stages. The great majority of respondents in all cohorts in both ratings indicated that they were constantly learning new duties and responsibilities and that they were constantly changing jobs. This was especially true for incumbents who had been promoted into higher pay grades during their first enlistments. In addition, the composition of the workgroup changed frequently, so interpersonal role skills were being adjusted constantly.

It is not clear whether our failure to obtain the expected results represents a shortcoming on the part of the theory itself, or a shortcoming in our implementation of the theory (i.e., in predicting differences across cohorts). Comparison of the results of our interviews with our original assumptions regarding changes in the job over time suggest that the method chosen was not appropriate for assessing the applicability of the theory, and that different methods or contexts will be needed to adequately test the theory. Shortcomings of the methods used to implement the theory in the present report are discussed below.

Difficulties in Implementation

Our strategy of studying differences between cohorts of Machinist's Mates and Radiomen who were in their first enlistment may not have provided useful data for assessing the developmental theory presented here for three reasons: (a) inadequate understanding of the jobs and job contexts, (b) inadequate attention to individual differences, and (c) inadequate measurement of relevant constructs. First, our assumption was that in both ratings, major job tasks were learned during the first few months of the job, and that the remainder of the first enlistment (or at least significant periods of time) was spent performing these well-learned tasks. Our field interviews suggest that this assumption is not accurate. Enlisted men in both ratings reported the need to constantly learn new skills, tasks, and duties throughout their early years. In retrospect, our decision to focus on the first enlistment may have been a mistake. The stable stages described by the theory may not occur at all until later in the enlisted man's career. To the extent that stable stages occur at all in the first four years, they are probably both infrequent and brief, especially for good performers, who may progress quickly in acquiring new duties and responsibilities. Second, data from the interviews suggested that grouping enlisted men in terms of their job tenure did not produce homogeneous groups. Half of the groups interviewed contained individuals who were at different pay grades. In general, differences in pay grade implied systematic differences in duties, responsibilities, etc. Even where pay grades were the same, individual differences in responses were extensive. Tasks, duties, and responsibilities, and opportunities for learning varied extensively from ship to ship and even from work group to work group. These results suggest that cross-sectional designs, such as the one employed here, may not be

appropriate for applying the theory. If the likelihood of encountering new tasks, duties, etc., varies substantially from setting to setting, it follows that groups of individuals who have equivalent levels of job experience will not have the same likelihood of being in transition or stable stages. Rather, groups that have equivalent levels of tenure might be highly heterogeneous with regard to the causes of each individual's good or poor job performance.

Suggestions for Future Research

A different research strategy is needed to assess the usefulness of the theory outlined in this report. First, different types of jobs should be studied. The data from our interviews suggest that stable stages may be rare in many Navy ratings, at least during the incumbent's first few years on the job. The theory may be more applicable to simpler jobs that require fewer skills, less training, and more time in them before the incumbent is moved. In the Navy context, the theory might be more useful for describing enlisted men's performance in their second enlistment or beyond. It is likely in many jobs that the rate at which many jobs change is best described by a negatively accelerating curve, such that job changes are both frequent and substantial during an initial period, but occur with less frequency and severity as time goes on. If this is true, more stable stages will occur after the first few years on the job than during those first few years. Second, a longitudinal, single subject design might be more appropriate than the cross-sectional design employed here. That is, the theory might be more appropriate for describing changes in an individual over time in the causes of job performance than for making valid predictions about heterogeneous groups of individuals. In this sense, the theory may be more valuable as a counseling and diagnostic tool than as a tool for understanding job performance in general.

More research is needed, using more tightly structured assessment instruments, to determine whether the extensive individual differences observed in our interviews are generally encountered. The issue of individual differences is extremely important, since it could potentially limit the applicability of the theory. If individual differences as extensive as those reported here are encountered elsewhere, the applicability of the theory to groups as well as individuals will be doubtful. However, it is possible that some of the individual differences reported here were the result of the semi-structured interview format rather than of real and substantial differences in the job. For example, open-ended questions (such as those used here) are open to many interpretations. The use of more precise measures will help to determine the extent of individual differences in relevant variables, as well as the situational parameters that determine whether or not it is possible to apply the theory to groups rather than individuals.

CONCLUSIONS

1. The research reviewed presents evidence that the relative contribution of cognitive abilities, psychomotor abilities, and other individual differences to performance varies over time, and is also affected by relatively minor changes in jobs or tasks and by practice at performing a task.

2. The theory outlined in this report was not supported by the results obtained from the field interviews. However, methodological shortcomings of the field interviews complicate the interpretation of these data.

3. The theory outlined in this report may be more easily tested using longitudinal design than a cross-sectional design.

RECOMMENDATIONS

1. Further research is needed to modify the theory outlined in this report. The constructs employed in this theory need further clarification, and better measures of these constructs need to be developed.

