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**P=F(MxA): COGNITIVE ABILITY AS A  
MODERATOR OF THE RELATIONSHIP  
BETWEEN PERSONALITY AND JOB  
PREFERENCE**

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**P=f(M xA): Cognitive Ability as a Moderator of the Relationship Between  
Personality and Job Performance**

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## **Abstract**

This study tested the validity of the use of personality tests with aptitude tests as predictors of performance for 203 warehouse workers using the Hollenbeck and Whitener (1988) interactive model. Results indicated cognitive ability explained a significant 2% of the variance in performance, with the interaction between cognitive ability and personality explaining a significant incremental 9% of the variance in performance. These results indicate a need to expand our models of the relationship between personality characteristics and job performance.

## **P=f(M x A): Cognitive Ability as a Moderator of the Relationship Between Personality and Job Performance**

The value of personality as a predictor of job performance has received substantial research attention over the past 25 years, yet this research has concluded that the validity of personality is quite low relative to other predictors (e.g., Guion & Gottier, 1965; Hunter & Hunter, 1984; Reilly and Chao, 1982; Schmitt, Gooding, Noe & Kirsh, 1984). In fact, the empirical support for the validity of personality tests for personnel selection has been so sparse that Guion and Gottier concluded "it is difficult, in the face of this summary to advocate with a clear conscience, the use of personality measures in most situations as a basis for making employment decisions about people, " (p. 160).

Recently, however, some support for the validity of personality measures as selection techniques has been observed. Barrick & Mount (1991) performed a meta-analysis on the validities of the "big five" personality dimensions (Extraversion, Emotional Stability, Agreeableness, Conscientiousness, and Openness to Experience). They found that Conscientiousness showed consistent relations with all job performance criteria for all occupational groups, Extraversion was valid across all criteria for two occupations having a high social interaction component, and that Openness to Experience and Extraversion were valid predictors for training proficiency. Similarly, Hough, Eaton, Dunnette, Kamp, and McCloy (1990) observed validity for six personality dimensions (Surgency, Achievement, Adjustment, Agreeableness, Dependability, and Locus of Control) in predicting performance in the military.

Although statistically significant correlations have been observed between personality and job performance in these studies, these correlations are still quite low relative to other predictors. Hollenbeck and Whitener (1988) recently argued that personality constructs might not relate to performance in a bivariate sense, but that their relationships with performance might be moderated by aptitude, or cognitive ability. Thus, the purpose of this study is to test the moderating role of cognitive ability in the relationship between personality and job performance.

## **The Personality - Aptitude Interaction**

Hollenbeck and Whitener (1988) discussed the role of personality in determining job performance. These authors relied on Maier's (1959) model of job performance which states that performance is a function of ability and motivation [i.e.,  $P = f(A \times M)$ ]. They argued that personality reflects individual differences in values, performance, needs or beliefs and, thus, would be more strongly related to one's motivation than ability to perform a job. Consequently, proposing that personality reflects one's motivation to perform a job and aptitude tests reflect one's ability to perform a job, they hypothesized that performance should be predicted by the interaction between ability and personality.

Hollenbeck and Whitener (1988) noted that they were not the first to recognize the possibility that personality measures may predict performance only when used in conjunction with aptitude tests. In discussing the low validities observed for personality measures, Ghiselli (1973) stated that the judicious selection of a combination of tests would increase the validity. Similarly, Hunter and Hunter (1984) noted with regard to personality measures that "... validity could be increased by using such predictors in conjunction with ability tests" (p. 95).

In addition, empirical support for the interaction between personality and aptitude in determining performance has previously been demonstrated. French (1958), using the Armed Forces Qualification Test and a measure of need for achievement, found that performance rates were an interactive function of these measures. Hobart and Dunnette (1967) observed that personality variables enhanced the validity of aptitude tests for predicting managerial effectiveness. Vroom (1960) found that only among high aptitude individuals was need for independence strongly correlated with performance.

More recently, Hollenbeck, Brief, Whitener, and Pauli (1988) conducted two studies specifically aimed at testing the interactive effects of aptitude and two personality constructs (self esteem and locus of control) in predicting performance. In study 1, the interaction between undergraduate management students' S.A.T. scores and locus of control explained 5% of variance in G.P.A., although the hypothesis was not supported with regard to self esteem. In study 2, the

interaction between aptitude (as measured by the Aptitude Index Battery) and self esteem explained 6% of the variance in life insurance salespersons' sales performance. However, in this case the hypothesis was not supported with regard to locus of control. The interaction observed in both studies indicated that personality was positively related to performance among high aptitude individuals, but was somewhat negatively related among low aptitude individuals..

