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Select on Intelligence

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Co-author's Note

Frank Schmidt died on 21 August, 2021 in Iowa City, IA. I am greatly indebted to him for his legacy in intelligence testing and meta-analysis, intellectual honesty and courage, and endless support and mentoring over the years. He will be forever remembered and forever missed.

The principle that we wish to convey in this chapter is quite simple: Ceteris paribus, higher intelligence leads to better job performance. Intelligence is the best determinant of job performance, and hiring people based on intelligence leads to marked improvements in job performance. These performance improvements have great economic value for organizations, giving organizations that hire people based on intelligence a leg-up over other organizations. This principle is incredibly broad and generalizable as it has been empirically validated across numerous jobs, occupations, and industries.

But before elaborating further on this principle, we would like to emphasize that, surprisingly, most human resource (HR) managers do not hire based on intelligence. In fact, most HR managers do not make decisions based on research-informed best practices at all (Rynes, Colbert, and Brown, 2002). This gap between practice and research findings is especially large in the area of staffing, where many HR managers are unaware of this most fundamental staffing principle based on extensive research findings and, as a result, fail to use scientifically established valid employment selection procedures. You may think that this is true only for a small portion of HR managers, but this is not the case.

In a survey of 5000 Society for Human Resource Management members whose title was at the manager level and above, Rynes and her research team (2002) asked two questions relevant to this chapter:

(a) Is conscientiousness, a personality trait, a better predictor of employee performance than intelligence?
(b) Do companies that screen job applicants for values have higher performance than those that screen for intelligence?

The answer to both the questions is (definitely) no![1] But shockingly, 72% of respondents answered yes to the first question and 57% answered yes to the second question. That is, on average, two-thirds of the respondents did not know the most basic principle established by extensive research findings; namely, that intelligence is the single best predictor of employee job performance. And worse, these were largely HR managers and directors with an average 14 years of work experiences in HR. Of the 959 respondents, 53% were HR managers, directors, and vice presidents, occupying an important role in designing and implementing HR practices. Given the respondents' high-level HR positions and considerable experience, we speculate that the percentage of wrong answers would be even higher among less experienced HR staff. This problem is not limited to the United States but is also widely observed in other countries (e.g. Tenhiälä, Giluk, Kepes, Simon, Oh, and Kim, 2016). Thus, we believe that many would benefit by reading this chapter.

What Is Intelligence?

The concept of intelligence is often misunderstood. Intelligence is not the ability to adapt to one's environment: Insects, mosses, and bacteria are well adapted to their environments, but they are not intelligent. There are many ways in which organisms can adapt well to their environments, of which intelligence is only one. Instead, intelligence encompasses the ability to understand and process abstract concepts to solve problems. Gottfredson (1997, p. 13), in an editorial originally published in the *Wall Street Journal* and later reprinted in *Intelligence*, defined *intelligence* as "a very general mental capability that, among other things, involves the ability to reason, plan, solve problems, think abstractly, comprehend complex ideas, and learn quickly and learn from experience." This traditional definition captures well *what* intelligent people can do, but this definition is still insufficient in capturing *why* smart people can do it. For the purposes of this chapter, we define intelligence as *the capacity to learn and retain complex information.* Higher levels of intelligence lead to more rapid learning, and the more complex the material to be learned, the more this is true. Intelligence is often referred to as general mental ability (GMA), and we use the terms "intelligence" and "GMA" interchangeably throughout the remainder of this chapter.[2]

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[1]With regard to the first question, the validity of conscientiousness measured via self-reports is 0.22, whereas that of General Mental Ability is 0.65 in predicting supervisory ratings of job performance (Schmidt, Shaffer, and Oh, 2008). With regard to the second question, the answer exists only at the individual level, not at the company level. Arthur, Bell, Villado, and Doverspike's (2006) meta-analysis has shown that the validity of person-organization fit (or value congruence) is 0.13, even less than that of conscientiousness measured via self-reports.

[2]In the applied psychology and HR/OB literatures, another term, "cognitive ability" is widely used.

Another important nature of intelligence is that it is the broadest of all human mental abilities. Narrower abilities include verbal ability, quantitative ability, and spatial ability. These narrower abilities are often referred to as special aptitudes. These special aptitudes also predict job performance (although not as well as GMA), but only because special aptitude tests measure general intelligence as well as specific aptitudes (Brown, Le, and Schmidt, 2006). In other words, it is the GMA component in these specific aptitude tests that predicts job performance. For example, when a test of verbal ability predicts job or training performance, it is the GMA part of that test – not specifically the verbal part – that primarily does the predicting, thus "not much more than *g* (GMA)" (Brown et al., 2006; Ree and Earles, 1991, 1992; Ree, Earles, and Teachout, 1994).

Finally, although behavioral geneticists have concluded that GMA is highly influenced by heredity, it does not necessarily mean that nothing can improve GMA (Gottfredson, 1997). A recent meta-analysis by Ritchie and Tucker-Drob (2018) has reported that an additional year of education improves GMA by approximately one to five IQ points across the life span: "Education appears to be the most consistent, robust, and durable method yet to be identified for raising intelligence" (p. 1358).

Higher Intelligence Leads to Better Job Performance

Intelligence plays a central role in virtually all of our daily activities and lifelong pursuits. It predicts many important life outcomes such as performance in school, amount of education obtained, rate of promotion on the job, ultimate job level attained, and salary (Gottfredson, 1997, 2002; Judge, Klinger, and Simon, 2010; Schmidt and Hunter, 2004). More relevant to this chapter is that it predicts job and training performance (Schmidt et al., 2008). No other trait predicts so many important real-world outcomes so well.

