Is the Relationship Between Cognitive Ability and Job Performance Stable Over Time?

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Schmidt, Hunter, and Outerbridge's (1986) causal model of job performance suggests that cognitive ability is the most important cause of job performance and that the relationship between ability and performance is stable over time. Research on both the stability of skilled performance and the ability requirements of tasks is inconsistent with this model. Our article describes an alternative model that ascribes a critical importance to ability during stages where workers are learning new tasks and performing unfamiliar functions (i.e., transition stages) but less so during stages where workers are performing well-learned, familiar tasks (i.e., maintenance stages). The alternative model is shown to account for the findings explained by the Schmidt et al. (1986) model, as well as for findings that cannot be accounted for by their model.

Models of job performance that incorporate variables such as ability, experience, motivation, and role perception have been debated for several years (Campbell, Dunnette, Lawler, & Weick, 1970; Porter & Lawler, 1970), but until recently there have been few successful attempts to estimate the causal parameters of these models. Schmidt et al. (1986) suggested that cognitive ability is the primary determinant (considering both direct and indirect effect) of job performance, and that the influence of ability either remains stable or increases over time (See also Hunter, 1983; McDaniel, Schmidt, & Hunter, 1987; Schmidt & Hunter, 1986; Schmidt, Hunter, Outerbridge, & Goff, 1988). Schmidt et al.'s (1986) analysis suggested that job experience also affects performance, but that the influence of experience decreases over time. Additional analyses have suggested that cognitive ability retains

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its influence well past the initial stages of employment, when incumbents are learning how to do their jobs, and that it is still the major cause of performance among more senior job incumbents (i.e., those with 5 or more years on the job; Schmidt & Hunter, 1986).

There is an extensive body of correlational evidence that is consistent with the Schmidt et al. (1986) model (Hunter & Hunter, 1984), but there are also several reasons to question this model. First, their application of path analysis to make causal statements in a context where several critical variables are not measured is clearly inappropriate (James, 1980; James, Mulaik, & Brett, 1982). Second, and more important, the model implies that the major cause of performance (i.e., ability) has a constant influence on performance and that the influence of less stable variables (e.g., experience) declines over time. There are several reasons to doubt the assumption that the causes of job performance remain stable over time. This article reviews research from several distinct areas that suggest that the causes of performance are more likely to change over time rather than remain stable.

DEFINITIONS

The terms ability, performance, and stability have all been used in a number of ways in the literature. For example, research on selection utility (Murphy, 1986; Schmidt, Hunter, MacKenzie, & Muldrow, 1979), validity generalization (Hunter & Hunter, 1984), and causal models of job performance (Hunter, 1983; Schmidt et al., 1986) has treated cognitive ability as a unitary trait; in these studies, the terms ability, cognitive ability, and general mental ability could probably be used interchangeably (Hunter, 1986; Murphy, 1988). In contrast, experimental research, such as that carried out by Fleishman and his colleagues, has typically focused on specific abilities (e.g., memorization, speed of closure, rate control), and their relationships to performance on well-specified tasks.

Modern theories of intelligence are rarely dominated by a single factor (g), but rather specify many different abilities, components, and even types of intelligence (Gardner, 1983; Guilford, 1985; Horn, 1985; Humphreys, 1985; Sternberg, 1982; Sternberg & Detterman, 1986). Nevertheless, there is some utility to concentrating on general, rather than specific, cognitive abilities in modeling job performance, (A specific issue of Journal of Vocational Behavior, Gottfredson, 1986, reviewed research on the g factor in employment.) General cognitive ability has been empirically related to performance on hundreds of jobs (Hunter, 1986) and shows levels of criterion-related validity greater than or equal to that of alternative predictors of job performance (Hunter & Hunter, 1984). In this article, the term ability refers to the general factor that is associated with performance on all (or essentially all) tests that involve the active processing of information (Jensen,
Although cognitive ability levels may gradually change over one's lifetime, it is reasonable to treat a worker's level of general cognitive ability, over the period of that worker's job tenure, as a constant.