Thus, in spite of the fact that research has not been overly supportive of the validity of personality as a predictor of job performance when used alone, there seems to be some support for personality's validity when used in conjunction with aptitude. As Hollenbeck et al. (1988) stated, however, future research is necessary to "uncover stronger effect sizes for personality-aptitude interactions," (p.450). In addition, these authors noted that "the critical need is for applied personality psychologists to develop more specific theories indicating which personality dimensions and which aptitudes predict success on which tasks," (p. 449).

### **Need for Achievement and Ability as Predictors of Performance**

One personality trait which contains an obvious underlying motivational theme is Need for Achievement. According to Jackson (1967), an individual who is high in Need for Achievement is one who aspires to accomplish difficult tasks; maintains high standards and is willing to work toward distant goals, responds positively to competition, and is willing to put forth effort to attain excellence. High need achievers are individuals who strive to accomplish things, and are very productive, resourceful and ambitious.

Although the focus of this study is on the incremental validity of using personality in conjunction with ability, research has demonstrated some support for the predictive value of an achievement orientation. For example, Hough et al. (1990) found that their measures of achievement (subscales of self esteem and work orientation) correlated approximately .20 with supervisory measures of performance in a military setting. In addition, Barrick and Mount (1991) classified this achievement orientation in their Conscientiousness dimension of personality. As previously discussed, this dimension of personality was the only one to be

significantly correlated with performance across all occupations (professional, police, managers, sales, and skilled/semi skilled) and across all criterion types (job proficiency, training proficiency, and personnel data). They observed uncorrected validities of .10 to .13, and corrected validities in the .20 range. Finally, Borman, White, Pulakos, and Oppler (1991) in a military setting, found that achievement orientation exhibited a direct relationship with supervisory ratings of performance as well as an indirect effect through predicting awards. Thus, the importance of achievement motivation as a determinant of work performance has recently been supported.

Similarly, cognitive ability has been consistently shown to be a valid predictor of job performance (Hunter & Hunter, 1984). In fact, Hunter and Hunter's meta-analysis found cognitive ability to be the strongest predictor of job performance among the various selection techniques studied, exhibiting a corrected mean correlation of .56 with job performance. Similarly, Ree and Earles (1992) noted the efficacy of general cognitive ability for predicting both training success and job performance.

In spite of the fact that both of these predictors may be related to performance alone, congruent with Hollenbeck and Whitener (1988), it is also possible to hypothesize that the predictive value of each may be enhanced when both are considered together. Need for Achievement is a personality characteristic which should be strongly indicative of an individuals' motivation to perform effectively in a job, whereas cognitive ability should accurately represent an individual's capability to perform effectively. For example, among those high in cognitive ability, the high achievement orientation should result in their increased performance through striving to accomplish higher and higher levels of performance, and engaging in activities which aid in improving performance. However, among those low in cognitive ability, an increased achievement orientation may actually detract from performance as one repeatedly attempts to perform the job when they are unable to do so effectively. Thus, the following hypothesis is proposed:

*The relationship between need for achievement and performance is moderated by cognitive ability such that a positive relationship will be observed for those high in cognitive ability, but a negative relationship will be observed for those low in cognitive ability.*

In summary, the purpose of this study was twofold. First, the study sought to replicate the results observed by Hollenbeck et al. (1988) with regard to the moderating role of ability in the relationship between personality and job performance using a larger and more heterogeneous sample. Second, this study attempted to extend their work by using a measure of general cognitive ability rather than a job-specific measure of ability.

## **Method**

### ***Sample***

Subjects were 203 employees working in a warehouse located in the midwest. The warehouse was owned by a Fortune 500 manufacturer of home appliances. Management at the warehouse was planning a major technological change, moving to a totally automated warehouse system. This project was aimed at identifying employees with basic skill deficiencies in an effort to provide them with recital training in these skill deficiencies prior to the training for the new technological systems. While approximately 11 different job categories were identified, all employees were classified with the title "warehouseman" and most were expected to perform any of the existing 11 job categories.