However, until several decades ago, most people believed that general principles of this sort were impossible in personnel selection and other social science areas. It was believed that it was not possible to know which selection methods would be most effective for a given organization unless a local validation study was conducted for each job in that organization. This belief, called "situational specificity," was based on the fact that validity studies of the same selection procedures in different jobs in the same organization and across different organizations appeared to give different and often conflicting results. The differences were attributed to the assumption that each job situation includes subtle yet significantly different (i.e. situation-specific) characteristics related to the nature of job performance. Therefore, practitioners at that time (to the delight of consulting firms) were advised to conduct time-consuming and costly local validation tests for virtually all jobs in all organizations to determine if a selection procedure was valid (Ghiselli, 1966).

We now know that these "conflicting results" were caused mostly by statistical and measurement artifacts (e.g. sampling error[3]), and that some selection procedures (e.g. intelligence) have higher validity for predicting performance than others (e.g. age, graphology) across all jobs (Schmidt and Hunter, 1981, 1998). This discovery was made possible by a new method, called meta-analysis or validity generalization, that allows practitioners and researchers to statistically synthesize the results from individual studies.[4] Many meta-analyses synthesizing numerous individual studies based on data collected from various jobs, occupations, organizations, industries, business sectors, and countries all point to the same conclusion that intelligence is the single best predictor of job performance (Schmidt et al., 2008). Thus, there is little to no need to conduct a local validation study to see whether intelligence is predictive of job performance.

Below, we will briefly review some notable studies among the vast body of literature documenting the strong link between intelligence and job performance. Ree and colleagues have shown this for jobs in the Air Force (Olea and Ree, 1994; Ree and Earles, 1991, 1992; Ree et al., 1994), as have McHenry, Hough, Toquam, Hanson, and Ashworth (1990) for the US Army in the famous Project *A* study. (With a budget of 24 million dollars, Project *A* is the largest test validity study ever conducted.) Hunter and Hunter (1984) showed this link for a wide variety of civilian jobs, using the US Employment Service database of studies. Schmidt, Hunter, and Pearlman (1980) have documented the link in both civilian and military jobs. Other large meta-analytic studies are described in Hunter and Schmidt (1996), Schmidt (2002), and Schmidt and Hunter (2004). Salgado and his colleagues (Salgado, Anderson, Moscoso, Bertua, and de Fruyt, 2003a; Salgado, Anderson, Moscoso, Bertua, de Fruyt, and Rolland, 2003b) demonstrated the link between GMA and job performance across a variety of settings in European countries. Further, the strong link between GMA and job performance was found whether performance was measured objectively – via work samples or productivity records – or subjectively – using rankings of performance ratings (Nathan and Alexander, 1988). Finally, the validity of

[3]The sampling error is the error caused by using a (non-representative, small) sample instead of the entire population of interest. Because of this error, sample-based statistics (validity coefficients) can be smaller or greater than their population parameters, thus causing "conflicting results" (i.e. artifactual variance) across local validation studies (Schmidt, 1992).

[4]Meta-analysis has also made possible the development of general principles in many other areas beyond personnel selection (Schmidt and Hunter, 2015). For example, it has been used to calibrate the relationships between job satisfaction and job performance with precision (Judge, Thorensen, Bono, and Patton, 2001), between organizational commitment and work-related outcomes including job performance (Cooper-Hakim and Viswesvaran, 2005), and between transformational leadership and employee, team, and firm performance (Wang, Oh, Courtright, and Colbert, 2011).

GMA for predicting job performance does not differ across major ethnic groups and gender groups (e.g. Roth, Le, Oh, Van Iddekinge, Buster, Robbins, and Campion, 2014; Schmidt, 1988).

On a more technical note, there has recently been an important development in the method of estimating the validity of a selection procedure by correcting for range restriction more accurately.[5] Applying this procedure to a group of existing meta-analytic data sets shows that previous figures for the validity of GMA (0.51 for job performance and 0.56 for training performance as noted in Schmidt and Hunter, 1998) underestimated its real value by around 30%. Specifically, when performance is measured using ratings of job performance by supervisors, the average of eight meta-analytic correlations with intelligence measures is 0.65–65% as large as the maximum possible value of 1.00, which represents perfect prediction (Schmidt et al., 2008, table 1). Another performance measure that is important is the amount learned in job training programs. For training performance (either based on exam scores or instructor ratings), the average of eight meta-analytic correlations with intelligence measures is 0.67 (Schmidt et al., 2008, table 2). Thus, the more accurate estimate of validity of intelligence is even higher than we previously thought.

Why Does Higher Intelligence Lead to Better Job Performance?

It is one thing to have overwhelming empirical evidence showing a principle is true and quite another to explain *why* the principle is true. Although part of the answer to this question of why higher intelligence leads to better performance in the definition of intelligence was discussed earlier (i.e. learning ability), a more convincing answer can be found by examining the causal mechanism through which intelligence influences job performance. According to Schmidt and Hunter (1998), people who are more intelligent are able to hold greater amounts of job knowledge because they can learn more and more quickly than others. Hence, the more "direct" determinant of job performance is job knowledge, not GMA.[6] Said another way, the biggest influence on job performance is job knowledge, and the biggest influence on job knowledge is GMA. People who do not know how to do a job cannot perform that job well. Research has shown that considerable job knowledge is required to perform even jobs most people would think of as simple, such as data entry.

