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Meta-Analyzing the Relationship Between Grades and Job Performance

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Employers and academics have differing views on the value of grades for predicting job performance. Employers often believe grades are useful predictors, and they make hiring decisions that are based on them. Many academics believe that grades have little predictive validity. Past meta-analyses of the grades–performance relationship have suffered either from small sample sizes or the inability to correct observed correlations for research artifacts. This study demonstrated the observed correlation between grades and job performance was .16. Correction for research artifacts increased the correlation to the .30s. Several factors were found to moderate the relationship. The most powerful factors were the year of research publication and the time between graduation and performance measurement.

There has been considerable disagreement as to whether grades predict job performance. In general, employers have believed that grades help them understand who will perform a job well (Campion, 1978; Zikmund, Hitt, & Pickens, 1978). Employers have argued that grades are useful predictors because they reflect intelligence, motivation, and other abilities applicable to the job (Baird, 1985). Many employers screen applicants with a minimum grade point average (GPA) or heavily weighted grades when analyzing resumés (Dipboye, Fromkin, & Wiback, 1975; Reilly & Warech, 1993).

Many academics have contended that grades are not good predictors of job performance (e.g., Calhoon & Reddy, 1968; Nelson, 1975). Nelson (1975) argued that there were situations in which skills learned in college were not required by the job or skills not learned in college courses affected job performance (e.g., social skills). They also argued that grades varied as a function of the university and college from which they were assigned (Reilly & Warech, 1993).

The purpose of this article was to meta-analyze the relationship between GPA and job performance to help resolve the controversy. The current meta-analysis focuses on supervisory performance ratings and expert performance ratings as the dependent variable and GPA as the independent variable.

Previous meta-analyses have not presented a clear answer to the question of whether grades predict job performance. Three previous meta-analyses have examined the broad issue of the relationship between grades and adult accomplishments. One analysis of 39 studies concluded that there was no relationship between GPA and adult accomplishments in many settings (Bretz, 1989). Two more detailed meta-analyses of over 100 studies also examined if grades predicted adult accomplishment. They operationalized accomplishment to mean success in graduate school, amount of salary earned, number of promotions received, job performance, and many other achievements. They found a modest (r = .15; Samson, Graue, Weinstein, & Walberg, 1984) to moderate r = .20; Cohen, 1984) relationship between grades and adult accomplishments.

The studies also found several moderators. First, business, nursing, and military settings were associated with much higher levels of validity than teaching and engineering settings (Cohen, 1984; Samson et al., 1984). Second, undergraduate and master's GPAs were more valid than doctoral or medical school grades (Samson et al., 1984). Third, studies published before 1950 were associated with higher validities than studies published after 1950 (Cohen, 1984). Fourth, published studies were associ-

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ated with higher validity than unpublished studies (Samson et al., 1984).

Although interesting, the previous results may be limited by the nature of the dependent variable. The variable "adult accomplishments" is a grab bag of many different phenomena that may be considered somewhat ill-defined and is not necessarily relevant to the grade–performance link. Furthermore, none of the investigations corrected for artifacts such as criterion unreliability or range restriction.

Another early meta-analysis directly addressed the link between grades and job performance. It suggested that the grades–supervisory ratings relationship was modest (r = .14, K = 8, and N = 994; Reilly & Chao, 1982). Unfortunately, corrections for artifacts such as measurement unreliability and range restriction were not routinely conducted at that time.

Recent meta-analyses offered more methodologically sound results. One reported a relationship of r = .11 (K = 11, N = 1,089) between grades and job performance including correction for measurement reliability (Hunter & Hunter, 1984). Unfortunately, the "hard-to-find nature" of studies linking grades to performance limited Hunter and Hunter's (1984) sample size to 11 studies and did not allow correction for range restriction.

The most recent meta-analysis of grades and job performance found an observed correlation between grades and measures of job performance of .15 for high school grades (K = 13) and .14 for college grades (K = 50; Dye & Reck, 1988). These validity figures increase to .19 for high school grades and .18 for college grades when corrected for measurement reliability. They also found that partial measures of GPA were more valid than overall GPA. Specifically, they found that the combined freshman and sophomore GPA, the combined junior and senior GPA, or the GPA in the major subject were most valid. Finally, they found the 90% credibility value for the grades–performance correlation to be −.01; validity did not generalize.

