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Individual differences as predictors of work, educational, and broad life outcomes

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ABSTRACT

Ongoing research on measures of individual differences (personality, cognitive ability, and admissions tests) has revealed their importance in academic success (including outcomes beyond college grades), work success (including objective and subjective measures of job performance), and everyday life (including divorce and mortality). Despite the body of evidence, confusion remains about foundational empirical questions including their strength, importance beyond a threshold, and independence from social class and other confounds. We first discuss the likely sources of confusion when considering the literature. We then review a series of large-scale studies and meta-analyses conducted to unambiguously address nine common, but false, assertions about the relationship between intelligence and personality measures with life outcomes.

1. Introduction

In this paper we offer a very brief overview of the question of the consequences of individual differences for three outcome arenas: post-secondary academic performance, work performance, and broad life outcomes, such as mortality, divorce, and occupational attainment. We focus on two broad individual difference domains, namely, cognitive ability and personality.

Individually, collectively, and in conjunction with a broad range of collaborators, members of our Minnesota group have examined the relationships among individual differences in cognitive ability and personality and this set of outcomes in a wide array of studies. What our investigations have in common is an emphasis on meta-analytic syntheses and on the use of large nationally representative samples. We believe that much confusion about the relationships among these individual difference variables and life outcomes is the result of a set of common errors.

The first is the over-interpretation of small-sample studies. For example, Chamberlain (2009) characterized the research on the relationship between the GRE and graduate school success as mixed, contrasting the positive findings reported by Kuncel et al. with less supportive findings from Sternberg and Williams (1997). But the Kuncel et al. study was a meta-analysis of 1753 studies (N = 82,659) while Sternberg and Williams was a single-sample study (N = 166) of Yale students. Small-sample individual studies are prone to the effects of sampling error and other artifacts discussed below, and argue for the value of large-scale systematic examinations of a domain, via meta-analyses and large national data bases.

The second is the failure to understand the consequences of studying highly restricted samples. In settings such as educational admissions and employee selection it is not uncommon to encounter highly selected research samples, where only individuals with scores on individual difference measures at the top end of the score distribution have been screened and for whom subsequent performance measures are available. Widely used indices such as the correlation coefficient are systematically biased downward by such restriction of range, and failure to take this into account via strategies such as the use of psychometric corrections can lead to severe mis-estimation of the role of individual differences (Sackett & Yang, 2000).

The third is the failure to understand the roles of the reliability and validity of the outcome measure in understanding the role of individual differences. For example, in the job performance domain, the most widely used approach performance measurement involved ratings by a supervisor. However, if two supervisors are asked to rate the same individual, the two ratings will, on average, correlate r = .52 (Viswesvaran, Ones, & Schmidt, 1996). Thus a single supervisor's rating is a highly fallible measure of job performance, and the use of such a measure will lead to a downwardly-biased estimate of the role of individual differences (Ones, Viswesvaran, & Schmidt, 2008).

The combination of small-sample individual studies, restricted samples, and flawed criterion measures leads to substantial underestimates of the magnitude of individual difference-outcome relationships and to the appearance of great variability in these relationships from sample to sample. In each of several areas of

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individual differences, we argue that a much clearer picture involving stronger associations emerges when these issues are taken into account.

2. Individual differences and post-secondary academic performance

2.1. Cognitive measures

We focus on a series of four common assertions raised by critics who claim that admissions tests are not valid indicators of subsequent academic performance (see Sackett, Borneman, and Connelly (2008) for responses to a larger set of criticisms). A recent overview of the usefulness of cognitive measures in post-secondary admissions is available in Kuncel and Hezlett (2007). In addition, meta-analyses documenting validities of cognitive ability tests in post-secondary educational settings are comprehensively summarized and detailed in Ones, Viswesvaran, and Dilchert (2004a). In college settings, we draw on meta-analyses and a recent large data set which we have used in a series of studies. In the data set, SAT scores for over 165,000 students from a diverse set of 41 colleges and universities in the United States are paired with first year grades, cumulative grades for up to 6 years, and individual course grades for each course taken by each student.