[5]A new and more accurate method for correcting the biases created by range restriction has been developed and applied (see Hunter, Schmidt, and Le, 2006; Oh, Schmidt, Shaffer, and Le, 2008; Schmidt, Oh, and Le, 2006; Schmidt et al., 2008). (Range restriction is the condition in which the variance of the predictor [here intelligence] in one's sample of people [job incumbents] is lower than that in the population of people [job applicants] for which one wants estimates.)

[6]The traditional psychological theory of human learning (Hunter, 1986; Hunter and Schmidt, 1996; Schmidt and Hunter, 2004) posits that the effect of GMA on job performance would be mostly explained by the learning of job knowledge.

More complex jobs require much more job knowledge. The simplest model of job performance is this: GMA causes job knowledge, which in turn causes job performance.

But even this model is too simple, because GMA also *directly* influences job performance. That is, GMA does not have to be converted to job knowledge before it can influence job performance. In all professions, unforeseen problems arise that are not covered by one's prior education or a body of job knowledge (i.e. manuals), and GMA is used directly to solve these problems. Based on two large samples (in total, over 4500 managers), Dilchert and Ones (2009) found that problem-solving across various assessment center dimensions is most highly correlated with GMA. That is, GMA is not only an ability to learn facts and structured procedures but also an ability to tackle unstructured, real-life problems and solve them. This means that even when workers of varying levels of intelligence have equal job knowledge, the more intelligent workers still have higher job performance given their advantage in problem-solving skills.

Many studies have tested and supported this causal model (Borman, White, Pulakos, and Oppler, 1991; Hunter, 1986; Ree et al., 1994; Schmidt, Hunter, and Outerbridge, 1986). Using an extremely large data set from the US Army Selection and Classification Project (Project *A*), McCloy, Campbell, and Cudeck (1994) differentiated two types of job knowledge – declarative knowledge and procedural knowledge – and showed that GMA was related to each of the two types of job knowledge, which was, in turn, related to job performance. This research is reviewed by Hunter and Schmidt (1996) and Schmidt and Hunter (2004).

What Is Required to Make This Principle Work?

Based on research on selection procedure utility (Le, Oh, Shaffer, and Schmidt, 2007; Schmidt and Hunter, 1998), there are three conditions that are required for companies to improve job performance levels by using GMA tests in hiring and to reap the resulting economic benefits.

First, the company must be able to be selective in who it hires. If the labor market is so tight that all who apply for jobs must be hired, then there can be no selection and hence no gain. The gain in job performance per person hired is greatest with low selection ratios. For example, if one company can afford to hire only the top 10%, while another must hire the bottom 10% of all applicants, then with other things equal the first company will have a much larger gain in job performance. There is another way to look at this: Companies must provide conditions of employment that are good enough to attract more applicants than they need to fill the vacant jobs. It is even better when they can go beyond that and attract not only a lot of applicants, but the higher-ability ones that are in that applicant pool. In addition, to realize maximum value from GMA-based selection, organizations must be able to retain high-performing hires. As discussed later in this chapter, one excellent way to retain high-intelligence employees is to place them in jobs consistent with their levels of intelligence. Otherwise, high-intelligence employees who are ill-placed (and thus not satisfied with their job) may look for alternatives outside the organization; if they leave, then the organization will incur enormous direct and indirect costs (e.g. unpaid-off selection and training costs, performance loss, low morale among existing coworkers).

Second, the company must have some effective way of measuring GMA. The most common and most effective method is a standardized employment test of general intelligence, such as the Wonderlic Personnel Test, the Wesman Personnel Classification Test, or the Watson-Glaser Critical Thinking Appraisal Form. Such tests are readily available at modest cost. This method of measuring GMA is highly cost-effective given its excellent validity and reliability, low cost, and ease of administration and scoring. However, there are alternative methods of measuring intelligence as listed as follows. We advise the reader that part of the reason that these alternative methods can be somewhat successful is often due to their high correlation with GMA. For example, meta-analytic evidence has shown that grade point average (Roth, Bevier, Switzer, and Schippmann, 1996), work sample tests (Roth, Bobko, and McFarland, 2005), assessment center scores (Collins, Schmidt, Sanchez-Ku, Thomas, McDaniel, and Le, 2003), employment interviews (Huffcutt, Roth, and McDaniel, 1996), and situational judgment tests (particularly, knowledge-based ones; McDaniel, Hartman, Whetzel, and Grubb, 2007) are moderately to strongly correlated with GMA. That is, as Schmidt (2002) pointed out, performance on these selection procedures is moderately to strongly a consequence of GMA and, hence, reflects GMA. These findings further attest to the fact that what is more important is the constructs (i.e. the traits themselves) measured during the selection process, not the formats/methods (how the traits are measured). These alternative selection procedures are generally less valid and more costly (especially assessment centers and employment interviews) than standardized tests of GMA. Therefore, we recommend that hiring managers simply use GMA tests whenever possible to maximize cost-effectiveness. However, many organizations that rarely use written GMA tests build oral GMA tests into the interview process. For example, high-tech companies such as Microsoft and Google use multiple job interviews to measure GMA (and other important characteristics) among their highly intelligent applicants perhaps because standardized GMA tests are too easy for many of their highly intelligent applicants and, thus, cannot differentiate their applicants in terms of GMA. Moreover, these highly profitable organizations may not care about selection costs.

