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A plea for the teaching of intelligence: Personal reflections

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ABSTRACT

Difficulties in teaching Psychology owing to political sensitivities are discussed. Justifications for teaching intelligence to diverse audiences are considered. An idiosyncratic survey of important literature in the field is presented leading to suggestions for possible topics to be considered in a course on intelligence.

1. Why it is difficult to teach intelligence

Intelligence is a controversial field. Owing to America's fraught history of slavery and racial discrimination, the discussion of racial differences in test scores as well as other group differences frequently leads to criticism and even class disruptions. The vexed history of discussions of racial differences has tarnished the field and is in no small measure responsible for the limited number of courses on intelligence offered in American Universities.

Shortly after arriving at Wesleyan University in 1976, I taught my first undergraduate course on intelligence. At the initial meeting of the course during "shop around", I reviewed the syllabus and course requirements. The students asked a number of questions indicating explicitly or implicitly that they wished to be informed about biases in tests that were designed to oppress minority groups and why intelligence tests were "instruments of oppression." I explained to the students that these were issues that I would discuss in the course and that they would be exposed to a variety of opinions on these issues that would enable them to reach their own informed conclusions. This neutral statement seemed to disappoint the students and over half the students dropped the course — this was an unprecedented number of drops. In subsequent years, I taught my course on intelligence as an advanced seminar and as the student grapevine led to informed choices, I no longer encountered a large number of drops of my course. I did, however, occasionally receive negative comments on student ratings of my Introductory Psychology course with specific reference to the one lecture in the course on intelligence. I recall receiving comments indicating that students thought I was a racist. This comment is interesting since I did not discuss group differences in my lecture. The lecture dealt with *g* theory and the taxonomy of abilities; genetic and environmental influences on intelligence; biological and cognitive correlates of psychometric indices and the predictive validity of tests of intelligence. The material dealt with was heavily empirical and not overtly controversial. The accusation of racism did not disturb me since I was a tenured Full Professor and I was reasonably sure that it was not true owing in part to my long-lived marriage to an African-American woman who was Chair of the African-American Studies program at Wesleyan. The experiences described above indicate that an instructor is likely to encounter considerable resistance to some topics dealt with in a course on intelligence. This is especially true for a discussion of racial differences in scores on tests of intelligence. I have no easy answer for dealing with this problem. I can recommend Hunt and Carlson's excellent discussion of ethical issues in the study of racial differences (Hunt & Carlson, 2007). I am also sufficiently Panglossian to believe that students whose instructors used

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Hunt's or MacIntosh's excellent textbooks would find the careful, cautious, empirically based discussion of controversial issues in these books instructive. Such students should (and would?) be receptive to the increased understanding they would acquire from assimilation of the material in these books (Hunt, 2011; Macintosh, 2011).

There are a number of things we know about intelligence that students find troubling. We know that a considerable portion of the variance in scores on tests of intelligence over the life-span is, for many individuals in our society, determined by potential influences present prior to conception, at conception, or from measures obtained during the first year of life. Parental IQ is a potential influence that is present prior to conception. Genetic characteristics are substantially determined at the moment of conception and indices of infant cognitive processes may be obtained in the first year of life. These are overlapping characteristics that are related to scores on tests of intelligence. We also know that pre-adolescent IQ test scores are correlated with scores on tests of intelligence obtained in old-age (see Deary, Whalley, & Starr, 2009). And, age 11 intelligence test scores are substantially correlated with achievement test performance at the end of secondary school. Deary, Strand, and Fernandes (2007) obtained a correlation of .81 between the latent trait for intellectual ability assessed at age 11 and the latent trait for academic achievement at age 16 based on national school tests for a large sample of students in England. These results provide support for a conception of intelligence as a latent trait that is partially determined by influences early in life that remains relatively invariant over the life-span that has important real-world influences on educational achievement.