2.2. Assertion 1: Admissions tests predict badly

The prototypical correlation between admission test scores and first year grades is .35. Critics view this as very small, as the squared correlation (i.e., .12) represents a rather small proportion of the variance in grades even though such an effect can have a large effect on the percent of students who are successful versus unsuccessful in school. Berry and Sackett (2009) used the 41-school SAT data set and found a correlation of .36 between observed SAT combined scores (Verbal + Math) and first year GPA. These data were range restricted, as the colleges used the SAT as part of the admissions process. Correcting for range restriction resulted in a corrected r of .46. Berry and Sackett had access to individual course grades and thus were able to compute separate validity coefficients for each course at each college, resulting in a meta-analysis of over 130,000 course-specific validity coefficients. While validity estimates based on first year GPA suffer from the problem of students choosing to take courses differing in difficulty, estimates based on individual course grades, by definition, do not (i.e., course difficulty is held constant, as all students are taking the same course). From the individual course data, Berry and Sackett were able to estimate the correlation that would be obtained between the SAT and GPA if all students took a common set of courses (i.e., course difficulty is held constant): that correlation is .55. Thus, .55 is our best estimate of the relationship between the SAT and academic performance in this large sample. While there is no doubt that there is criterion variance unexplained by the SAT, we think these findings frame the search for additional predictors as a search for supplements to a strong predictor, rather than as a replacement for a weak predictor.

2.3. Assertion 2: Validity is an artifact of socioeconomic status

Sackett, Kuncel, Arneson, Cooper, and Waters (2009) present results from eight data sets, including the 41-school SAT data set, a meta-analysis, data on all individuals entering an accredited law school in 1991, and three large longitudinal studies following samples of high school students through college. They found that SES is indeed related to test scores. In broad unrestricted populations, this correlation is quite substantial (i.e., r = .42 among the population of SAT takers). Consistent with our earlier discussion of range restriction, it is considerably smaller in restricted samples (i.e., r = .15–.20 among samples of students enrolled in a single institution). Second, test scores are indeed predictive of academic performance, as indexed by grades. Observed correlations in samples of admitted students average about r = .35; applying range restriction corrections to estimate the validity for school-specific applicant pools results in an estimate of .47 as the operational validity. Third, the test-grade relationship is not an artifact of common influences of SES on both test scores and grades. Partialling SES from the above estimate of the operational validity of tests (r = .47) reduces the estimated validity to .44. The assertion that the predictive power of tests disappears once the effects of SES are removed is at odds with the findings from these multiple sources of data.

2.4. Assertion 3: Above a modest threshold, higher scores don't matter

The assertion here is that while tests may have value in screening out those with very low levels of ability, increments in ability do not lead to increments in performance for those above a threshold. If true, it would be argued that it is not appropriate to prefer high-scoring individuals over lower-scoring individuals once this threshold is reached. This assertion features prominently in Gladwell's (2009) best-selling book, *Outliers*. However, there is strong evidence that higher test scores are associated with higher criterion scores throughout the test score range. Arneson and Sackett (submitted for publication) examined relationships between test scores and college grade point average in three large data sets (i.e., the 41-school SAT data set, the National Educational Longitudinal Study of 1988, and Project TALENT), and found monotonic test-grade relationships throughout entire score range in each data set. Throughout the entire test score distribution, higher performance levels are found for any increase on the test.

2.5. Assertion 4: Tests only predict first year grades

As we were preparing this article, one of us was asked to review a paper submitted to a prominent journal, which opened with the statement, without citation, that "as is well known, admissions test predict nothing but first year grades". Contrary to this piece of folklore, test scores are related to a wide array of outcomes. Berry and Sackett (2009) examined the 41-school SAT data set, and found that the mean observed correlation between SAT and first year grades (r = .36) was quite similar to the SAT's correlation with cumulative grades (r = .33). More critically, once taking differences in student course choice into account and also correcting for range restriction, a correlation of .55 was found between the SAT and both first year and cumulative grades.

In addition, admissions tests predict other learning outcomes besides course grades. Kuncel and Hezlett (2007) summarize findings demonstrating relationships between all major graduate admissions tests and important outcomes beyond first year grades including research productivity, faculty evaluations of dissertation quality, and finishing a graduate degree. Within the science and humanities, the GRE predicts comprehensive examination performance, faculty ratings of student performance, and subsequent citation counts (Kuncel, Hezlett, & Ones, 2001) while LSAT scores and MCAT scores are predictive of passing the Bar Examination and medical board tests, respectively.