The advantage of focusing on general, rather than specific, abilities is that it restricts the range of questions that can be asked. For example, a number of studies by Fleishman and his associates (See Fleishman, 1972, and Fleishman & Quaintance, 1984, for reviews of this research) have examined changes in the pattern of abilities needed to perform tasks, as one progresses through training or practice. These studies have demonstrated that the relative importance of different cognitive and psychomotor abilities changes as the individual learns and practices the task. Changes in the mandated patterns of abilities are not examined here. This article focuses on the level of general cognitive ability required for successful performance on the job.

In this article, performance refers to overall job performance, and not to performance on any single task. Job performance is certainly a function of the individual's performances on the specific tasks that comprise standard job descriptions but is also affected by variables such as success in maintaining good interpersonal relations, absenteeism and withdrawal behaviors, substance abuse, and other behaviors that increase hazards at the work place (Murphy & Kroeker, 1988). Thus, overall performance is a composite variable that reflects the extent to which individuals engage in work behaviors that contribute to, or detract from, the achievement of goals associated with their jobs (Astin, 1964).

As was the case with ability, the choice of a global definition of performance has clear implications for the type of phenomena that different models of the ability-performance relationship seek to explain. This article is specifically concerned with explaining the relationship between one general mental ability and one overall criterion (overall job performance) when performance is measured at different points in time, after different amounts of training or practice, or at different points in the learning curve.

Finally, stability refers to the extent to which the correlation between general cognitive ability and overall job performance changes over time. Instability does not necessarily imply random fluctuation; if the correlation between ability and performance were to increase monotonically over time, this relationship, although systematic, would not be stable.

**EVIDENCE OF INSTABILITY**

There is evidence that the relationship between a variety of predictors and performance measures is unstable over time (Henry & Hulin, 1987). When
validity coefficients or intercorrelations among performance measures collected at several different times are arrayed in a temporally ordered matrix, these matrices generally take the form of a simplex, in which the correlations decrease as the interval between measurements increases (Ackerman, 1987; Humphreys, 1960). Whereas cognitive ability itself is highly stable, this pattern would not be expected if the influence of ability on performance was also stable across time.

Extensive practice on a task has been shown to change the correlation between measures of cognitive ability and task performance. In a widely cited study, Fleishman and Hempel (1955) demonstrated changes in the validity of cognitive and psychomotor ability measures for predicting performance in a visual choice reaction task as a function of practice. These results have been replicated by Fleishman and his associates (Fleishman, 1957; Fleishman, 1972; Fleishman & Fruchter, 1960) and have been supported by other researchers (e.g., Fuchs, 1962), who obtained similar results with other complex tasks. Furthermore, these results are not method-bound; Fleishman and his colleagues have demonstrated this phenomenon of validity changes using a variety of methods (e.g., factor analysis, experiments) and a variety of tasks, ranging from Morse code transmission (Fleishman & Fruchter, 1960) to complex tracking tasks (Parker & Fleishman, 1960). Although specific conclusions reached by Fleishman and others have been criticized (Ackerman, 1987), the general finding that the abilities required for successful task performance change over time seems well-established. If the causal impact of performance is stable over time, one would not expect the correlation between measures of ability and performance to change with practice.

Ackerman (1986, 1987) suggested that the effects of practice on the ability-task performance relationship depend on the type of task. These studies distinguish between tasks that involve consistent mapping (which allow one to pursue an invariant sequence of information-processing steps in performing the tasks) and tasks that involve varied mapping (in which task performance requires attention and active information processing). In a consistent mapping task, general cognitive ability is involved in task performance only when the task is new to the respondent. With practice on a consistent mapping task, information processing shifts from a controlled to an automatic mode (Schneider & Shiffrin, 1977), at which point cognitive ability is no longer involved in task performance. Ackerman (1986) noted that learning curves for consistent mapping tasks typically illustrate a shift from ability-dependent to ability-insensitive performance-ability functions as practice accumulates.