Although there is evidence that intelligence may be increased as a result of environmental interventions, there is relatively little evidence of large, enduring changes attributable to manipulations designed to increase intelligence. Consider, for example, the results of the Abecedarian intervention that provided intensive intervention starting shortly after birth for the entire pre-school period for a group of low income children assumed to be at high risk for developing low IQ. At age 21, the children in the treated group had a WAIS IQ of 89.7 and the children in the control group had an IQ of 85.2 (Campbell & Burchinal, 2008, Table 4.4). The intervention still left the treated group over two-thirds of a S.D. lower than the hypothetical mean IQ of the population. In principle, intensive early intervention could produce a "virtuous cycle" in which changes in intelligence early in life lead individuals to interact with the environment in ways that continue to increase intellectual ability. The small effect sizes and the continued evidence of deficits suggest that this did not happen for subjects in the Abecedarian Project. There is some evidence indicating that the effects of early intervention in this project are partially ephemeral. In one of their analyses, Campbell and Burchinal entered early verbal ability assessed at 30, 42, and 54 months of age in their hierarchical regression analysis. The effect size for the experimental treatment on intelligence test scores now became negative at ages 12 and 21. At age 21, the effect size was −.38 — a value that may be compared to the comparable positive effect size of .19 for the intervention when early verbal ability is not entered into the regression equation (see Campbell & Burchinal, 2008, Table 4.6). These results may be interpreted as indicating that early intervention in this study influenced a component of intelligence of fading importance over the life-span. The predictions of age 21 intelligence test scores based on early verbal ability in the treated group were too high implying that the early gains did not endure.

Although low maternal IQ was one of the selection criteria for the Ss in this study, the maternal IQ of the Ss varied considerably with some mothers having an IQ in excess of 120. Maternal IQ accounted for three to four times more variance in outcomes in this study than the experimental intervention at age 12 and at age 21 (see Campbell & Burchinal, 2008; Campbell & Ramey, 1994). This result indicates that maternal IQ predicts children's abilities and IQ even when children encounter intensive interventions that substitute sophisticated University based day care experiences for a substantial portion of the early cognitive socialization experiences normally provided by mothers living in poverty. The enduring importance of individual differences in intelligence for individuals with similar socioeconomic backgrounds is buttressed by the results of Murray's analysis indicating that differences in IQ between siblings reared in the same family are related to educational attainment, socioeconomic status and income (Murray, 1998).

I have chosen to analyze the results of the Abecedarian Project in some detail in order to illustrate some of the ways in which research on intelligence may disappoint many students who hold the following beliefs: Scores on tests of intelligence are not important and do not relate to important socially relevant outcomes. Scores on tests of intelligence are principally determined by socioeconomic status. Interventions may be designed that will result in large and enduring changes in intelligence. My discussion should not be construed as a negative view of many of the meaningful changes in outcomes associated with the Abecedarian Project. Rather, I want to indicate that despite the important changes that follow from the Abecedarian intervention, the results of this study, if properly analyzed, continue to support the enduring significance of intelligence.

2. Why we should teach intelligence

2.1. To increase public understanding

There are many public policy issues that may be informed by an understanding of intelligence. Empirical results do not dictate public policy — they may, however, provide an informed context for the discussion and resolution of public policy issues. It would be possible to teach a course, possibly collaboratively with a Political Scientist, dealing with public policy and legal issues related to intelligence. Alternatively, material related to public policy issues could be introduced in a survey course to emphasize the ways in which research on intelligence is germane to many public policy issues. Consider the following three public policy decisions that may be informed by relevant research on intelligence:

1. In his Inaugural Address, President Obama indicated that he would support legislation to increase the availability of quality pre-school experiences. There are several studies of the benefits and costs of such programs as well as research indicating how variations in program quality and duration may influence outcomes. These studies are germane to policy decisions about expanding pre-school education.

2. The use of affirmative action policies to increase the diversity of the student body at institutions of higher learning continues to be a source of controversy. The Supreme Court is currently considering a case involving the constitutionality of using race as a factor in college admissions. Previous decisions, including a controlling opinion by Justice Sandra Day O'Conner, supported the use of race as a component of the decision process with the understanding that this policy should remain in place for a limited duration — 25 years (Grutter v. Bollinger, 2003). Racial differences in scores on tests of intelligence are relevant to an understanding of affirmative action policies. Research attempting to find valid measures of ability that are not as related to race as IQ tests and the SAT is relevant to an understanding of the ways in which assessments may contribute to diversity without reducing the validity of admissions decisions (see Sternberg (2006) for one such example). Changes in the magnitude of racial differences in scores on tests of intelligence at different times of testing in the 20th century are also relevant to an understanding of the changing nature of racial differences in test scores as well as to the assumption that affirmative action policies will not be needed in 25 years (see Dickens & Flynn, 2006; Murray, 2007).
3. The Supreme Court has ruled that it is unconstitutional to allow the death penalty for individuals who are mentally challenged. Such a policy raises many issues about the appropriate determination of low mental ability. Is a single test adequate? What is the "best" test to use to determine mental competence? What role should evidence of mental accomplishments exhibited in everyday life play in judging overall mental competence? What is an appropriate cut-off score on an IQ test? Intelligence is a continuum not a category. How do we reach a categorical assignment for an individual? All of these are issues of testing and intelligence that are literally a life and death matter.