Third, the variability in job performance among employees must be greater than zero. That is, if all applicants after being hired have the same level of job performance anyway, then nothing is gained by hiring "the best." However, this is never the case. Across all jobs studied, there have been large differences between different workers in both quality and quantity of output. Hunter, Schmidt, and Judiesch (1990) meta-analyzed all the available studies on this topic and found large difference between employees. In unskilled and semi-skilled jobs, they found that workers in the top 1% of performance produced over three times as much output as those in the bottom 1%. In skilled jobs, top workers produced 15 times as much as bottom workers. In professional and managerial jobs, the differences were even larger. At the CEO level, we can easily find many examples supporting huge performance variability (e.g. Steve Jobs, Bill Gates). These are precisely the reasons why it pays so handsomely to hire the best workers, managers, and CEOs.

But there is another advantage to hiring the best workers: the pool of talent available for future promotion is greatly increased. This is of great value to organizations, because it helps ensure high performance all the way up through the ranks of managers. When the right people are promoted, their value to the organization in

their new jobs is even greater than it was in their original jobs. Thus, the selection of high ability people has implications not only for the job they are hired onto, but also for other jobs in the organization.

Are There Moderators or Exceptions to This Principle?

Is Intelligence More Valid for More Complex Jobs?

For many predictors of job performance (motivational techniques, personality, etc.), their relationship with job performance depends on some moderators or boundary conditions (e.g. situational constraints). In addition, some predictors can replace other predictors. Many relationships in personnel psychology are bounded by situational constraints, which can be frustrating to managers who are looking for broad, overarching principles that are applicable across their organization. There is no relationship in the field of personnel psychology for which there are as few situational constraints as there are for the relationship between GMA and job performance.

The only major moderator to the relationship between GMA and job performance is job complexity level. That is, the validity of GMA for predicting job performance increases as the difficulty or complexity of the job in question increases. Schmidt et al. (2008) also reported validities for GMA ranging from 0.55 for low-complexity jobs to 0.61 for medium-complexity jobs to 0.78 for high-complexity jobs based on two meta-analyses that tested job complexity level as a moderator for the validity of GMA (Hunter, 1986; Salgado et al., 2003b). Similarly, Schmidt et al. (2008) also reported that the validity of GMA for training performance varies by job complexity level: 0.56, 0.69, and 0.81 for low-, medium-, and high-complexity jobs, respectively (Hunter, 1986; Salgado et al., 2003b). That is, while intelligence is predictive of performance on jobs of all the complexity levels, it is more predictive for jobs of high complexity.

Contrary to many lay people's intuition that applicants for high-complexity jobs do not differ much from each other in intelligence and thus intelligence may not work as a selection tool for them, the research findings mentioned here have clearly shown that there is still considerable variability in intelligence among applicants for high-complexity jobs and intelligence is still an excellent selection tool in these situations (Sackett and Ostgaard, 1994). We believe that the straightforward nature of the link between GMA and job performance comes as good news for many practitioners who are under time and competitive pressures to allocate resources as efficiently as possible, because it means that they do not have to consider many situational peculiarities when designing and implementing an intelligence-based staffing system. Given the massive amount of evidence available, there can be no doubt that intelligence is the best, most useful predictor of job performance across most situations (Schmidt, 2002).

Can Job Experience Replace the Role of Intelligence?

As long as the three conditions described earlier are met, there are no known cases or situations in which it is inadvisable to select employees for general intelligence. Nevertheless, some believe there is one exception (as we illustrate later in the example of *US Steel*): That companies should not select on GMA if they can select on job experience. That is, they believe that job experience is a better predictor of job performance than is GMA or job experience may replace GMA.

But what does available research show? For applicants with job experience between zero and five years, experience is a good predictor of job performance. But in the range of higher levels of experience, say 5–30 years of job experience, job experience does not predict performance very well (Hunter and Schmidt, 1996; Schmidt, Hunter, Outerbridge, and Goff, 1988). On most jobs, once people have about five years of experience, further experience does not translate into higher performance. This is likely because experience beyond five years does not lead to further increases in job knowledge. In other words, after five years of on-the-job learning, people in the typical job are forgetting old job knowledge about as fast as they are learning new job knowledge.

Even for new hires in the one-to-five-year range of job experience, where experience is a valid predictor of job performance, the validity of experience as a predictor declines over time. Specifically, experience predicts performance quite well for the first three years or so on the job and then starts to decline. By 12 years on the job, experience has low validity. In contrast, GMA continues to predict job performance quite well even after people have been on the job 12 years or longer (Schmidt et al., 1988). What this means is that job experience is not a substitute for GMA. In the long run, hiring on intelligence pays off much more than does hiring on job experience (Hunter and Schmidt, 1996). Hence, if you must choose, you should choose GMA. However, typically you do not have to choose; more than one procedure can be used. It may be desirable to use both experience and GMA in hiring; as discussed later, it is usually best to use multiple hiring methods whenever possible. But in this case, the weight given to GMA should be higher than the weight given to job experience.

Can Intelligence Predict Nontask Performance?

When supervisors assess overall job performance for each employee, they incorporate into their final ratings both nontask performance (i.e. organizational citizenship behaviors [OCBs] and counterproductive work behavior [CWB]) and core job performance (i.e. task performance) (Orr, Sackett, and Mercer, 1989; Rotundo and Sackett, 2002). One may ask, given the expanded criterion domain of job

performance beyond task performance (e.g. bookkeeping tasks as an accountant): Is the validity of GMA for nontask performance, an important aspect of overall job performance, also strong?