Lubinski, Benbow, Webb, and Bleske-Rechek (2006) reported that the SAT predicts getting a Ph.D., getting tenure, and getting patents in a gifted sample. Thus, these meta-analyses and large-scale samples provide strong support that the usefulness of these test scores in academic settings is not limited to predicting first year grades; indeed, these scores are predictive of a variety of long-term indicators of academic and career success.

2.6. Personality measures

Relative to the large amount of research on ability and achievement measures in the educational admissions domain, the quantity of research on personality measures in this domain is sparse. Much research focuses on measures in operational use, and personality measures are not commonly used in this domain. Nonetheless, there is a body of research that reports relationships between personality measures and academic performance. Kuncel et al. (2005) review the literature on the use of self-report measures and report correlations with grades in the $r = .30$ range for conscientiousness and socialization consistent with a Big Five focused meta-analysis by Poropat (2009). Connelly and Ones (in press) report somewhat higher correlations (e.g., mid-0.30s for conscientiousness) for other-reports of personality than for self-reports.

Latest evidence also suggests that the relationships between personality attributes and academic performance may be substantially higher for later grades than earlier grades. Lievens, Ones, and Dilchert (2009) assembled a longitudinal database of personality scale scores (Big Five factors and facets) for the 1997 entering cohort of medical students across all medical schools in Belgium and related these scores to grades throughout their medical school career of 7 years. Extraversion, openness, and conscientiousness scale score validities substantially increased in predicting grade point averages. For conscientiousness, validities increased from .18 (year 1) to .45 (year 7). In medical education, personality characteristics gain importance for later academic performance when applied practice (such as performance in practicums and clerkships) increasingly plays a part. Similar trends are likely in other areas when academic knowledge acquisition shifts to applications in the course of educational experiences.

There is emerging evidence that self-report personality variables also appear to be important in predicting getting involved in deviant college behaviors. In the first comprehensive study of this domain of college behaviors, Dilchert (2007) and Dilchert and Ones (2009) examined the relationships between personality variables and peer reports of behaviors such as theft, academic deviance (e.g., plagiarism), illegal behaviors (e.g., physical violence), incivility (e.g., disruptive class behaviors), negligence, and lack of effort (including absences from class). Conscientiousness correlated −.29 with overall college deviant behaviors. Correlations with specific behavioral clusters from this domain were variable ($r = -.32$ to $-.08$), but nonetheless useful in explaining college deviance.

Moving away from personality per se to a behavioral manifestation of personality, Crede and Kuncel (2008) report that study skills, habits, and attitudes correlate .41 with grades, exceeding the typical findings for personality measures. They also report that these measures have quite modest correlations with admissions tests ($r = .18$), with the implication that measures of study skills, habits, and attitudes can provide incremental prediction above and beyond admissions tests. Thus, individual difference measures in the non-cognitive domain do appear to play a role in understanding variance in academic performance.

3. Individual differences and work performance

3.1. Cognitive tests

Cognitive ability plays a major role in occupational environments. Individuals gravitate to occupational environments commensurate with their cognitive ability (Wilk & Sackett, 1996). Cognitive ability is the workhorse of employee selection. Thousands of studies of criterion-related validity have been reported for a multitude of criteria (Ones et al. 2004a). Here we review empirical findings relating to four assertions raised by critics of the validity of cognitive ability testing for employee selection. A more detailed, recent overview of the usefulness of cognitive measures in personnel selection is available in Ones, Dilchert, Viswesvaran, and Salgado (in press).

3.2. Assertion 5: Cognitive ability tests predict work performance poorly

Critics of the use of cognitive ability testing assert that the amount of variance in work performance explained by cognitive ability tests is not sizable. Such assertions may result partly from misinterpretations of validity evidence due to a set of common errors that were outlined at the beginning of this article (e.g., range restriction and unreliability in criterion measurement). Moreover, such criticism is also erroneous because it fails to consider the full extent of accumulated data. In fact, the validity of cognitive ability tests in predicting overall job performance is about .50. This is the major finding summarizing results across over 20,000 primary studies including data from over five million individuals (Ones et al., 2004a). The squared correlation (i.e., .25) indicates the percent of variance in overall job performance accounted for by cognitive ability tests (25%). However, such an interpretation is misleading and underestimates the magnitude of the relationship (Ozer, 1985). From an applied point of view, the relevant interpretation of the .50 correlation between cognitive test scores and job performance is: A standard deviation increase in cognitive ability is associated with a .50 SD increase in overall job performance. Being able to identify potential employees who will perform .50 standard deviations above the norm is a very large impact indeed. Thus, it is the correlation coefficient itself, not the square of the correlation coefficient, that is pertinent to calculate the behavioral and financial outcomes and benefits of personnel selection systems that utilize cognitive ability.