2.2. To educate professionals

Intelligence tests are ubiquitous in our society. They are administered or interpreted by guidance counselors, vocational counselors, college admissions officers, personnel officials and clinical psychologists among others. It is my impression that many of these individuals who are entrusted with the administration and interpretation of intelligence tests are sometimes uninformed or misinformed about the research literature that is relevant to an interpretation of test results. I first became aware of this problem as a first year graduate student in Clinical Psychology at The University of Michigan in 1957. I had a course on assessment devoted to the administration and interpretation of tests of intelligence. I was trained to infer personality characteristics and psychopathological conditions from an analysis of the pattern of scores on the sub-scales of the Wechsler test. Several students in the class asked the instructor about a recently published article by Guertin, Frank, and Rabin (1956) reviewing studies of inferences from the Wechsler to personality characteristics and psychopathological conditions. These authors concluded that research had failed to support the validity of such inferences. The instructor informed us that we were to ignore the results of flawed research studies and rely instead on her clinical expertise. Her reply created a deeply felt intellectual crisis for many students leading some of them, including me, to leave the Clinical Psychology program.

I recall another incident that occurred almost two decades later. I was teaching a graduate course in Assessment at the Graduate Faculty of the New School in New York. A colleague at another University who was going on sabbatical arranged for his Clinical Psychology students to take my course to fulfill a requirement in their PhD program. The students I taught as a result of this arrangement had completed a graduate course on intelligence as a pre-requisite for the course on Assessment. The students had been trained to make the same inferences that were invalid two decades earlier. In addition, none of the students were aware of the discussion of this issue in the quasi-official manual for the Wechsler test that also indicated that inferences of this sort had not been supported by relevant research (see Matarazzo, 1972). And, none of the students were aware of basic findings such as the longitudinal stability of test scores that they should have known in order to appropriately interpret the results of the tests they were trained to administer. Note that the problems I have described are present for psychologists who have taken a course on intelligence. I could expand this section of the paper by reporting experiences I have had over the years encountering various professionals empowered as consumers or test administrators who were uninformed or misinformed about ability tests. My experiences lead me to a proposal. Anyone who administers or uses a test of intelligence to reach a decision about a person should be required to take a course on intelligence that is empirically based taught by an instructor who is familiar with the research literature.

2.3. To advance the "two disciplines of scientific psychology"

Ever since Cronbach (1957) wrote his classic paper on the two disciplines of scientific psychology, we should be aware that a complete Psychology involves the integration of individual difference research and experimental research. Personality and intelligence are among the central dimensions of a complete Individual Difference Psychology. We teach the former to our students and, at least in the United States, ignore the latter. I believe that the study of intelligence is more advanced than the study of personality. There is one central difference — intelligence is assessed behaviorally by a sampling of intellectually relevant tasks; personality is usually assessed by self-reports and ratings. Even if one objects to the artificiality of the behavioral tests used to measure intelligence, the extensive evidence of their relations to real world accomplishments and academic achievement renders this objection partially moot. It would be possible in principle, if not invariably in practice, to observe individuals in a variety of relevant situations in order to assess their personality characteristics. The use of actual behavioral assessments that are ubiquitous in the measurement of intelligence is, in my judgment, a superior method of assessment relative to ratings and self-reports.

The availability of a set of tasks that sample intellectual abilities allows for the construction of a taxonomy of abilities

that is more developed than any comparable taxonomy of personality traits. Genetic covariance analyses may be used to investigate genetic and environmental contributions to the taxonomic structure of intellectual abilities. In addition, these analyses may be used to study environmental and genetic contributions to relationships between test scores and variables that define the nomological network that provides evidence for the intelligence construct. These studies provide tentative support for the hypothesis that the taxonomic structure of measures of intelligence, as well as the extended relationships between scores on tests of intelligence and other related measures, are partially mediated by genetic covariances. This hypothesis provides support for a genetic *g* construct that is isomorphic with a psychological *g* construct (see Brody, 2007). Comparable results are not firmly established for research in personality.