As noted earlier, many people find it hard to believe that GMA is the dominant determinant of overall job performance (Rynes et al., 2002). Often, they say they have known people who were very intelligent but who were not a good citizen. This is related to a facet of job performance called "contextual performance" or "organizational citizenship behaviors." Broadly speaking, there are three types of OCBs (Chiaburu, Oh, Berry, Li, and Gardner, 2011: (i) cooperation (e.g. willingness to help other employee such as new employees and employees with work-related problems), (ii) compliance/loyalty (e.g. willingness to work late in an emergency or on a holiday, supporting the community relations and reputation of the company), and (iii) change (e.g. willingness to communicate concerns and suggestions organizational and work-related problems and play the role of a change agent). The Project *A* research showed that GMA is the predictive of contextual performance such as extra effort and taking initiative, although the validity of GMA was a bit lower than that of conscientiousness-related personality traits. However, a comprehensive meta-analysis by Gonzalez-Mulé, Mount, and Oh (2014) revealed that the validity of GMA for OCB (0.16 for cooperation, 0.18 for compliance/loyalty, and 0.24 for change) is moderate and generally similar to that of some of the most valid Big Five personality traits, such as conscientiousness and emotional stability (Chiaburu et al., 2011). Note that these meta-analytic findings contradict and thus inform the previous notion that "the major source of variation in contextual performance, however, is not proficiency, but volition and predisposition . . . predispositional variables represented by personality characteristics" (Borman and Motowidlo, 1993, p. 74).

Lay people may also say they have known people who were very intelligent but dismal failures on the job because of "bad behaviors" such as repeated absences, carelessness, hostility toward the supervisor, unwillingness to work overtime to meet a deadline, or stealing from the company. These are examples of the so-called counterproductive work behaviors. These behaviors reflect another facet of overall job performance that is also not directly related to core job performance (i.e. task performance) but is still considered when assessing overall job performance. Some individual studies have suggested that people who are more intelligent are likely to engage in fewer CWBs – self-reported or other-rated or objectively recorded – because they are more aware of the potential negative consequences of engaging in CWBs and better able to control their impulses and behaviors. However, a comprehensive meta-analysis by Gonzalez-Mulé et al. (2014) showed that while the relationship between GMA and self-rated CWB is almost zero or slightly positive (0.05), the relationship between GMA and non-self-rated CWB (supervisor-rated or objectively recorded) is moderately negative (–0.11). Although there may be other interpretations, these results seem to suggest that intelligent people do not necessarily engage in fewer CWBs, *but* they are better able to avoid getting caught by others, thus reminding us of the famous phrase, "catch me if you can." Moreover, the validity of GMA for CWB is lower than that of the Big Five personality traits.

In summary, the validity of GMA when predicting nontask performance (OCB and CWB) is at best moderate (similar to or lower than that of self-rated conscientiousness). However, as Ones, Viswesvaran, and Dilchert (2005, p. 400) emphasized, there is one important caveat that practitioners and researchers should not forget: "Even if this were true, no organization is likely to forgo hiring on task performance (Gottfredson, 2002); also, equal validity does not mean that the same kinds of individuals would be hired using different predictors." That is, most selection decisions are and should be generally based on who will show higher task or overall performance, the best predictor of which is undeniably GMA. Thus, there is no exception to the principle that GMA is the best predictor of job performance.

Five Common Questions About Implementing an Intelligence-Based Hiring System

Can an Applicant Be Too Intelligent for a Job?

An applicant was rejected for a job as a police officer in a New Jersey city on the grounds that his intelligence test score was too high! Officials in this city believed something that many people believe: Intelligence leads to better job performance but only up to a point, and, after that point, more intelligence actually leads to lower job performance. Of course, this statement is false, and assumes a nonlinear relationship between intelligence and job performance. Can job performance suffer from having "too much of a good thing" (GMA)? Hundreds of studies have shown that this is not the case: There is a straight line (linear) relationship between intelligence and job performance, and higher intelligence has been shown to lead to better job performance even up to the highest levels of intelligence (Coward and Sackett, 1990).

Why then do so many people believe the false assumption? Perhaps it is because it makes intuitive sense. When imagining a university professor or a medical doctor working as a janitor, it is easy to think, "This person would be so bored with this job that he or she would do a poor job." But such a conclusion ignores the fact that the university professor or doctor would be highly unlikely to apply for the janitor's job to begin with. Among people who actually apply to get real jobs, there is a linear relationship between intelligence and performance; the higher the intelligence, the better the job performance.

Moreover, some lay people tend to think that applicants for high-complexity jobs are so similar in terms of intelligence that an intelligence test may not differentiate them from one another. If this were true, intelligence tests would not be a valid selection tool for high-complexity jobs. However, as discussed previously, there is substantial variability in intelligence even among the most educated people with the most advanced degrees. Furthermore, intelligence is a more valid selection procedure than educational level among applicants with varied levels of education applying for the same job (Berry, Gruys, and Sackett, 2006). The validity of intelligence remains substantial even in a group of the most talented individuals even at

1-in-10 000 scarcity (Lubinski, Webb, Morelock, and Benbow, 2001). In general, there should be no concern about hiring someone who is too intelligent for a job, ceteris paribus. Relatedly, recent research by Brown, Wai, and Chabris (2021) has shown that "there is little evidence for any robust detrimental effects of or risk associated with having high cognitive ability" in predicting various "beneficial outcomes in work, education, health, and social contexts" (p. 18). That is, a saying such as "the relationship between success and IQ works only up to a point" is only a misconception, which should be discredited given the continued positive linear relationships between GMA and important life outcomes even at the very high end of GMA.

Interestingly, it has also been shown that over their careers people gradually move into jobs, either within a single organization or by moving to another organization, that are consistent with their levels of GMA. This "sorting" process occurs over time and has been called the gravitation process (Wilk, Desmariais, and Sackett, 1995; Wilk and Sackett, 1996). People whose GMA exceeds their job level tend to move toward more complex jobs (internal or external upward movement) and people whose GMA is below their job level tend to move toward less complex jobs.

