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Culture-fair prediction of academic achievement

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ABSTRACT

A theoretically based, culture-fair test of new learning ability is predictive of academic achievement. A sample of 633 adults, 121 of minority status, drawn from urban private universities, colleges, and community colleges were given information as to the meanings of previously unknown words, sayings, similarities, and analogies. They were also tested for their existing knowledge of vocabulary, opposites, and analogies with a brief version of the Scholastic Assessment Test (SAT). New learning ability proved to be culture-fair, reliable, and predictive of grades and of the brief version of the SAT.

1. Introduction

The present research tests the validity of a culture-fair test of the ability to process new information for the prediction of academic achievement (exam scores in college courses). The culture-fair test of new learning is based on a theory which defines intelligence as information processing ability and the intelligence quotient (IQ score) as a measure of knowledge resulting from processing ability and from the information provided by the culture for processing (Fagan, 2000).

The search for a culture-fair test predictive of academic achievement begins with a question. Are majority–minority differences in IQ due to differences in innate intellectual ability or to cultural variations in exposure to information (Jensen, 1985)? There is no agreed upon answer and there is evidence for both sides of the argument (Gottfredson, 2005; Nisbett, 2005; Rushton & Jensen, 2005a,b; Sternberg, 2005; Suzuki & Aronson, 2005). Therefore, many (Cooper, 2005; Helms, 2007; Hunt & Carlson, 2007; Newman, Hanges, & Outtz, 2007; Sternberg, Grigorenko, & Kidd, 2005) argue for the need for new theoretical approaches to the question of the sources of racial inequality in IQ. The theoretical approach taken in the present study assumes that group differences in IQ not accompanied by group differences in information processing ability are due to group differences in access to information (Fagan, 2000). Based on these assumptions, studies by Fagan & Holland (2002, 2007) offer a theoretically guided, empirical approach to the question of the basis of racial differences in IQ.

Fagan and Holland (2002) investigated the contributions that information processing ability and access to information make to racial differences in IQ. Majority and minority group members were compared for their knowledge of the meanings of words, a task that typically results in racial group differences in IQ. Fagan and Holland (2002) insured that the people in each group were given equal opportunity to learn the meanings of novel words and tested to determine how much knowledge had been acquired. General knowledge of word meanings was also tested to control for the possibility that the particular people chosen to represent each racial group might, by chance, simply have been equal in vocabulary knowledge. The majority group members were, as expected, superior to those in the minority in general vocabulary knowledge. However, when equal opportunity for exposure to the meanings of words was experimentally assured, both racial groups were equal in knowledge. Fagan and Holland (2007) explored the generality of their original findings by testing majority and minority group members for their

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knowledge of sayings, analogies, or similarities. Material was presented in such a way that knowledge of the concepts and terms employed in each test were commonly available for individuals of either race. Participants were also tested for their understanding of sayings, similarities, and analogies typically given in assessments of IQ, assessments which vary with race (Jensen, 1980; Jensen, 1981). As in their earlier study (Fagan & Holland 2002), knowledge such as that tested on conventional IQ tests varied with race while knowledge based on information made generally available did not vary with race.

1.1. Summary

In brief, the data of Fagan and Holland (2002, 2007), based on some 1000 participants, support the view that differences among races in knowledge typically tapped on standard IQ tests have to do with experience. A chief implication of such findings is that it may be possible to develop culture-fair tests of intelligence. As Williams (2000, p. 17) notes "Fagan's ideas" are "relevant to the debate on intelligence testing and affirmative action because …. a true measure of processing efficiency (if it could be devised) would be fair to members of all racial and ethnic groups". The goal of the present investigation was to discover if a culture-fair test of information processing based on new learning ability is predictive of academic achievement. Specifically, adults drawn from private universities, colleges, and community colleges in a major urban setting were tested for their ability to acquire new information concerning the meanings of previously unknown words, sayings, similarities, and analogies. They were also tested for their knowledge of vocabulary, opposites, and analogies via a brief version of the verbal section of the Scholastic Assessment Test (SAT-V) constructed for the purposes of the present study. Associations among performance on the culture-fair tests of new learning, a more conventional estimate of academic aptitude (the brief SAT), and academic achievement (objective test scores in college courses) were analyzed. For a small number of the participants standard SAT-V scores were available which allowed an estimate of whether the brief SAT constructed for the present study was comparable to the standard SAT-V in predicting class exam scores.