Research in intelligence benefits from the existence of large data bases that are often relatively representative of a population. For example, Deary et al. (2009) used tests of the entire population of Scotland who were administered a test of intelligence in their longitudinal studies. Several European countries administer IQ tests to all males in the country as part of their required military service. Large representative samples are less common in personality research.

Individual differences in intelligence are related to many important socially relevant outcomes. A single index of intelligence obtained at age 11 is more predictive of a variety of outcomes than any other single thing we can know about a person.

We cannot have a complete Psychology with an incomplete understanding of individual differences. And, we cannot have a complete understanding of individual differences if we ignore that component of individual differences (intelligence) that is arguably studied in a more rigorous manner than the dimension of individual differences we emphasize in the curriculum of American universities.

2.4. To enhance and integrate the Psychology major

Research on intelligence is related to research in different fields in Psychology. Among them are these: Neuroscience, Behavioral Genetics, Cognitive experimental Psychology, Life-span Developmental Psychology, Educational Psychology, Personality Psychology, Social Psychology, Cross-cultural Psychology and Clinical Psychology. An undergraduate course on intelligence may have almost the breadth of an Introductory Psychology course. Such a course should enable the undergraduate to integrate and study at an advanced level many of the concepts derived from his or her other courses or from an introductory course. A discussion of the broader social policy issues inherent in the study of intelligence should serve to enhance the relevance of such a course. At the graduate level a course on intelligence should serve as an antidote to the excessive specialization characteristic of contemporary graduate education. Graduate students exposed to such a course might even eventually contribute to our knowledge of intelligence.

3. What should be taught?

Good teaching of any subject involves a transmission of passion and intense intellectual excitement. I have encountered research on intelligence that reported counter-intuitive findings. I was frequently impressed by the scope of imaginative analyses of large data sets. And, I frequently encountered works of detailed scholarship that uncovered many relevant studies. Although intelligence may suffer as a field with an unwarranted paucity of course offerings, it is not deficient with respect to the originality and diligence of its researchers. There is an ample quantity of good research and scholarship for any instructor to use in a general course. In what follows I shall present a subset of the papers and books I found interesting. It is not a list of publications that contain ideas I always agree with — rather it contains material I found interesting and important. And, it is only a sample of work I found interesting. The list is weighted toward the initial publications on many topics and any contemporary course would of necessity rely on newer publications that may, in some respects, derive from some of the earlier work I will list. Apart from an examination of my idiosyncratic interests, I believe that the list can also serve as a survey of some of the topics that could be covered in a course on intelligence. My list follows:

The structure of intellect.

1. Spearman's paper on *g* (Spearman, 1904). I have always marveled at the originality and enduring significance of this paper. My list is a sample of the things I found interesting. The one indispensible item on any list I would construct is Spearman's paper.
2. Cattell's masterful exposition of the distinction between crystallized and fluid intelligence as well as his more general theoretical discussions of such topics as investment theory (Cattell, 1971).
3. Carroll's extensive investigation of the taxonomy of intellectual abilities (Carroll, 1993).
4. Johnson and Bouchard's use of confirmatory analyses in support of the VPR model (Johnson & Bouchard, 2005).

Cognitive experimental psychology and intelligence.

1. The revival of attempts in the modern era to study relationships between tasks used in experimental studies of cognitive processes and intelligence. I first encountered this work in a paper by Hunt, Frost, and Lunneborg (1973). This initial study is the first of many studies in the modern era relating psychometric indices to tasks used to measure cognitive processes in laboratory settings. These include studies of reaction time summarized by Jensen (2006), inspection time summarized by Nettelbeck (2003) and studies of working memory summarized by Ackerman, Beier, and Boyle (2005).
2. Sternberg's analysis of the relationship between intelligence and components of reasoning (Sternberg, 1977). Although this work has not been especially propaedeutic, I consider it a brilliant attempt to reorient the study of the cognitive basis of intelligence.

The biological basis of intelligence.

1. Initial attempts to use new technologies for scanning the brain to discover the biological basis of intelligence. Haier et al. were among the first to use these technologies to discover relationships between glucose metabolism and intelligence (Haier, Siegel, Neuchterlein, et al., 1988).