Is Intelligence All That Matters?

If some hypothetical sets of constraints allowed that only a single assessment would be used in the hiring process, and if the goal of the hiring process were to maximize future job performance, then we would strongly recommend the use of an intelligence assessment. However, in reality, no such constraints exist. Although GMA is the best predictor of job performance, it does not follow that the use of intelligence alone in hiring is the best way to select people. In fact, it is well known that other predictors can be used along with GMA to produce better predictions of job performance than can be produced by GMA alone. For example, according to the authors' recent work, for most jobs, the use of a structured employment interview in addition to a GMA test increases validity by 18%. And, the use of self-reported measures of conscientiousness in addition to a GMA test increases validity by 8%. It is almost always possible to add some supplemental selection procedure(s) that can further increase the validity offered by a GMA test. The best supplementary selection procedure is one that has high validity in and of itself and a low correlation with scores on a GMA test (in order to minimize measurement redundancy), and a low cost. It follows that practitioners should use well-established measures of personality traits such as conscientiousness (as shown in the next chapter) and structured employee interviews (Schmidt and Hunter, 1998).

Does the Use of GMA Tests Have Any Adverse Impact?

This is an important question, and one that requires a thorough response. In terms of gender differences, it has been found that there is no difference in mean levels of GMA test scores between males and females (Ployhart and Holtz, 2008), although

there are some well-known gender differences in specific aptitudes (i.e. higher mean scores for females in speech production and higher mean scores for males in spatial perception). Though we mention differences in specific aptitudes, we do not recommend the use of specific abilities in staffing contexts, given that the validity of GMA tests is almost always higher than that of specific aptitudes ("not much more than GMA") – even when specific aptitudes are chosen to match the most important aspects of job performance (i.e. spatial perception for the pilot job). Further, research generally does not support differential validity of GMA tests for males and females (Hartigan and Wigdor, 1989; Rothstein and McDaniel, 1992), particularly for jobs that are gender-neutral (i.e. jobs that tend to have a largely even distribution of men and women). Rothstein and McDaniel's meta-analysis (1992) found slightly higher validity of GMA tests for job performance in female-dominated jobs (e.g. nursing) for females, and the opposite was found in male-dominated jobs. Today, most jobs are gender-neutral or are becoming more so. Overall, one can conclude that intelligence test scores predict equally accurately for females and males in most, if not all, cases.

Perhaps, more controversial is the adverse impact that GMA tests seem to produce in terms of ethnic group differences. Research shows that members of some minority groups have lower average scores on GMA tests. If applicants are selected based solely on their GMA test scores, this can lead to lower hiring rates on average for lower scoring groups.[7] These lower hiring rates for minority applicants raise two potential problems: Legal risks and decreased workplace diversity.

From a legal standpoint, GMA tests are quite defensible in court given that the tests are valid predictors of job performance and their validity does not differ across major ethnic groups (e.g. Roth et al., 2014; Schmidt, 1988). In other words, "greater cognitive ability [GMA] is likely advantageous in many aspects of life [including job performance, practically to the same degree], no matter one's race or ethnicity" (Brown et al., 2021, p. 18). Such demonstrations rely increasingly on summaries of the kinds of research findings discussed in this chapter, rather than on studies conducted by organizations (this is part of the move away from the false notion of situational specificity, as discussed earlier). Since the mid-1980s, organizations have been winning more and more such suits, and today, they prevail in 80% or more of such suits. Moreover, today, there are simply far fewer such suits. In recent years, less

[7]The research surrounding the issue of ethnic group differences in test scores is quite extensive (see Roth, Van Iddekinge, DeOrtentiis, Hackney, Zhang, and Buster, 2017 for updated estimates of Hispanic-White and Asian-White differences for 12 widely used selection procedures including GMA tests). For readers who are interested in a more technical, detailed treatment of this issue, we recommend Roth, Bevier, Bobko, Switzer, and Tyler (2001); Sackett, Schmitt, Ellingson, and Kabin (2001); Sackett, Borneman, and Connelly (2008); Schmidt (1988); and Wigdor and Garner (1982).

than 1% of employment-related lawsuits are challenges to selection tests or other hiring procedures, and from a purely economic standpoint, research shows that the value of the increases in job performance from good selection practices overshadows any potential costs stemming from defending against such suits. Thus, there is little legal risk stemming from the use of GMA tests.

However, solving the problem of legal defensibility still leaves the problem of decreased workplace diversity. Given the fact that many hiring managers are under constant pressure to increase the diversity of their workforce, this can be a serious issue. Sackett and colleagues (2001) explain that emphasizing GMA tests in selection with the purpose of maximizing performance typically results in a lower ratio of minority hires, while eschewing the use of GMA tests with the purpose of increasing workplace diversity typically results in a decrease in job performance. The authors go on to ask, "What are the prospects for achieving diversity . . . without sacrificing the predictive accuracy and content relevancy present in knowledge, skill, ability, and achievement tests?" (p. 303). Over the years, some organizations tried to reduce this adverse impact by introducing various forms of minority preferences in hiring, and others used adjusted test scores (e.g. score banding[8]) or other test scoring methods with the goal of equalizing minority and nonminority hiring rates. However, the 1991 Civil Rights Act made such score adjustments illegal, leaving hiring managers with more questions than answers. Fortunately, a good and legally appropriate solution to the so-called validity-diversity dilemma lies well within the realm of currently accepted best hiring practices. Specifically, the use of GMA tests can be supplemented with the use of valid noncognitive predictors – such as self-reported measures of conscientiousness – that show little, if any, adverse impact. In this way, a battery of predictors can be assembled that not only will predict future job performance, but also will help reduce the adverse impact associated with GMA tests. In recent years, some organizations have also attempted to address this dilemma by balancing the biobjectives of validity (performance) and diversity using co-optimization (Pareto-optimal weighting) methods (De Corte, Lievens, and Sackett, 2011; Rupp et al., 2020).[9]

How Do Job Applicants React to the Use of GMA Tests?