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); certain authors claim that the changing-subject model has received more consistent support (Alveres & Hulin, 1972, 1973; Dunham, 1974). The resolution of this debate is not critical to the arguments developed in this article. It is sufficient to note that both models are inconsistent with the hypothesis that the relationship between ability and performance is stable over time. In general, this research suggests that the abilities and characteristics that account for performance on well-learned, well-practiced tasks are different than those that account for performance on similar tasks that are new to the incumbent.

There are aspects of jobs themselves that make it unlikely that the causes of job performance will remain stable over time. For example, 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) noted that employees' perceptions of their work roles are ill-defined at the outset, and that these roles are not fully understood by employees (or possibly by their supervisors) during their first few months on the job. Helmreich, Sawvin, and Carus (1986) noted that a "honeymoon effect" may exist during an employee's first few months on the job. During this period the employee may perceive the job as novel and challenging, resulting in an unusually high level of output and job commitment. Helmreich et al.'s (1986) data suggest that personality measures show higher levels of validity after 6 to 8 months on the job than during the first 3 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, but also in terms of the level of tasks performed. 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, whereas experienced workers devote their time to the most routine tasks. For both new and experienced workers, however, changes in the job or in the tasks performed may lead to changes in the causes of job performance.

There is considerable evidence that the abilities needed for successful performance change as the tasks performed by workers in the same job change. A program of research by Fleishman (1975) and his associates has shown that minor changes in the tasks performed by subject 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, Fleishman 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 performances 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. 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. One interpretation of this result is that although 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 validity of class rank measures. In a study using cross-sectional design, Kozlowski and Hults (1986) suggested that there are systematic changes in the determinants of engineers’ performances over time; these changes may in part be due to temporal variation in the complexity of this job.

The research just cited implies that the hypothesis regarding the stable relationship between ability and performance over time is unreasonable. Before describing an alternative model and its implications, it is useful to specify the range of phenomena that must be accounted for by such a model.

BOUNDARY CONDITIONS FOR ALTERNATIVE MODELS

The Schmidt et al. (1986) model suggested that cognitive ability is the single most important cause of job performance and that this relationship either remains invariant or grows stronger over time. Although the aforementioned literature notes several findings that are inconsistent with this model, there exist other findings that are accounted for by Schmidt et al. (1986) and that must be accounted for by alternative models or theories. These include:

1. Measures of cognitive ability have shown consistent evidence of predicting performance in essentially all jobs (Hunter & Hunter, 1984; Schmidt & Hunter, 1981; Schmitt, Gooding, Noe, & Kirsch, 1984). Furthermore, the validity of cognitive ability tests is consistently greater than or

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1 These correlations are corrected for range restriction.
equal to that of available alternatives such as interviews, simulations, or biographical information blanks (Hunter & Hunter, 1984; Reilly & Chao, 1982). Schmidt et al. (1986) accounted for this finding by assuming that cognitive ability has a strong causal impact, both directly, and indirectly (via the acquisition of job knowledge), on job performance.

2. One of the few variables that clearly moderates the validity of cognitive ability tests as predictors of performance is job complexity (Gutenberg, Arvey, Osburn, & Jeanneret, 1983; Hunter & Hunter, 1984). The more complex the information-processing demands of the job, the higher the validity. This phenomenon can easily be accounted for by the Schmidt et al. (1986) model, by assuming that the causal impact of cognitive ability on performance becomes stronger as job complexity increases. However, as I note later, the relationships between complexity, information-processing demands, and cognitive ability may not be as simple as those suggested here.

3. If complexity is held constant, the validity of cognitive ability tests does not vary substantially from job to job (Hunter & Hirsh, 1987; Hunter & Hunter, 1984). The Schmidt et al. (1986) model accounted for this phenomenon by assuming that job complexity is the only moderator of the causal impact of ability on performance.

Any alternative to the Schmidt et al. (1986) model must account adequately for these three phenomena and for the instability of skilled performance over time. It must explain as well the effects of changes in the job over time on the relationship between ability and performance. An alternative model that meets these criteria is described next.