2. Further theoretical development is needed to specify critical parameters of the theory. For example, at present there is no exact way of determining whether incumbents are in transition or stable stages at a given point.

3. Further research is needed to determine the extent to which individual differences limit the applicability of the theory. We do not know whether the extensive individual differences encountered in this study will be encountered in different ratings, in jobs outside of the Navy, or in groups who have significantly longer tenure on the job.

4. Further research on the potential applications of this theory in individual counseling should be carried out. For example, the theory predicts cyclical variation in behaviors such as absenteeism. The appropriate interventions for reducing these behaviors may depend on whether the incumbent is in a transition stage or a stable stage.

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APPENDIX A
INTERVIEW PROTOCOLS

Name: _____

Rating: _____

Duty: _____

ACQUISITION OF JOB KNOWLEDGE:

Where Learned

When

- A: A-school
- B: Deck duty
- C: On the job
- D: Prior knowledge

TASK-RELATED: What things do you have to know about this duty to perform it well?

SOCIAL KNOWLEDGE: What things do you have to know about the informal (social) system to perform this duty?

NOTES/COMMENTS:

Duty Questionnaire

Name: _____ Approx. Mos. on Ship _____

Rating: _____

Duty: _____

1. Generally, what processes do you have to go through to make a decision on your job?

- _____ Rely on their own experience and knowledge to make decisions
- _____ Gather information before making decisions
- _____ Analyze information to detect problems or changes & decide what to do

2. When you do this, does it require lots of thought and concentration, or can you do it without thinking much about the steps involved? Which description fits best?

- _____ Know this so well I can do it without thinking about it
- _____ Requires little thought and planning
- _____ Requires considerable thought and planning
- _____ Requires complete concentration

3. Are you still learning things about how to do this, or do you know about all you need to know to do this duty?

Still Improving _____ Complete Knowledge _____

Duty: _____

1. Generally, what processes do you have to go through to make a decision on your job?

- _____ Rely on their own experience and knowledge to make decisions
- _____ Gather information before making decisions
- _____ Analyze information to detect problems or changes & decide what to do

2. When you do this, does it require lots of thought and concentration, or can you do it without thinking much about the steps involved? Which description fits best?

- _____ Know this so well I can do it without thinking about it
- _____ Requires little thought and planning
- _____ Requires considerable thought and planning
- _____ Requires complete concentration

3. Are you still learning things about how to do this, or do you know about all you need to know to do this duty?

Still Improving _____ Complete Knowledge _____

General Questions

1. If you were going to redesign the individual's first few months actually on the job (after deck duty, etc.), what would you change?

2. Some things on the job seem to be learned the hard way. By this we mean that sometimes you have to learn things on your own or learn through your mistakes. Did you have to learn anything the hard way that it would have been helpful to know earlier?

3. What do you do differently in your job now that you have some experience, than you did when you first came on the job?

4. What didn't they teach you in A-school that turned out to be important? How did you learn these things?

5. With experience, other people's expectations of you have probably changed. For example, sometimes people will expect an experienced person to handle certain situations differently or do more things than an unexperienced person.

How have your coworkers expectations changed?

How have your supervisor's expectations changed?

6. In an emergency or unique situation, what is the most important: training, experience, general intelligence or specific skills learned on the job? Why?

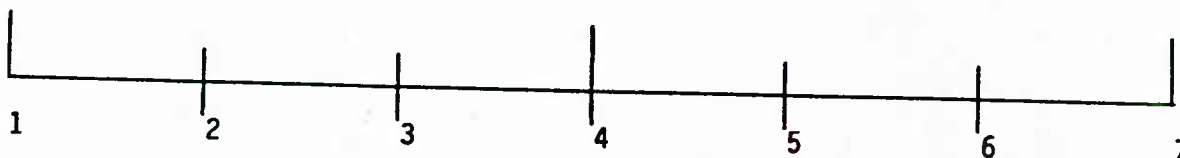
Questionnaire

Name _____

Rating _____

Approximate # of months on the ship _____

Some people perform well in their jobs, and others perform poorly. We'd like you to think about people who have about the same amount of experience in your rating as you do, and indicate the degree to which each of the following is important as a cause of poor performance. Use the scale below.



Not at all important

Has some impact on performance

Very important cause

Importance

1. Job Knowledge - "Book Knowledge" needed to carry out major duties _____
2. Job Skills - ability to translate knowledge into actions _____
3. Motivation - degree to which people are willing to work hard, take responsibility _____
4. Knowing the system - knowing how to get things done in your department or on your ship _____
5. Personality and attitude - general approach to work and life _____

Now, think about the importance of each of these five factors as a cause of good performance. For some factors, your answers may be the same as above, but for others, your answers might be different. Use the same scale as above.

1. Job Knowledge _____
2. Job Skills _____
3. Motivation _____
4. Knowing the System _____
5. Personality and attitude _____

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