Some have argued that the administration of GMA tests during the hiring process can be a detriment to an organization's recruitment efforts because applicants do not like to take ability tests. On the contrary, meta-analytic research on this subject

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[8]Score banding is a method associated with "using standard errors to create score bands where applicants within a band are considered equal and then making diversity-related hires within a band" (Rupp, Song, and Strah, 2020, p. 247).

[9]According to Rupp et al. (2020), "Pareto-optimal weighting is similar to regression weighting in that it also seeks "optimized" composite scores. However, it differs from regression weighting in that it aims to optimize two (or more) outcomes simultaneously" (p. 249).

reveals that applicants perceive mental ability and GMA tests to be relevant to job performance, and that applicants generally react more favorably to GMA tests than they do to personality assessments, bio-data, and integrity tests, which they view as irrelevant to job performance (Hausknecht, Day, and Thomas, 2004). At the same time, applicants react less favorably to GMA tests than they do to the most widely used selection tools – employment interviews and résumés (Hausknecht et al., 2004). Interestingly, it appears to be the case that when GMA or other ability tests are used, applicants tend to perceive the selection requirements as being more stringent, thus increasing their perceptions of the status and attractiveness of the job in question. The conclusion is this: Job applicants generally respond relatively well to a GMA test because they believe it is relevant to job performance.

Economically, Is a GMA-Based Hiring System Really Worth the Effort?

One argument against using GMA assessments is that if an organization hires more intelligent people, then the organization will have to pay them a higher salary, and this will cancel out any economic gains associated with increases in job performance. This claim is utterly false. In fact, the potential economic gains that can be realized by hiring a more intelligent workforce are quite substantial. Several key research findings are particularly relevant to this issue. First, research has shown that job performance can be measured in actual dollar value. Second, there is considerable variance in job performance among employees. Third, the dollar value of the standard deviation of job performance is at least 40% of a given employee's salary. These findings have been synthesized into a single equation that allows hiring managers to compute the actual dollar value of a particular hiring method. After reviewing all of the available data and computing the value of various hiring methods, it is clear that the value gained from the use of GMA assessments far outstrips the cost of hiring intelligent people. For readers who are interested in a more detailed explanation of how to compute the dollar value of job performance, we recommend articles by Le et al. (2007) and Schmidt and Hunter (1998).

As top-performing employees are promoted to higher levels in the organization, they are rewarded with higher pay, but the value of those employees' performance to the organization increases much more than the employees' salaries do. This creates large net benefits to organizations that are careful to use the most effective selection procedures available. In some cases, offering top performers a salary increase might be necessary to retain them. In any event, the payoff to the organization in terms of enhanced job performance is much greater than any increase in the compensation costs. On the other hand, organizations that hire less intelligent people for entry-level positions find that their higher-level jobs also become filled with mediocre or poor performers. Thus, selection based on GMA improves performance not only in the job in question, but also later in higher-level jobs in the organization.

Last but not least, a recent meta-analysis (Van Iddekinge, Aguinis, Mackey, and DeOrtentiis, 2018) has shown that intelligence predicts job performance practically to the same degree regardless of the level of motivation (e.g. effort level), thus

providing little to no support to the interaction of intelligence and motivation. That is, this meta-analysis shows that the effects of ability and motivation on performance are additive rather than multiplicative. We believe many would find this finding – i.e. performance = *f*(Ability + Motivation) – counterintuitive given the prevalent belief that performance = *f*(Ability × Motivation). However, it is noteworthy that intelligence is a "trait" variable and motivating is a "state" variable in the meta-analytic finding mentioned here. A growing number of studies on goal difficulty have shown that ability (e.g. task-specific strategies, knowledge, or expertise) and motivation (e.g. goal specificity and difficulty) both at the "state" level "interact" to predict task performance. In other words, specific challenging goals usually have a more positive effect on task performance when individuals use smart rather than poor task strategies (see Wood, Whelan, Sojo, and Wong, 2013 for a review). In addition, as an "all-purpose" tool, intelligence is even involved in everyday activities such as shopping, driving, and paying bills (Gottfredson, 1997). On a fun note, a recent meta-analysis has shown that intelligence is also positively related to "reading the mind in the eyes," telling others' mental/emotional states just by seeing their eyes (Baker, Peterson, Pulos, and Kirkland, 2014).

Case Examples

We will first look at one positive example of real-world applications of GMA-based hiring followed by one negative example.

The Philip Morris Plant in Cabarrus County, North Carolina

The US Employment Service began a new nationwide program of employment testing, operated through state employment offices, in the early 1980s. Like its earlier program, it was based on the General Aptitude Test Battery. One of the three abilities measured in that program was GMA (the other two were general perceptual ability and general psychomotor ability). This new program was based on the methods of meta-analysis or validity generalization that were mentioned at the beginning of this chapter.

The large Philip Morris plant in Cabarrus County, North Carolina, was one of the first organizations to subscribe to the new testing program. They signed an agreement under which the state employment service tested and referred the higher scoring applicants to Philip Morris for possible hires. For the jobs at Philip Morris, most of the weight was placed on GMA in determining who was hired.