A Dynamic Model of Job Performance

It is possible to account for the various findings cited earlier with a model that incorporates systematic changes over time in the relationship between ability and job performance. In developing such a model, two questions must be asked: (a) What do people do with cognitive ability that results in high levels of job performance?, and (b) Do these activities occur with the same frequency throughout an individual’s tenure on the job? In answering the first question, Schmidt et al. (1986) suggested that cognitive ability enables incumbents to acquire and apply job knowledge. Cognitive ability is also related to incumbent ability to solve novel problems and to make appropriate judgments in situations where routine procedures do not apply (Cascio, 1987; Vernon, 1960). This suggests that cognitive ability will be most important in situations where the worker must learn new procedures or techniques, or where novel problems or job demands that require judgment on the part of the employee occur. Answering the second question leads directly to the dynamic model that is outlined next.

This model is concerned with the effects of individual differences on job
performance. Thus, the broad class of organizational and environmental context variables (e.g., availability of tools and materials, interdependency among work units, performance norms, reward systems, technological constraints, etc.) that affect performance are not considered here. Rather two classes of individual difference variables are considered; (a) abilities—individual differences in cognitive, physical, and psychomotor ability; and (b) dispositional variables—individual differences in personality, interests, values, and motivation. Abilities are relatively stable, whereas dispositional variables range from highly stable (values) to potentially unstable (motivation). The proposed model is concerned with changes over time given the relative influence of ability and dispositional variables on job performance.

The central assumption of the model is that activities requiring or involving ability, particularly cognitive ability, do not occur with equal frequency throughout a person’s job tenure. Rather, it is assumed that a person’s tenure on a job can be characterized in terms of two distinct stages—transition stages and maintenance stages (several models of skill development suggest additional stages; Ackerman, 1987; Anderson, 1982). The relative importance of ability and dispositional variables as causes of job performance varies across stages. These stages are described herein.

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; the workers must learn new skills and tasks and make decisions about unfamiliar topics. During transition stages, performance depends largely on cognitive ability because: (a) workers must acquire new information, and (b) workers cannot rely on past experience but rather must rely on sound judgment to perform their jobs.

Maintenance stage. Between periods of transition, workers in many jobs will enter maintenance stages in which major job tasks are well-learned and can be performed with minimal mental effort. During maintenance stages, job performance is a matter of executing well-learned procedures; individual differences in job performance are not affected by differences in cognitive ability. Personality and motivational factors have a greater influence on job performance than do individual differences in cognitive ability. The distinguishing characteristic of the maintenance 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 extreme of stage pro-
gression, in which the work required is relatively simple and does not change substantially over time. The transition stage in this case is comparatively short; once the worker had mastered 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 that most jobs feature multiple transition phases that vary in length, across both occasions and individuals. First, it is assumed that all new workers start off in a transition stage, and that some workers in a particular job reach a maintenance stage more quickly than others. The length of the initial transition stage will depend on both individual characteristics (e.g., ability, motivation; Dweck, 1986; Mumford, Weeks, Harding, & Fleishman, 1988) and situational characteristics (e.g., quality of training, informal instruction). Second, it is assumed that in most jobs there are occasional changes in the tasks performed or in the procedures used to accomplish major tasks 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 relatively 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. An example of the latter occurs when a worker receives new duties, responsibilities, etcetera 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.

The prediction of transition stages versus stable stages requires an accurate assessment of characteristics of both the worker and the job. Although worker characteristics (e.g., ability and personality) are relatively stable, it may be necessary to periodically reassess them, because there is clear evidence that: (a) ability and personality change over time (Kagan, Sontag, Baker, & Nelson, 1958), and (b) ability and personality variables interact (Dweck, 1986; Mumford et al., 1988). Predicting the length of transition stages may be particularly difficult, because this depends in part on the cognitive ability of the worker and in part on the knowledge and skills the worker possesses prior to encountering a new task, or a new set of demands. Thus, even if the general intelligence of a worker and the nature of the new demands placed on that worker are well-understood, it may still be difficult to predict the amount of time that worker will need to adequately learn the new tasks or procedures.