2. Studies of the relationship between frontal lobe functioning and intelligence initiated by Duncan, Emslie, Williams, and Johnson (1996). This research is interesting since it begins a potentially fruitful dialog between cognitive neuroscientists and psychologists interested in individual differences in intelligence.

Genetic influences.

1. The counter-intuitive findings indicating that the heritability of measures of intelligence may increase from childhood to late adolescence. The results of the Colorado Adoption Study provide evidence for this generalization (see Plomin, Fulker, Corley, & DeFries, 1997).
2. Although, as far as I know, there are few replicable relationships between molecular genetics and intellectual ability, it is likely that eventually molecular genetics will lead to advances in the study of intelligence. A study by Deary, Yang, Davies, Harris, et al. (2012) is a recent example of the possibility of using emerging understanding of molecular genetics to study intelligence.

Socially relevant outcomes.

1. The meta-analyses summarized by Ones, Viswesvaran, and Dilchert (2005) supporting the use of intelligence tests in selection.
2. Longitudinal studies of the Johns Hopkin's talent surveys indicating the extraordinary intellectual achievements of the "1 in 10,000" group (Lubinski, Benbow, Webb, & Bleske-Rechek, 2006).
3. Emerging evidence of the relationship between intelligence and health and mortality (see Deary (2009) for a summary of this work).

Life-span development.

1. Research indicating that individual differences in intelligence can be assessed in infancy (see Colombo, 1993, and for a more recent summary, Fagan, 2011).
2. Schaie and Strother's demonstration of the confound between age and cohort effects in cross sectional studies of the relationship between age and intelligence (Schaie & Strother, 1968). This study was instrumental in initiating an active area of longitudinal studies of intelligence in old age (see Schaie (2005) for a summary of studies of intelligence in old age with one intensively studied sample).
3. The longitudinal investigations of changes in intelligence over the life-span using the Scottish Mental Surveys of 1932 and 1947 (Deary et al., 2009).

Group differences.

1. Braden's summary of studies of the intelligence of the deaf (Braden, 1994).
2. An emerging consensus indicating that sex differences in mean intelligence are exceedingly small combined with evidence that males have higher variability in intelligence than females (see Deary (2012) for a summary of some of the research on this topic).
3. Jensen's comprehensive survey of studies that he interprets as providing support for a genetic basis for Black–White differences in scores on tests of intelligence (Jensen, 1998, chapt. 11 and 12; see also Brody (2003) for a critique of Jensen's analysis).

Relationships between intelligence and other individual difference measures.

1. Ackerman's studies of the relationship between intelligence and personality (see Ackerman, 1996; Ackerman & Heggestad, 1997).
2. Matthews, Zeidner, and Roberts (2002) comprehensive critical survey of research on emotional intelligence.
3. Sternberg's attempts to broaden the definition of intelligence by considering practical and creative intelligence (Sternberg, 2006).

Cultural and social influences.

1. Flynn's discovery of the widespread increases in scores on tests of intelligence (Flynn, 1987).
2. Studies of the influence of neighborhood poverty on intelligence (Brooks-Gunn, Duncan, & Aber, 1997a, 1997b).
3. Steele and Aronson's studies of stereotype threats and their possible influence on test performance (Steele & Aronson, 1995, 1998).
4. Rindermann's sophisticated multivariate cross-lagged panel analyses of cross-national studies of the relationship between intelligence, educational achievement and economic outcomes and other cross-national comparisons (see Rindermann, 2007, 2008). Rindermann's analyses follow earlier investigation of the economic significance of cross-national variations in intelligence initiated by Lynn and Vanhaven (2002).

Legal issues.

1. Elliott's book contains an interesting analysis of some court cases dealing with the use of tests of intelligence (Elliott, 1987).
2. A study of Supreme Court cases dealing with the use of tests of intelligence such as the recent decision in the New Haven firefighter's case (Ricci v. DeStefano, 2009) is interesting for an analysis of questionable reasoning in the arguments by Judges on both sides of the issue.
3. Jensen's comprehensive analysis of bias in mental testing. The studies reported in this survey are useful for understanding issues related to affirmative action (Jensen, 1980).

The communication of passion and awe.

Last, but not least, intelligence is a field of study that has more than its fair share of profound and meaningful contributions to knowledge. It is an instructor's task to communicate this to his or her students.

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