The conclusions of the most recent meta-analysis (see Dye & Reck, 1988) may be limited by two factors. First, Dye and Reck (1988) noted that having no correction for range restriction was a major limitation. Second, Dye and Reck did not examine moderators such as type of occupation, (business vs. engineering) or level of education (master's vs. bachelor's degree) that have shown strong effects in the adult accomplishment literature.

The current investigation was designed to answer the question, "Does grade point average predict job performance?" It adds value by three means. It is based on a larger number of studies and therefore a larger sample size than past GPA–performance studies. It also corrected for range restriction. Finally, it investigated key moderator variables from the adult accomplishment literature.

Table 1
Reliability of Coded Variables

Variable	Reliability
Correlation between two continuous variables	
GPA–performance	.99
Sample size	.98
Time between GPA and performance measurement (years)	1.00
Agreement for noncontinuous variables (%)	
Education level	98.4
Criterion type	98.4
Source of performance information	98.4
Criterion gathered for research versus administration	100.0
Criterion gathered within a field or job	100.0
Type of organization	95.3
Sample type	98.4
Information source	98.4
Year of publication	100.0

Note. Reliability data were determined before consensus was reached with regard to discrepancies between the determinations of the two coders. N = 61. GPA = grade point average.

Method

Literature Review

The literature reviewed was gathered from four sources. First, we searched the following databases: Abstracted Business Information (known as ABI Inform) of University Microfilms, Medline of the National Library of Medicine, PsycLit of the American Psychological Association, Educational Resources Information Center (known as ERIC), and Dissertation Abstracts International. Second, we checked the reference lists and studies used by several literature reviews and meta-analyses (Calhoon & Reddy, 1968; Cohen, 1984; Dye & Reck, 1988; Pascarella & Terrenzini, 1991; Samson et al., 1984; Wingard & Williamson, 1973). Third, a call was made over HRNet (an electronic network of more than 1,000 human resource professionals) for studies relating GPA to criterion variables such as job performance. Fourth, letters were sent to approximately 20 researchers working in the area.

Criteria for Inclusion

There were three criteria that must have been met for studies to be included in the meta-analysis. First, there had to be no evidence of criterion contamination. This precluded studies in which the same person hired and rated the performance of an incumbent and studies that used self-ratings of performance (individuals who knew their GPAs). Second, measures of job performance had to be measures of output, ratings of performance by supervisors or ratings by subject-matter experts. Subject-matter experts were occasionally used to rate the per-

Table 2
Results of Meta-Analysis

Variable	r	r_{cr}	$r_{cr,rr}$	$r_{cr,rr,pr}$	CI[a]	K	N
Overall Observed variance = .0087 Sampling error = .0047	.16	.23	.32	.35	.17–.53 .30–.41	71	13,984
Education level							
College Observed variance = .0073 Sampling error = .0048	.16	.23	.33	.36	.22–.50 .30–.42	49	9,458
Master's degree Observed variance = .0030 Sampling error = .0084	.23	.33	.46	.50	— .31–.56	4	446
PhD or MD degree Observed variance = .0021 Sampling error = .0033	.07	.10	.14	.15	— .08–.25	6	1,755
Years between GPA and performance							
1 year Observed variance = .0095 Sampling error = .0085	.23	.32	.45	.49	.40–.58 .40–.62	13	1,288
2–5 years Observed variance = .0083 Sampling error = .0066	.15	.21	.30	.33	.21–.45 .23–.48	11	1,562
6+ years Observed variance = .0076 Sampling error = .0045	.05	.08	.11	.12	−.05–.29 .00–.41	4	866
Source of performance information							
Supervisor Observed variance = .0073 Sampling error = .0046	.16	.23	.33	.36	.21–.51 .31–.41	56	11,117
Expert Observed variance = .0082 Sampling error = .0045	.11	.16	.23	.25	.07–.43 .15–.39	12	2,539
Type of organization							
Business Observed variance = .0090 Sampling error = .0064	.14	.19	.27	.30	.16–.44 .18–.51	6	868
Medical Observed variance = .0068 Sampling error = .0052	.11	.16	.23	.25	.13–.37 .14–.38	10	1,853
Education Observed variance = .0105 Sampling error = .0053	.21	.27	.39	.42	.24–.60 .35–.50	29	4,817
Scientific Observed variance = .0082 Sampling error = .0073	.12	.17	.24	.27	.18–.34 .15–.44	7	895
Military Observed variance = .0030 Sampling error = .0021	.14	.20	.29	.31	.22–.40 .22–.46	8	3,568
Source of information							
Publication Observed variance = .0094 Sampling error = .0047	.17	.24	.34	.37	.18–.56 .31–.43	58	11,212
Dissertation Observed variance = .0052 Sampling error = .0056	.13	.19	.27	.30	— .18–.39	12	2,062