Subjects had an average of age of 44.4 years, and average seniority of 12.2 years. Fifty-eight percent of the sample was male, and 16.5% were members of ethnic minority groups.

### ***Measures***

**Cognitive Ability.** Cognitive Ability was measured as a composite of four separate ability tests. Three tests (Reading Comprehension, Number Operations and Problem Solving) were taken from the Adult Basic Learning Exam (ABLE) Level 3 (Karlsen & Gardner, 1986a). The ABLE norms booklet (Karlsen & Gardner, 1986b) indicates that the coefficient alpha

reliability estimates for these three tests are .87 for Reading Comprehension, .87 for Number Operations, and .90 for Problem Solving.

In addition, the Wonderlic Personnel Test (Form A) (E.F. Wonderlic and Associates, 1981; 1983) was administered. This test has been used extensively as a measure of cognitive ability (Stone, Stone & Guetal, 1990). In fact, with regard to the Wonderlic, Guion (1965) stated "as a measure of general mental ability, [the Wonderlic] has amassed an impressive collection of validities" (p. 223).

Scores from each of the four tests were first converted to standardized Z-scores, and then summed to form a composite measure of cognitive ability. The coefficient alpha reliability estimate of this four-item (test) composite was .89.

**Need for Achievement.** Need for Achievement was measured with a modified version of the 20 item scale from the Jackson PRF Form E (Jackson, 1967). This measure was modified by having subjects indicate their agreement with each statement using an expanded four point scale consisting of the choices of Very True, True, False, and Very False (instead of the True/False response categories in the PRF). The Coefficient alpha reliability estimate of this measure was .84.

**Performance.** Performance was measured with a ten item scale filled out by the employee's supervisor. Supervisors were asked to indicate their agreement with each of the ten items on a 7 point likert scale, ranging from strongly disagree to strongly agree. Example items of this scale were "This subordinate always gets things done on time," "I never have to check up on this subordinate," and "This subordinate gets along well with co-workers". The coefficient alpha reliability estimate for this scale was .90.

### ***Procedure***

The researchers visited the job site to administer the skill assessment system (SAS). All warehouse workers, their supervisors, and managers (total N=300) were required by plant management to take the tests. These individuals were all brought together at the beginning of each of three shifts, and the tests were administered in one large group during work hours. Subjects were assured that no employment decisions would be made on the basis of their test scores, but that a list of individuals whose scores indicated skill deficiencies would be given to the training director. They were also assured that they would receive their scores soon after the test administration.

Following the administration of the system, the supervisors were reassembled and were given the performance evaluation scales to complete. The purpose of the study was explained to them, and it was emphasized that these evaluations would never be seen by the employees, nor by anyone employed by the company. They were asked to complete the scales over the following week and mail them directly to the researchers. Within three weeks, all of the performance evaluations had been returned.

### **Results**

The means, standard deviations, and intercorrelations among the variables are displayed in Table 1. As can be seen in the table, cognitive ability was significantly related to performance, but need for achievement exhibited no significant correlation with performance.

**Table 1.**

Means, Standard Deviations and Intercorrelations among the Variables.

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Variable	Mean	Std. Dev	1	2	3
Cognitive Ability	.02	.85	-		
Need for Achievement	2.17	.29	-.02	-	
Performance	4.63	1.17	.14*	-.10	-

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N = 203

\*  $p < .05$

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The hypothesis that the relationship between personality (need or achievement) and performance would be moderated by cognitive ability was tested through hierarchical regression (Cohen & Cohen, 1983). This technique has also been referred to as moderated regression (Stone & Hollenbeck, 1984). Performance was regressed on the cognitive ability composite in the first step, need for achievement in the second step, and the cognitive ability by need for achievement cross product in the third step. This cross product carries the interaction. Support for the hypothesis would be demonstrated by a significant amount of variance being explained by the third step in the hierarchical regression, the step containing the cross product term. The results of this analysis are presented in Table 2.

**Table 2.**

Regression Results Regressing Performance on Cognitive Ability, Need for Achievement, and the Interaction.