2. Methods

2.1. Participants

The sample included 633 students (392 females, 241 males). Racial identity was voluntarily provided by the student who checked, on a form, one of five categories labeled "American Indian or Alaskan Native", "Asian or Pacific Islander", "Black or African-American, not of Hispanic origin", "Hispanic", or "White, not of Hispanic origin". The categories used were based on the designations employed by the United States Public Health Service and were consistent with the use of the same categories employed in the Fagan and Holland (2002, 2007) studies. Of the 630 who provided information as to their race, those of majority status (461 Whites, 48 Asians) constituted 80% of the sample and those of minority status (100 African-Americans, 18 Hispanics, 3 American Indians) constituted 20%. The mean age was 21.3 years (SD 6.0 years), the mean education 13.7 years (SD 1.3 years). Some 49% of the students were enrolled at two private universities, 3% attended a small, private, liberal arts college, and 48% attended a two-year, community college. Admission to the community college is not based on standard tests such as the SAT or the ACT, only proof of completion of high school is required. Including community college students as well as students in private universities and colleges allowed a representative estimate of performance across a wide range of ability. All were registered for psychology classes at the undergraduate level.

2.2. Apparatus and materials

A culture-fair test of the students' ability to acquire new information concerning the meanings of previously unknown words, sayings, similarities, and analogies was given. Examples will be noted below. In addition to the culture-fair tests of new learning all participants were given a brief SAT type test based on questions available from books containing practice questions for the SAT (examples will be given below). The brief SAT was given to insure that all participants would be given the same test, since community college students are not required to take the SAT for admission. In addition, students from other countries and transfer students did not always have SAT scores on record. Measures of exam performance on all of the objective tests taken during a semester (expressed as % correct out of 100) were obtained from instructors of psychology courses, with the students' consent.

2.3. Procedure

2.3.1. Culture-fair tests of new knowledge

Tests of new knowledge were based on a training phase and a testing phase. All training and testing was done in a group setting. Training for the learning of the meanings of new words, consisted of a form that said: "Now you are going to see how some unusual words are used in sentences. Read each sentence carefully." An example of such a sentence was "It cost 1500 BEZANTS to buy the rug in Byzantium." Training would then continue for the remaining 11 words of the 12 item set. Instructions for learning the meaning of new sayings were: "On the following pages you will see how 16 sayings from various cultures are explained in English. Carefully read the explanation for each saying." An example of such a saying was "IN THE SOUP: Stuck. Not able to escape. Can't get away." Training for learning the meanings of new similarities and analogies was accomplished using pairs of nonsense words. Each of 20, two-word sets was explained. Later, 10 pairings of words were used to test for knowledge of the similarity between the words and 10 pairings were used to estimate newly gained knowledge of how the words fit into an analogy. The training instructions for two examples follow: "On the following pages you will see how simple words from rare languages are explained in English. Carefully read the explanation for each set of words. BRILLIG and CIDY: A BRILLIG is easily picked from a low branch and a CIDY from off a vine. Both a BRILLIG and a CIDY are juicy and Delicious. KODT and VALD: Big drills went into the earth hoping to find solid, shiny KODT or energy-rich, flowing VALD."