Table 2 (*continued*)

Variable	r	r_{cr}	$r_{cr,rr}$	$r_{cr,rr,pr}$	CI[a]	K	N
			Year of publication				
Up to 1960 Observed variance = .0134 Sampling error = .0065	.23	.33	.45	.50	.27–.37 .37–.63	24	3,256
1961 or later Observed variance = .0053 Sampling error = .0047	.14	.20	.28	.30	— .25–.35	47	10,728
			Combination of two or more moderator variables				
Publication in 1961 or later and 1 year between GPA and performance Observed variance = .0060 Sampling error = .0077	.21	.29	.41	.45	— .35–.55	10	1,154
Publication in 1961, 1 year, and undergraduate Observed variance = .0049 Sampling error = .0093	.19	.27	.37	.41	— .32–.54	7	697

Note. Results are reported with "more correction" from left to right. Coefficients are the observed correlation (r), the correlation corrected for measurement reliability of the criterion (r_{cr}), the correlation corrected for range restriction in the predictor and the previous correction ($r_{cr,rr}$), and the correlation corrected for measurement reliability of the predictor and the previous corrections ($r_{cr,rr,pr}$). CI = credibility interval and confidence interval; for details see column-specific table footnote. GPA = grade point average.

[a] One cannot calculate a credibility interval when there is no residual variance left; therefore, dashes have been inserted in affected cells. The top figure represents the 80% credibility interval (as per Hunter & Schmidt, 1990). The lower figure represents the bootstrapped 95% confidence interval around the mean. Thus, the credibility interval refers to the value that describes the distribution of validity coefficients that were fully corrected, and the 95% confidence interval describes the variability in mean values one would expect when analyzing different samples or studies.

formance of medical professionals. This criterion precluded paper-and-pencil tests or composite measures of performance that included paper-and-pencil tests of relevant knowledge, skills, or abilities. Third, grades had to be reported in the form of GPA. Studies reporting class standing or judgments that were based on grades and other factors were excluded.

We used several rules for dealing with multiple validity coefficients for the primary analysis looking at the relationship between grades and job performance. Grades were from only one degree program in a school. If grades from two levels of education (e.g., bachelor's and master's of business administration grades) were reported for a single set of individuals, the most recent grades were entered in the primary analysis. The other grades could be used in subsequent analyses of moderator variables. In addition, the overall GPA was used when multiple types of grades were provided. For example, a study that provided overall GPA, senior grades, and grades in major contributed the overall GPA–performance coefficient to the primary analysis.

Coding

Two individuals coded the variables in the majority of the studies. The first coder was Craig A. BeVier who was pursuing doctoral studies in industrial/organizational psychology. The second coder was a student pursuing the master of science degree in industrial management. These individuals coded 61 of the 71 studies. The remaining studies were coded by only one individual because of the difficulty of accessing the study results.

Each individual independently coded articles on all the characteristics noted in Table 1. After rating approximately every 20% of the articles, we held a meeting to reach a consensus and resolve discrepancies in the coding of the two individuals. The data in Table 1 reflect reliability before consensus was reached.

Meta-Analytic Procedure

The Hunter–Schmidt (1990) approach was used to analyze the data. It involved computing sample size weighted observed means and standard deviations and then correcting for the artifacts of criterion reliability, predictor reliability, and range restriction in the predictor (GPA). In these analyses, the mean correlation was used instead of individual correlations in the estimation of sampling error (Law, Schmidt, & Hunter, 1994).