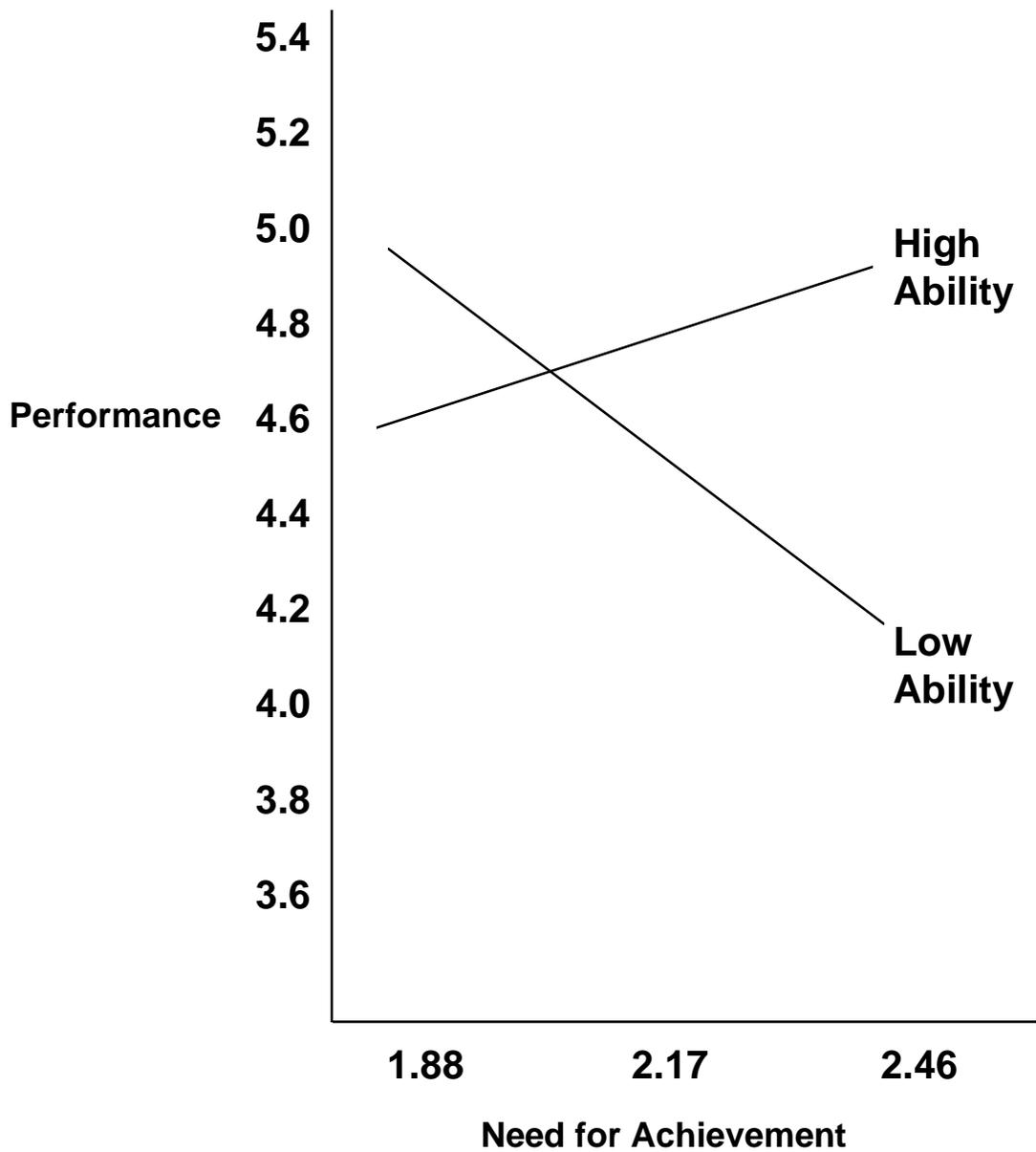
Step	Variable	R <sup>2</sup>	R <sup>2</sup> Change	B-Weight
1	Cognitive Ability	.02*	.02*	-2.71**
2	Need for Achievement	.03*	.01	-.48
3	CA x nAch	.12**	.09**	1.35**
			(Constant)	5.67

N = 203

\*  $p < .05$  \*\*  $p < .01$

As can be seen in Table 2, the cognitive ability composite explained 2% ( $p = .05$ ) of the variance, need for achievement explained no incremental variance (0%; n.s.), and the cognitive ability by need for achievement interaction explained an incremental 9% ( $p = .01$ ) of the variance in performance. The nature of this interaction was plotted in Figure 1 by computing predicted performance scores for individuals one standard deviation above and one standard deviation below the mean of each of the two predictors. As can be seen in the figure, need for achievement is positively related to performance among those high in cognitive ability, but is negatively related among those low in cognitive ability. Thus, these results strongly support the hypothesis.