Ones, Viswesvaran, and Dilchert (2005a) provide a thorough accounting of the meta-analytic validities for cognitive ability tests in work settings. Here we summarize the general findings across the meta-analyses reviewed by Ones and her colleagues. First, cognitive ability tests predict how well employees learn in job training. Across jobs and industries, the relationship between ability test scores and training performance is in the .60s. However, the higher the complexity of the job and thus the complexity of the job knowledge to be acquired, the higher the validities are. Second, cognitive ability tests predict actual job performance very well. As we have already noted, the validity for tests of general mental ability are in the .50s across jobs (for overviews of the existing evidence see Ones et al., 2004a,b, in press). Confirming the importance of cognitive ability as a determinant of complex work performance, validities are higher in high complexity jobs – in the upper .50s to .60s range. However, we should note that even for the lowest complexity jobs, validities tend to be substantial – in the .30–.40 range. Individuals who score higher on cognitive ability tests perform better on their jobs. There is evidence from large samples that cognitive ability tests are even useful in predicting rule compliance and avoidance of detected counterproductive work behaviors (e.g., theft, security violations, aggressive behaviors (Dilchert, Ones, Davis, & Rostow, 2007) and rule compliance (Mount, Oh, & Burns, 2008).

A remarkable finding from this vast meta-analytic literature is that validities of cognitive ability tests are substantial and useful across industries, job families, and even cultures. In other words, validity generalizes at useful levels. Data from large-scale meta-analyses leave little doubt that, although not the sole determinant of job performance, in many – and perhaps most – settings it is the single best predictor for personnel selection.

3.3. Assertion 6: Educational stratification among job applicants negates usefulness of ability tests

We often encounter an argument that since there are educational requirements for entry to various jobs, the applicant pools tend to be cognitively homogenous. This, supposedly, is particularly true for higher-complexity jobs. For example, lawyers need law degrees; medical doctors need medical degrees; accountants need accounting degrees for entry into their occupations, and so forth. The argument suggests that the level of cognitive ability required to complete complex and specialized education in such domains would result in reduced variability in applicant pools to such jobs, reducing the usefulness of ability tests in distinguishing among individuals.

In a direct test of this hypothesis, our Minnesota group examined the general cognitive ability differences among applicants to a large variety of jobs. Even for jobs with high educational requirements, variability in applicant pools tends to mimic variability in the general population (Ones & Viswesvaran, 2003; Sackett & Ostgaard, 1994). The degree of reduced variability among applicant pools, where it exists, tends to be small, typically less than 10–20% lower than the general population (Ones & Viswesvaran, 2003). The same is true even for management applicants to top executive positions (Ones & Dilchert, 2009). Thus, although there are mean differences among groups of individuals at differing levels of educational attainment, the latter is not a homogenizing influence on cognitive ability of applicants. Educational attainment is not a good proxy for cognitive ability (Berry, Gruys, & Sackett, 2006). Although more restricted than the general population, there are still large differences in cognitive ability among those at the same educational level.

3.4. Assertion 7: Once a certain level of cognitive ability is reached, there is little room for cognitive ability tests to predict job performance