The students then handed in their training materials and received a set of multiple choice tests on the newly learned material. To test new knowledge of 12 word meanings, the student was asked to choose among four possible answers. For example: "BEZANT a. Hotel b. Coin c. Mill d. Harbor". To test knowledge for the 16 newly learned sayings the students were given multiple choice tests such as: "IN THE SOUP means a. Broke b. Rich c. Trapped d. Knowing". To test for knowledge of how a pair of newly learned words was most similar students saw 10 questions such as: "BRILLIG and CIDY a. Round b. Colored c. Fruit d. Vitamins". To test for knowledge of newly learned analogies students saw 10 questions such as: "KODT is to silver as VALD is to_____ a. Gold b. Mecca c. Oil d. Eggs"

2.3.2. The brief SAT

Questions of the sort traditionally tested on the SAT-V were taken from practice texts for the SAT-V (Robinson & Katzman, 2002) and the Graduate Record Exam (Martinson, 2000). They comprise what will be referred to here as the brief SAT. The test included 24 items, eight of which tested knowledge of the meanings of words. For example: "Henry viewed Melissa as_____; she seemed to be against any position regardless of its merits. a. Heretical b. Disobedient c. Contrary d. Inattentive e. Harried". A second set of eight questions tested knowledge of opposites. For example: "EXONERATE a. Testify b. Engender c. Accuse d. Inundate e. Abrogate." A set of eight questions tested knowledge of analogies. For example: "WATERFALL: CASCADE:: a. Snow : Freeze b. Missile : Launch c. Tree : Exfoliate d. Wave : Undulate e. Monarch : Reign". An entire session (training and testing) lasted about 40 min.

3. Results

3.1. Measures

Total scores across tests of newly acquired meanings of words, sayings, and similarities; total scores based on the brief SAT type tests of knowledge of meanings, opposites and analogies; and class exam scores as the index of achievement were the measures of interest.

3.2. New learning is culture-fair

The relationships among race, knowledge of newly learned material, past knowledge as estimated by the brief SAT scores and class exam scores were explored in a series of multiple regression analyses. The first two of these analyses were based on 628 participants for whom scores on new learning and the brief SAT were available and who had indicated their racial identity. Both race and new learning ability were expected to play a role in past knowledge (brief SAT scores). Indeed, such was the case. A regression analysis yielded a multiple R of .65, F (2/627)=232.7, $P<.001$, with Beta values of .06 ($t=2.0$, $P<.05$) and .64 ($t=21.0$, $P<.001$) for race and new learning, respectively, for the prediction of brief SAT scores.

Past knowledge (i.e. brief SAT scores), but not race, was expected to be related to the ability to process new information. The results were as predicted. A regression analysis yielded a multiple R of .65, F (2/625)=230.9 $P<.0001$, with Beta values of .04 ($t=1.3$, $P>.18$) and .65 ($t=21.0$, $P<.0001$) for majority–minority status and brief SAT scores, respectively, for the prediction of new learning.

A similar analysis was undertaken for the contributions of race and new learning ability to class exam scores. These analyses were based on 539 participants for whom scores on new learning and class exam scores were available and who had indicated their race. Age was entered into the regression analysis as well, since a preliminary analysis indicated some relationship between age and grades. Both race and new learning ability were expected to play a role in class exam scores. They did, with a multiple R of .44, F (3/533)=43.2, $P<.0001$, with Beta values of .10 ($t=2.4$, $P<.02$) for majority–minority status, .42 ($t=10.6$, $P<.0001$) for new learning ability, and .15 ($t=3.7$, $P<.0001$) for age, respectively, for the prediction of class exam scores.

If both information processing ability and cultural exposure to information determine knowledge, class exam scores, but not race, should be related to the ability to process new information. The results confirmed such a prediction. The regression analysis yielded a multiple R of .43, F (3/533)= 39.8, $P<.0001$, with a non-significant Beta value of .007 ($t=0.2$) for majority–minority status, and significant Beta values of .42 ($t=10.6$, $P<.0001$), and −.11 ($t=-2.7$, $P<.006$) for class exam scores and age, respectively, for the prediction of new learning.