An additional difficulty involved in predicting transition versus stable stages for an individual worker is the complexity of the class of variables (referred to here as "dispositional"). Although there are many separate cognitive abilities, there is also evidence of a strong general ability factor,
which allows the researcher to describe ability in a consistent fashion over time. There is no strong general factor in the domain of dispositional variables, and it is possible that different personality or motivational variables are important at different stages of skill acquisition (Dweck, 1986).

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), an optimal test of the model would require a longitudinal approach in which individuals are assessed at frequent intervals and are tracked over significant periods. This approach may make it possible to identify transition and maintenance periods for each individual. In general, the relative predictive power of ability and dispositional measures will depend on the proportion of workers who were in transition versus maintenance stages at the time their performance is measured. Application of the model 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 job duty changes as a function of tenure.

In summary, the model outlined here can be described in terms of four propositions:

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 maintenance stages.

2. The causes of performance are different during transition stages than during maintenance stages. During transition stages the relative importance of cognitive abilities as causes of performance is maximized, and the relative importance of dispositional variables (e.g., personality and motivation) is minimized. During maintenance stages, the relative importance of dispositional variables is maximized, and the relative importance of ability variables is minimized.

3. Workers enter transition phases when the job tasks or procedures that change, either through introduction of new technology or processes or through the addition of new duties or responsibilities. The frequency of transition stages will vary across jobs and individuals, as does the proportion of time spent by a worker in transition versus maintenance stages. At any given time, among a set of incumbents doing the same job, some workers may be in transition stages and others in maintenance stages. This holds true even when differences in job tenure are partialed out. The proportion of workers who are in maintenance versus transition stages at any given time will vary across jobs and organizational units.

4. When not in transition stages, workers are in maintenance stages.
It is important to note that Proposition 2 refers to the relative importance of ability versus dispositional variables as causes of job performance. The evidence reviewed earlier is consistent with the hypothesis that the absolute impact of ability on performance changes over time but at the same time says little about changes in the absolute impact of personality and motivational variables. Helmreich et al. (1986) presented some data suggesting that the importance of personality variables may change over time. Research on job commitment (Kanungo, 1982) is also consistent with the hypothesis of changes in the absolute impact of dispositional variables over time. However, the evidence is hardly conclusive regarding changes in the impact of dispositional variables. Proposition 2 is conservative, in that a relative rather than an absolute change in the impact of dispositional variables is hypothesized. If there is little systematic change in the absolute impact of dispositional variables over time and the absolute impact of ability variables decreases, the relative impact of dispositional variables will still increase.

The model presented here can be viewed as a simplified version of more complex models of skill development proposed by Ackerman (1986, 1987) and Anderson (1982). In particular, the Ackerman (1986, 1987) model involved a number of constructs that could be profitably applied to the understanding of job performance. Ackerman (1987) suggested that the correlation between cognitive ability and performance depends on whether the individual is engaged in automatic or controlled processing. Some tasks involve consistent rules and procedures, whereas others require individuals to continually learn new rules, procedures, and performance strategies. Tasks that involve the consistent application of well-learned rules or procedures allow an individual to move from a controlled processing mode, where task performance is a direct function of the cognitive resources available, to an automatic mode, in which performance is resource-independent; tasks that do not feature consistent rules or procedures require controlled processing, in which performance is highly resource-dependent.

Ackerman's (1986, 1987) model is directly relevant to an issue that has been examined in depth in the job performance literature: the moderating influence of job complexity on ability-performance correlations. The definitions of job complexity employed in this research (e.g., Gutenberg et al., 1983; Hunter & Hunter, 1984) are both crude and imprecise. Anderson's (1982) model suggested that job complexity should be defined in terms of the extent to which the job involves consistent versus inconsistent tasks. Jobs in which most of the tasks involve the consistent application of standard procedures and rules are simple, which implies that workers in these jobs will often experience short, infrequent transition stages and long stable stages. Jobs in which most tasks require workers to frequently learn new rules, procedures, and strategies are more complex, which implies that
workers in these jobs will experience frequent transitions and short stable stages. Therefore, jobs that predominantly involve consistent tasks (i.e., simple jobs) are likely to produce lower validity coefficients (vis-à-vis dispositional measures) for cognitive ability (adjusting for differences in the reliability of performance measures, range restriction, etc.) than will jobs that consist primarily of inconsistent tasks.