A persisting common belief is that once individuals reach a minimum level of cognitive ability, there is little variability in job performance that can be explained using cognitive ability tests. Such a belief manifests itself in personnel selection systems that impose minimum ability requirements in hiring, with the implication that above the cut-off there is little room for cognitive ability to distinguish between good and poor performers. Statistically speaking, the assertion here is one of non-linearity between ability test scores and job performance. That is, it is assumed that after a certain point higher levels of cognitive ability are not associated with increases in job performance. There have been hundreds of datasets brought to bear on the question. For example, Hawk (1970) summarized data from 367 studies (N = 23,488), comparing eta and Pearson correlation coefficients. Nonlinear relationships were no greater than would be expected by chance. Coward and Sackett (1990) provided an update on the same using a power polynomial approach (with higher statistical power) rather than eta-Pearson r comparisons used in previous investigations. Across 174 studies (N = 36,614), again, nonlinear relationships (a negative or positive change in slope as indicated by a polynomial term in a regression model) were no greater than would be expected by chance. Contrary to popular belief, ability differences are associated with better performance throughout the ability continuum, even among those at the very top of the ability distribution (Lubinski, 2009) where performance of those in the top quartile of the top 1% out perform those in lower quartiles even when educational background is held constant.

3.5. Assertion 8: School smarts are different from work smarts

Another persistent belief is that intelligence for school is not the same as intelligence for work or everyday life. Although research has demonstrated the importance of ability measures in both academic, work, and creative settings and positive relationships among cognitive abilities (e.g., Johnson & Bouchard, 2005) assessments used in one setting are rarely used in other. Specifically, educational admissions tests are almost never used in work settings, leaving open the possibility that something about "book smarts" are unrelated to work smarts. Our Minnesota group conducted a direct test of this question by examining the predictive power of a standardized, commonly-used academic admissions test for academic, work, creativity, and career-transition measures of both academic and work success (Kuncel, Hezlett, & Ones, 2004). This meta-analysis of the Miller Analogies Test (MAT) revealed two key findings. First, the MAT predicted a range of success measures including grades, degree attainment, and faculty evaluations of competence in the academic setting, and work performance and career potential in the work setting, as well as evaluations of creativity across both. Second, a meta-analysis of test correlations with the MAT revealed that it was measuring the same verbal and general cognitive ability skills as other measures used in work and academic settings. One intelligence measure predicts complex academic and work outcomes, indicating that the same intelligence is important at work and school.

3.6. Personality measures

In the work domain, the value of personality variables was doubted until recently. Certainly, personality variables in work settings received little scientific attention during the situationalist 1960s and 70s. Research on personality variables has burgeoned in the past 25 years, largely due to large-scale studies and meta-analyses documenting their usefulness for work performance (Barrick & Mount, 1991; Hough, Eaton, Dunnette, Kamp, & McCloy, 1990; Ones, Viswesvaran, & Schmidt, 1993). Although criticisms persist, multiple meta-analyses have demonstrated that personality traits are useful for a variety of work behaviors, including job performance (Ones, Dilchert, Viswesvaran, & Judge, 2007). Here we provide an overview of conclusions from Ones and her colleagues who provide a comprehensive summary of meta-analyses documenting the role that personality variables play across a broad spectrum of occupationally important behaviors and outcomes. Such behaviors and outcomes include overall job performance (measured both objectively and subjectively [typically using supervisory ratings]), counterproductive work behaviors, teamwork, leadership emergence and effectiveness, job and career satisfaction, training performance and motivation, among others. Validities for the Big Five dimensions of personality as a set are in the .20 to .40 range for most criteria examined. In predicting overall job performance, conscientiousness is the one Big Five dimension that provides consistent, across-the-board prediction of performance across jobs, settings and cultures examined. Other dimensions of personality appear to be useful for either specific job categories (e.g., extraversion for managers) or for specific criteria to be predicted (e.g., agreeableness for behaviors during service encounters). In predicting counterproductive work behaviors, the three indicators of Digman's (1997) factor alpha, namely conscientiousness, agreeableness, and emotional stability, correlate in the .30s with avoiding both organizational and interpersonal deviance (Berry, Ones, & Sackett, 2007).

In addition to the Big Five personality factors and facets, there are other personality scales often used in occupational settings which simultaneously tap into multiple Big Five domains. Such scales have been posited to assess emergent, or compound personality traits (Ones & Viswesvaran, 2001b). One example is integrity tests (Ones et al., 1993: Sackett, Burris, & Callahan, 1989; Wanek, Sackett, & Ones, 2003) assessing conscientiousness, agreeableness and emotional stability (Ones 1993). Remarkably, such scales

predict both avoiding counterproductive work behaviors as well as overall job performance well (Ones & Viswesvaran, 2001a). They also out-predict Big Five factor scales (Hough & Oswald, 2000; Ones, Viswesvaran, & Dilchert, 2005b). For example, integrity test scores of job applicants are correlated .41 with job performance (Ones et al., 1993). Large-scale meta-analyses on the relationships between personality variables and work attitudes, behaviors and outcomes provide strong evidence for the importance of personality attributes at work.