The present findings are in accord with the results of Fagan and Holland (2002, 2007) where minority and majority group members did not differ in the ability to process novel information but did differ when previous exposure to information was not controlled (brief SAT and class exam scores). For our present purposes, the results confirm the culture-fair nature of the items chosen in the present study to measure the ability to acquire new knowledge.

3.3. Reliability

Correlations either uncorrected or corrected for unreliability were computed to determine the relationships among the indices of new knowledge, the brief SAT scores and class exam scores. The means and standard deviations for the test of new learning, the brief SAT test and class exam scores along with estimates of reliability based on Kuder–Richardson formula 21, (Cronbach, 1960) are listed in Table 1 for the 539 participants in the sample who indicated their racial grouping, who completed each test and who consented to have their class grades made available. As one can see from the data in Table 1, both the new learning and the brief SAT scores were of the same level of difficulty and of the same level of reliability.

Table 1
Estimates of reliability for new knowledge, brief SAT scores, and class exam scores ($N=539$)

Test	Mean	SD	% correct	Reliability
New knowledge	25.8	6.8	53.8	.77
Brief SAT	11.8	5.4	49.2	.82
Class exam scores	80.9	12.3	80.9	.91

3.4. Predictive validity

The next focus of analysis was on the predictive validity of the culture-fair test of new learning. Obtained coefficients, either uncorrected or corrected for attenuation due to unreliability, for the total sample of 539 participants are listed in Table 2.

The data given in Table 2 indicate that class exam scores were predicted at a moderate and statistically significant level by the culture-fair test of new knowledge (r=.41, R=.50) and there was a substantial and significant relationship between the culture-fair test of new knowledge and the brief SAT index (r=.66, R=.83).

Table 3 lists the correlations (uncorrected or corrected for unreliability) among new knowledge, the brief SAT, and class exam scores presented separately for majority and minority participants. As can be seen, the finding that tests of new learning are valid in predicting achievement for the sample as a whole are as true for minority participants as they are for majority participants with no significant differences obtained in any comparisons of corresponding coefficients for majority vs. minority members.

In considering the magnitude of the predictive validity coefficients listed in Tables 2 and 3 it should be borne in mind that the coefficients obtained between class exam scores and either new knowledge or the brief SAT are attenuated by the fact that exam scores from one class to another are not exactly comparable. Teachers vary in the difficulty of the tests they construct, readings required, clarity of lectures, etc., and, thus, in the class exam scores obtained by their students. Thus, differences among teachers remains as an (undetermined) attenuating factor in assessing the accuracy of predictive validity coefficients.

It is important to note, for the total sample (Table 2), that the relationships between the brief SAT and class exam scores (r=.51, R=.59) are somewhat higher than the relationships between new learning and class exam scores (r=.41, R=.50) with the difference (.10) between the r values of .51 and .41 for the 541 participants being reliable at t=3.3, df 536, P<.001. According to the theory guiding the present study such a disparity is to be expected. Information processing ability (measured here by the new learning task) plays a role in how much knowledge is gained over time, hence new learning predicts both brief SAT scores as well as class exam scores. The brief SAT scores, however, are based not only on processing ability but on specific information provided by one's culture. The exposure to information provided by one's culture necessary to solve items on the brief SAT (e.g. knowledge of word meanings) also plays a role in understanding course material. Thus, one would expect the brief SAT scores to be somewhat better predictors of class exam scores than the new learning scores.