Relation to Previous Ability-Performance Research

Although some of the details of the proposed model are new, it is important to note that the general outline of this model was anticipated over 30 years ago by Fleishman and his associates. Features of the model are also reflected in the work of other researchers (e.g., Ackerman, 1987; Humphreys, 1968) who have examined ability-performance relationships. Fleishman (1957) showed that the aptitudes involved in successful performance for skilled and unskilled individuals were quite different and suggested that individual differences at advanced levels of proficiency were more a function of the integration of well-learned component skills than of general or specific cognitive abilities.

One of the major objectives of Fleishman's research program has been to understand how specific abilities contribute to performance at various stages of learning a practice. The model proposed here is more restricted in scope, in that it focuses on general rather than specific abilities, and on the level rather than the pattern of the abilities required. One way that the proposed model goes beyond that of Fleishman is to suggest mechanisms to account for two apparently conflicting sets of results: (a) those of Schmidt, Hunter, and their colleagues that suggest that the correlation between general cognitive ability and performance is stable over time; and (b) those of Fleishman, Hulin, Ackerman, and others that suggest the correlation between ability and performance change with practice on the task. The following section illustrates how the proposed model achieves these ends.

Does the Model Meet Boundary Conditions?

Earlier it was noted that an alternative to the Schmidt et al. (1986) static model should account for several findings in the research on skilled performance and on test validity. These findings, and the way in which the proposed model accounts for them, are reviewed here.

**Validity of ability tests.** The first set of findings to be accounted for is the validity of cognitive ability tests in virtually all jobs. The model accounts for this finding in two ways: (a) all jobs require some learning, at least in their initial stages; and (b) changes in technology, procedures, work roles, and personnel that occur with some frequency in most jobs will
sometimes require workers to learn new rules, procedures and concepts. Both a and b imply that transition stages will occur in all jobs. Because these stages occur at different times and last for different durations in different organizations, locations, and work groups, a validity study done at any point in time is likely to include some individuals who are in transition stages. A meta-analysis of several validity studies is virtually certain to include data from a substantial number of individuals who were in transition stages at the time of the studies were done.

The second finding to be accounted for is that job complexity moderates the validity of cognitive ability tests. Schmidt et al. (1986) would explain this finding by noting that the intensity of demands on cognitive ability is greatest in complex jobs. The model suggests that the frequency of demands on cognitive ability is greatest in complex jobs. That is, complex jobs are characterized by the constant need to learn new material and to make difficult decisions. The frequency and duration of transition stages increases as job complexity increases. At any given point the proportion of the workforce that are in transition stages will increase as job complexity increases.

In this article, "complexity" is used as a gross index of a job's cognitive demands. Hunter and Hunter (1984) specified five levels of complexity, defined in terms of how workers use data and objects to perform their jobs (see also Gutenberg et al., 1983). This definition is not entirely satisfactory, because jobs in the same complexity category are likely to vary widely with the type, frequency, and intensity of the cognitive demands placed on the rater.\(^2\) As we noted earlier, definitions of job complexity that are more firmly rooted in the learning and skill development literature would be preferable. Nevertheless, research has suggested that complexity, measured even at this gross level, moderates the relationship between cognitive ability and job performance.

The third finding to be accounted for is the stability of the validity of ability tests across jobs that differ greatly in content but are equivalent in complexity. This model accounts for this finding by assuming that the probability that a worker is in a transition stage at a given point in time is solely a function of job complexity.