**Figure 1. Depiction of the Interaction  
Between Ability and Personality in Determining  
Supervisory Ratings of Performance**



## Discussion

The validities observed for personality constructs in personnel selection research have been quite low when these tests are used alone. However, this study supported Hollenbeck and Whitener's (1988) model of performance which posits that personality and aptitude interactively predict job performance. Need for achievement was positively related to performance among those high in ability, but it was negatively related to performance among those low in ability.

What is even more interesting about the support for this hypothesis is that not only was significant interaction observed, but the nature of these interactions was consistent with those found in past research. The interaction in Hollenbeck et al.'s (1988) study 1 indicated that there was a positive relationship between locus of control and performance among those high in aptitude, but a negative relationship among those low in aptitude. The interaction in their study 2 indicated a positive relationship between self-esteem and performance for those high in aptitude and a small negative relationship among those low in aptitude. As can be seen in Figure 1, the interaction observed in our study, using need for achievement, almost exactly replicates those found in the Hollenbeck et al. studies.

Recent research has demonstrated that personality may be related to performance in a bivariate sense (Barrick & Mount, 1991; Borman et al., 1991; Hough et al., 1990). However, this study demonstrates the need for expanding our view of the role of personality in determining performance beyond that of just a bivariate relationship. However, although this research has demonstrated statistically significant relationships with job performance, these observed relationships have been relatively low ( $r$ 's usually  $<.20$ ).

Numerous researchers have suggested that the validity of personality constructs can be improved by considering these constructs in conjunction with ability (Ghiselli, 1973; Hollenbeck et al., 1988; Hunter & Hunter, 1984). In addition, empirical support has been demonstrated for this relationship in various settings, and with a variety of personality constructs (French, 1958; Hobart & Dunnette, 1962; Hollenbeck et al. 1988; Kipnis, 1962). Thus, these results indicate

that there is a need to further examine the moderating role of cognitive ability in the relationship between personality and job performance.

Some limitations to our study must be noted, however. In spite of the fact that we had a rather large sample which provided strong statistical power ( $>.80$ ) and stable regression results (Cohen & Cohen, 1983), it was not a random sample. Considering Schneider's (1983) contention that all employees in a single organizational context undergo the same attraction-selection-socialization-attrition cycles, the range of the sample on the variables of interest was probably restricted. This might argue against the generalizability of the results to other organizations.

A second criticism is that the effect sizes, although larger than those observed by Hollenbeck et al. (1988), were not extremely large. The incremental R squared for the interaction was equivalent to a correlation of only about .29. In addition, the multiple R was only equal to .34, a value somewhat lower than the estimates provided by Hunter and Hunter (1984) for cognitive ability alone (.56).

With regard to this criticism, however, three points must be noted. First although the incremental R squared for the interaction was not extremely large, it was still four times as large as that associated with cognitive ability alone. In addition, an effect size this large qualifies as a "moderate" effect size according to Cohen and Cohen (1983). Second, it must be noted that Hunter and Hunter's estimates were corrected for range restriction and unreliability, whereas ours were not. Finally, research by Hunter and Hunter does note that the validity of cognitive ability is low for less complex relative to highly complex jobs. Given the fact that the job of warehouse worker is rather simple, the low correlation between cognitive ability and performance is not surprising.

Although the focus of our study was on the increased validity of personality observed when considered in conjunction with ability, our results imply that the predictive value of ability tests may also be enhanced by the simultaneous consideration of theoretically valid personality constructs. This implication, if it can be further validated, has a great deal of promise for researchers and practitioners in the area of selection.

While selection research no longer completely shuns the use of personality variables when developing and designing selection procedures, personality variables still cause some concern. However, as this research indicates, personality may have a strong influence on one's performance. By viewing personality as other than a bivariate cause of performance, as was done in the present study, a more accurate picture of how personality affects performance can be found. This finding may have important practical implications for the development of selection systems in organizations.

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