Corrections for Measurement Reliability and Range Restriction

None of the studies reviewed for this meta-analysis reported information on measurement reliability or the range restriction of grades. Thus, we relied on other research for this information. An estimate of reliability of supervisory ratings was found in a study by Rothstein (1990). Rothstein found the mean reli-

ability for duty ratings was .48 and mean reliability of ability ratings was .52 after approximately 1 year of observation. Our calculations used the .50 reliability coefficient because most studies measured performance within 1 year.

Reliability of grades was also estimated from using other research. Reilly and Warech (1993) reported an internal consistency measure of grade reliability of .84. This figure was used in our analyses.

The amount of range restriction was assessed by examining data from other types of studies to find plausible values of u (restricted SD and unrestricted SD). Several sources converged upon an estimate of an average u across multiple studies of .70. An interviewing meta-analysis found $u = .68$ (McDaniel, Whetzel, Schmidt, & Maurer, 1994). Other analyses suggested $u = .712$ for cognitive ability tests with low cut-off scores and $u = .697$ for educational predictors such as the Law School Admissions Test (LSAT; Alexander, Carson, Alliger, & Cronshaw, 1989). Although none of these is completely similar to GPA, the value of .70 seemed like a reasonable value to use in the analyses to avoid a large downward bias in results.

The use of point estimates for reliability is somewhat limiting. The lack of reliability and range restriction distributions did not allow calculations of the amount of variance in observed correlations due to these factors.

Results

Results are presented by discussing (a) outlier analysis, (b) interrater reliability, and (c) meta-analysis coefficients.

Outlier Analysis

Outlier analysis was conducted by graphing a scree plot of the sample adjusted mean deviancy or SAMD statistics calculated for each study (Huffcutt & Arthur, 1995). Three correlations seemed much larger than the other correlations. These correlations were .56 (Clute, 1963), .60 (Knight, 1922), and .70 (Somers, 1923). They were dropped from subsequent analyses.

Interrater Agreement

Interrater agreement was calculated with correlations for continuous variables and percentage agreement for categorical variables; thus, both types of statistics are found in Table 1. Results in Table 1 suggest high reliability for both continuous and categorical variables. The high levels of reliability may be attributed to experienced researchers who have coded other material and the ease of the coding task. Most of the coding required finding the necessary information rather than making complex judgments.

Meta-Analysis

The results of the meta-analysis are presented in Table 2. The overall observed correlation is .16. The results are reported with "more correction" from left to right. Coefficients are the observed correlation (r, see Column 1), the correlation corrected (r_{cr}, Column 2) for measurement reliability of the criterion, the correlation corrected for range restriction in the predictor and the previous correction ($r_{cr,rr}$, Column 3), and the correlation corrected for measurement reliability of the predictor and the previous corrections ($r_{cr,rr,pr}$, Column 4). This ordering should allow readers to find the correlation of most interest. For example, a researcher might be interested in $r_{cr,rr}$ because that statistic is corrected for range restriction and criterion reliability. The correlations in Column 3 ($r_{cr,rr,pr}$) may be of primary interest to scientists interested in the relationship between constructs, and such validity coefficients will probably not be observed in most applied organizational settings.

The overall coefficient of .16 is quite close to the results of Dye and Reck (1988) and Cohen (1984). However, the 80% credibility interval (.17 to .53) does not include zero, suggesting that GPA is a valid predictor of job performance. In addition, corrections for range restriction and measurement reliability are available that suggest many correlations are in the .30s.

There appear to be several moderators. First, educational level seems to moderate the GPA–performance relationship. The observed correlation of .16 for undergraduate grades is notably larger than the .07 for PhD grades (though only six studies were available for PhDs). One might expect this because the work of many PhDs and MDs is difficult to measure and admission to such programs is more selective than undergraduate programs.

Second, the years between graduation and measurement of job performance may be a moderator. Table 2 shows that the mean validity is .23 after 1 year, .15 after 2 to 5 years, and .05 after 6 or more years. It is not clear if this decrease in observed correlation is a function of a dynamic criterion or an increasing amount of range restriction over the years (Barrett, Alexander, & Doverspike, 1992; Barrett, Caldwell, & Alexander, 1985).