**Instability of skilled performance.** The first finding to be accounted for is that skilled performance is unstable over time. This model accounts for this by noting that during maintenance stages, dispositional variables have a proportionally greater impact on performance than during transition stages and that some dispositional variables are less stable than abilities. This model assumes that skilled performance is overlearned, and implies

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\(^2\)One of Hunter and Hunter's (1984) categories contains over 60% of all jobs. It is not clear that all of these jobs can be equated in terms of their complexity.
that performance will become less stable as the prior level of practice and
the level of skill increases. Henry and Hulin's (1987) study of professional
baseball players presented striking confirmation of the instability of highly
skilled performance. The second set of findings to be accounted for are
those in the body of research on changing person and changing task
models. The model is entirely consistent with the changing task model and
also incorporates the possibility of cyclical changes in the emphasis on abil-
ity versus dispositional factors in determining performance. The present
model also provides some guidance for integrating the changing subject
model with the changing task model; the present model implies that the
tasks encountered draw more heavily upon different characteristics of the
individual (ability versus dispositional variables) at different stages of his
or her tenure in the job.

The final set of findings to be accounted for by the present model are re-
lated to the effects of practice on test validity. The present model suggests
that maintenance stages are more frequent in tasks that are practiced exten-
sively. All other things being constant, practice on most tasks will lead to
decaying levels of validity for cognitive ability tests.

IMPLICATIONS

The proposed model leads to several unique predictions. For example, be-
because transition periods in complex jobs are the result of the job itself, and
are the result of external events (e.g., changes in technology), the model
predicts that the true variation in validity coefficients will be larger in sim-
ple than in complex jobs. There is evidence in the validity generalization lit-
erature to support this prediction. Hunter and Hunter (1984) described
clerical jobs as more complex than work in the trades and crafts as well as
general industrial jobs. Separate validity generalization analyses of clerical
workers (Pearlman, Schmidt, & Hunter, 1980) and operators and mainte-
nance workers in the petroleum industry (Schmidt, Hunter, & Caplan,
1981) yielded residual standard deviations (i.e., standard deviations in the
distribution of the validity coefficient of general mental ability after tests
removing variability due to statistical artifacts) of .119 and .131 for clerical
and petroleum workers, respectively. This difference in standard deviations
is not large in an absolute sense, but is more impressive when considered in
the light of the results expected under the null hypothesis. Average (ob-
erved) validity coefficients for clerical and petroleum workers were .26 and
.19, respectively. Because the mean $r$ and the residual $SD$ are typically cor-
related (e.g., the average $r$ and $SD$ values shown in Table 5 of Pearlman et
al. (1980) are correlated, $r = .15$), a larger residual $SD$ would be expected
for clerical workers under the null hypothesis. The observed difference is in
the opposite direction, as predicted by the proposed model.
A second prediction that can be derived from this model is that a wide variety of organizational change and development (OD) activities will lead to increased validity for cognitive ability tests. OD efforts often lead to changes in the methods of supervision and, ultimately, to greater autonomy for employees at lower levels of the organization. Increased autonomy implies a greater need to make decisions and to act without explicit instructions; responding to this need will result in greater cognitive demands, more frequent transition periods, and higher levels of validity. To a certain degree, the job characteristics literature (Schwab & Cummings, 1976) and the OD literature (Golembiewski, Billingsley, & Yeager, 1976) affirm this hypothesis, but research that more directly addresses the problem is needed.

The proposed model suggests that we need to study the job environment rather than focusing solely on the job itself. For example, jobs that exist in a turbulent environment that features frequent changes in technology or work methods might be considerably more complex than similar jobs in a less turbulent environment. The model also suggests the need for longitudinal rather than cross-sectional research designs. The validity of cognitive ability tests and the causal impact of ability on performance may be dynamic rather than static. More research is needed to test the specific predictions of the present model. It is useful to note, however, that this model presents a viable alternative to the Schmidt et al. (1986) causal model of job performance: it accounts for the important phenomena accounted for by Schmidt et al. (1986) but that is also consistent with the growing body of literature that shows considerable instability in skilled performance.

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