4. Individual differences and broad life outcomes

Given the effects of cognitive ability and personality on both academic performance and degree attainment as well as job performance it should not be a surprise that these individual differences are related to occupational attainment and stable employment. Those who attain higher levels of education and perform and learn better in school should attain more prestigious jobs and tend to remain employed. Similarly, high performing employees are more likely to be promoted (increasing their occupational attainment) and less likely to be fired or laid off (leading to stable employment). Analysis of longitudinal studies containing SES, ability, and personality data reveal that cognitive ability is the single strongest correlate of these outcomes, with pro-social personality traits a close second (Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007). Parental incomes and family of origin are less strongly related. When SES variables are used as controls, ability and personality traits remain the dominant predictors.

4.1. Assertion 9: Individual differences are not important for real life outcomes

Although school and work encompass a great deal of people's lives, questions have been raised about the long-term relations among personality, ability, and outcomes like divorce and mortality. Poor marriages are likely to result from interpersonal conflict and, as such, would be expected to be predicted by personality traits. Longitudinal research supports this insight. Neuroticism, low agreeableness, and a lack of conscientiousness are predictive of divorce. In their aggregation of longitudinal studies Roberts et al. (2007) reported personality traits were substantially more related to eventual divorce over time spans of years or even decades. In contrast, SES was related to divorce ($r = .05$) but accounted for a fraction of the variance in divorce accounted for by personality variables. In part it appears that personality traits are related to personal investment of time and attention to family and the marriage (Lodi-Smith & Roberts, 2007).

4.2. Cognitive ability, personality, and health outcomes

Health outcomes, including mortality, have often been assumed to be functions of resources (i.e., access and quality of health care) and environments (i.e., work hazards, toxins). Although these can play important roles, a growing body of evidence has highlighted the importance of individual differences in this domain as well. Longitudinal research has demonstrated that intelligence is strongly related to mortality even when SES variables are controlled (e.g., Gottfredson & Deary, 2004; Roberts et al., 2007). Gottfredson and Deary (2004) proposed that the links between cognitive ability and health outcomes are mediated by thoughtful avoidance of risks and disease, effective identification of health care need, effective learning of self-care and health regimens, and long-term monitoring of health status. The parallels between these tasks and those of work and school are substantial. Each of these tasks requires learning and information processing, sometimes substantial amounts of each.

Data suggest that personality individual differences appear to have the largest effects on the avoidance of risky health behaviors. In a meta-analysis, Bogg and Roberts (2004) report correlations between conscientiousness and its facets with activity, excessive use of alcohol, drug use, unhealthy eating, risky driving, risky sex, tobacco use, suicide and violence (Bogg & Roberts, 2004). Although the effects are small to modest ($-.12$ to $-.28$) and most of the data did not come from longitudinal studies, the cumulative effects over time for health outcomes are likely to be substantial. This conclusion is strongly supported by a synthesis of prospective longitudinal studies (Roberts et al., 2007) which found substantial effects for several personality traits on all-cause mortality. Both conscientiousness, the best single predictor, and extraversion/positive emotionality exceeded IQ as predictors of mortality. Agreeableness and neuroticism also accounted for meaningful and partially independent sources of variance. The importance of these effects is particularly salient given that longitudinal prediction of mortality is difficult as mortality is a dichotomous and multiply determined criterion that is eventually experienced by all. Although the mechanisms underlying relations between personality traits and mortality are likely to vary by trait and cause of death, a good argument can be made that those who are conscientious tend to engage in healthier behaviors and therefore, tend to live longer.

5. Conclusion

Our research compiling thousands of studies across millions of subjects clearly establishes the importance of cognitive ability and personality traits as important predictors of some of the most important life outcomes. The evidence across studies reveals that the same human characteristics, particularly general cognitive ability and conscientiousness, are implicated across domains. These relationships are often substantial and their relevance is not limited by thresholds, explained by social class, or limited to one domain be it school, work, or life and death.

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