Third, supervisor ratings ($r = .16$) seem to be somewhat more predictable than expert ratings ($r = .11$). This may partially be a function of the increased time that supervisors have for observing worker behavior that leads to increasing levels of reliability (Rothstein, 1990).

Fourth, it appeared that validities were highest in education organizations (observed $r = .21$) and lower in business (.14), military (.14), scientific (.12), and medical (.11) organizations. The results for business, scientific, and military organizations should be viewed with caution because there are relatively few studies in each category.

Fifth, there was a marked drop in validity for studies published in 1961 to the present (observed $r = .14$),

whereas studies published in 1960 and earlier report higher observed validities (r = .23). This is similar to other studies that found differences in the validities before and after 1950 (Cohen, 1984).

Two analyses of a combination of moderators were possible. First, studies done after 1960 that measured job performance after 1 year suggested one would find an observed correlation of .21. Second, studies done after 1960 that measured job performance after 1 year and sampled only undergraduates showed an observed correlation of .19. This correlation rises to .37 when corrected for measurement reliability in the criterion and range restriction.

Discussion

The results can best be understood by discussing (a) answers to the research question, (b) limitations of the study, and (c) future research.

Answers to the Research Question

The answer to the question of whether grades predict job performance appears to be yes. The overall observed correlation of .16 is modest, but corrections for research artifacts increase the estimate in the population to the .30s. In addition, the 80% credibility interval does not include zero. This information is more optimistic than previous studies and suggests that GPA could be a more valid predictor of job performance than thought.

The relationship between GPA and performance also appears to be moderated by factors such as when articles were published and the time lag between grades and measurement of job performance. Grades reported before 1961 appeared to be more valid. In addition, validities were higher after 1 year on the job. Other moderators were not quite as strong. Published reports found slightly higher validities than unpublished dissertations and studies using supervisors to rate performance reported slightly higher validities than studies using experts.

There are also reasons for caution when viewing the GPA–performance relationship. First, there is little theory to help understand why grades predict job performance. Some of these concerns are also opportunities for future research and noted below. Second, while grades are more valid than previously thought, they are not as valid as other selection measures. The current corrected validities in the .30s are similar to the corrected validity of .33 for unstructured interviews (McDaniel, Whetzel, Schmidt, & Maurer, 1994). However, they are not as high as approximately .50 for cognitive ability tests (Hunter & Hunter, 1984) or .44 for structured employment interviews (McDaniel et al., 1994).

Limitations

There are two salient limitations. First, our correction for range restriction was derived from other studies and is only a rough estimate. This value could result in too much range restriction which would mean that the true rho would be between the observed r and the fully corrected r. Second, most of the studies in this meta-analysis sampled students only from one university (e.g., University of Tennessee or University of Washington); only a few included samples across two universities within the same study. Thus, variability in grades across multiple universities was not present in the statistics of most studies.

Future Research

Future research should focus on model building around grades. One approach would be to develop a model of the individual difference variables that grades might measure. Cognitive ability (Hunter & Hunter, 1984; Schmidt & Ones, 1992) and the "Big Five" personality measures (Barrick & Mount, 1991) might yield interesting results. Conscientiousness, which indicates persistence, planning, follow-through, and self-motivation, might be particularly relevant. Higher levels of conscientiousness might lead to more class attendance, organized studying, timely studying, and desire to achieve good grades.

Research on this model could use two approaches. First, researchers might test for incremental validity of grades over measures of intelligence, conscientiousness, and biodata. Second, researchers might use structural equations or path analysis to map a theoretical model (e.g., Hunter, 1983) that relates individual difference variables to performance, promotion, and salary.

There has also been relatively little research on the adverse impact associated with using grades as a selection device (Reilly & Warech, 1993). It appears that recruiters use this information either as a method of determining who is interviewed or as a part of the interview. Thus, both academics and recruiters may wish to understand the influence of these actions.

Finally, there is a need for studies examining how to use GPA as organizations recruit from multiple universities. Approaches might include measuring average GPA across institutions and adjusting grades or weighting GPAs by institutional prestige. However, this research effort should receive less emphasis than efforts to understand the variables that grades measure and a theoretical model that explains relationships between grades and job performance.

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