The human resources department at Philip Morris conducted a study to compare the performance of the workers who had been selected using the GMA assessments and those who had been hired without use of the test. They found that the

GMA-selected workers were superior across a variety of performance measures, including a 35% gain in performance output. The GMA-selected workers learned 8% more skills during job training and had 25% fewer operator failures and 58% fewer disciplinary actions. In addition, the incidence of unsafe job behaviors decreased by 35% and the reduction in work days lost to accidents decreased by 82%.

These are large differences. The Philip Morris personnel researchers, Dennis Warmke and William Van Arnam, noted that the employment interview that the company was using might have contributed somewhat to the performance superiority of these workers. However, they stated that because the GMA test was the method used to screen out most of the applicants who were not hired, the GMA test was the dominant influence producing the performance improvements. This research is described in McKinney (1984).

US Steel Plant at Fairless Hill, PA

Up until 1978, the US Steel plant at Fairless Hills, PA, selected applicants into their skilled trades apprentice programs based on the applicants' total scores on a battery of ability tests. These total scores were a good measure of GMA, and selection was from the top down. The plant maintained apprentice programs in the wide variety of skilled trades needed to run a steel mill: machinists, tool and die makers, electricians, sheet metal workers, etc. The local unit of the United Steel workers union, however, did not like this selection method. In negotiations with the union, the company agreed to modify the selection system. In the new system, all applicants who scored above a low cut-off on each test, set at about the seventh-grade level, were considered equally qualified and eligible for hire. Only a few applicants were screened out by this procedure. Applicants in the passing group were selected based on plant seniority only. Hence, this plant went from a GMA-based hiring system to one in which GMA played only a very minor role.

The apprentice training center at Fairless Hills was a well-run facility that kept excellent records of apprentice performance. However, after the new selection system was introduced, performance plummeted. Scores on the mastery tests of amount learned in training declined markedly. The flunk-out and drop-out rates increased dramatically. The training time and training costs of those who did make it through the program increased substantially – because many apprentices had to re-take multiple units in the training. And finally, the ratings of later performance on the job out in the plant declined.

This was a well-controlled, natural quasi-experiment. The only change made was the lowering of mental ability standards in selection. The training program and the tests given in the program remained the same. The decline in performance was clearly due to the lower intelligence of the new apprentices.

Conclusion

Higher intelligence leads to better job performance on all jobs, and the increases in job performance resulting from hiring on intelligence have high economic value for organizations. Higher intelligence causes higher job performance primarily because it causes people to learn more job knowledge and to learn it more quickly. However, intelligence is also used directly on the job to solve performance-related problems, independent of prior job knowledge. The primary requirement that an organization must meet to make intelligence-based hiring work well is the ability to attract job applicants and to retain them once they are hired. Although intelligence is the most important determinant of job performance, it is not the only determinant. Therefore, organizations should use other valid noncognitive procedures such as a self-reported measure of conscientiousness along with an intelligence test whenever possible. This composite use of predictors will also help reduce the adverse impact associated with an intelligence test while maintaining its high validity quite well.

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Exercises

Hiring Office Workers

You are the human resources director at a large organization and you are faced with designing a system for hiring office workers. An office manager comes to you and says the organization should not use written GMA tests because of the danger of law suits. He says he knows GMA is important to job performance but maintains that you can use "GMA-loaded" interviews to measure GMA and thus get the benefit of using GMA without leaving a "paper trail" of test scores that could stimulate a law suit. Respond to this manager based on what you learned from this chapter. What would you tell him? What is the foundation for your response?

Educating the CEO

You are the human resources director in your organization. The CEO calls you to her office for a meeting and tells you that she knows from 35 years of experience in dealing with people that the key determinant of high job performance is personal values and sense of responsibility. She says she would like to have all hiring in the company done using measures of values and sense of responsibility. Based on what you learned in this chapter, what would you tell her? What is the basis for the position you are taking?

Video Analysis and Discussion

Please watch the following video(s):

- Mark Zuckerberg: Hiring the Right People (https://www.youtube.com/watch?v=JPHVeQ7-ynA&list=WL&index=11)
- Laszlo Bock on how Google's hiring process works (https://www.youtube.com/watch?v=wBRJ01NNKj8)

- The Best Recruiter at Google | Talent Connect San Francisco 2014 (https://www.youtube.com/watch?v=hvebAGerh88) 16:42 – 17:36
- Jack Ma's hiring tip: "If you think s/he will be your boss in five years, hire her/him" (https://www.youtube.com/watch?v=SWjN3sVNwMQ) 00:15 – 00:45

Now form small groups to discuss the video(s) and answer the following questions:

1. What are the major points of the video?
2. How can you use information from the video in your career?
3. Based on the video, what advice do you have for leaders in organizations?

Be prepared to present the ideas from your small group discussion with the class as a whole.

Discussion Questions

- Why do you think many high-tech companies such as Facebook, Google, and Samsung rely more heavily on GMA – i.e. raw intelligence (per Mark Zuckerberg) and capability or general cognitive ability (per Lazlo Bock) – than on specific skills, expertise, and experiences in hiring new employees? It is noted that these companies do not use written GMA tests but assess GMA using multiple job interviews. Also think about the benefits of hiring highly intelligent people in terms of subsequent HR practices.
- Why do you think many HR managers believe that a GMA test is less predictive of employee performance than conscientiousness and value-based fit measures despite the extensive evidence that tells the opposite? Is their ignorance of research findings the real problem? Or something else?