Table 2
Correlations among new knowledge, brief SAT, and class exam scores, uncorrected (r) or corrected (R) for unreliability for N=539

		Brief SAT	Class exam scores
New knowledge	r	.66**	.41**
	R	.83**	.50**
Brief SAT	r		.51**
	R		.59**

**P<.0001.

Table 3
Correlations uncorrected (r) or corrected (R) for unreliability between new knowledge and class exam scores and brief SAT and class exam scores for majority and minority participants

		New knowledge	Brief SAT
Majority	r	.40**	.52**
	R	.48**	.60**
Minority	r	.46**	.50**
	R	.56**	.58**

** P<.0001.

A further multiple regression analysis based on the total sample asked if the test of new knowledge, being highly correlated with the brief SAT, would add independent variance to the prediction of class exam scores. Such was the case, as indicated by a multiple R of .52, F (2/536)=101.5, P<.00001, with Beta values of .14 (t=2.8, P<.005) and .42 (t=8.7, P<.0001) for new learning and the brief SAT, respectively, for the prediction of class exam scores on the part of the 539 participants.

3.5. Comparisons of the SAT-V and the brief SAT

How representative of the standard SAT-V is the brief SAT designed for the present study? The sample happened to include 192 students with an average age of 19.3 years (SD 1.6), attending two private universities who had taken the SAT's in 2005–2006. The 192 students included 92 males, 100 females, 167 majority group members and 25 minority group members. An initial analysis found that the brief SAT (M=15.5, SD=3.8) and the standard SAT-V scores (M=624, SD=79) were highly correlated at r=.66 (P<.001) with a correlation corrected for unreliability (R) of .82. Did the brief SAT test predict class exam scores as well as the SAT-V? Yes. The predictions from each test to class exam scores were virtually identical. No significant differences were found between the SAT-V predictions of class exam scores (r=.38, P<.01) or the brief SAT test's prediction of class exam scores (r=.40, P<.01). A comparison of coefficients corrected for unreliability, in fact, indicated, if anything, a superiority in prediction for the brief SAT (R=.54) over that for the standard SAT verbal score (R=.42) at t=3.3, df 189, P<.001).

4. Discussion

4.1. Empirical conclusions

The present study asked whether a racially unbiased test based on the ability to process new information would predict success in college classes. The test of new learning employed in the present study proved to be culture-fair, reliable, and predictive of both numerical scores on class exams and of a brief version of a standard test of scholastic aptitude (the Scholastic Assessment Test-Verbal). Further, the results demonstrate that tests of new knowledge and tests of existing knowledge (such as the brief SAT) each contribute independent variance to the prediction of performance on exams in

class. A final finding is that the brief, 24 item version of the SAT-V created for the present study is as predictive of performance in class as the standard SAT-V.

4.2. Theoretical significance

The present experiment serves as an example of how a long lived and still much debated issue such as culture-fair testing can be addressed by a theory which defines intelligence as information processing and by experimental studies guided by such a theory. The present findings and those of Fagan and Holland (2002, 2007) are consistent with findings from other studies which have attempted to experimentally insure equal opportunity for exposure to information to people of different races. For example, training verbal strategies can erase differences between African-American school children and White school children on tests of analogy solution (Bridgeman & Buttram, 1975). Teaching cognitive skills and strategies to African children in Tanzania increases their scores (relative to children not so trained) on tests of syllogisms, sorting, and twenty questions (Sternberg et al., 2002). Black college students in South Africa given a mediated learning experience reap significantly more benefit from such training on tests of matrix solution than do similarly trained White peers (Skuy et al., 2002), although the strength of the differential training effect reported by Skuy, et al. has been called into question by te Nijenhuis, van Vianen, and van der Flier (2007) in a reanalysis of a subset of the Skuy et al. data.

Why, in the present study and in related previous studies (Fagan & Holland, 2002, 2007) do majority group members and minority group members perform equally well on newly learned information but differ on similar tasks involving material supposedly learned over a lifetime? Why, indeed, are people with less previous knowledge able to process new information as well as people with more previous knowledge? No racial differences emerged for newly acquired information because the experimental procedures employed assured that all participants had equal opportunity to acquire the new information in a setting where past knowledge was common to all participants. The tasks in the present study involved knowledge of the meanings of word, similarities, and analogies. The procedures used to estimate information processing or new learning ability put previously unknown words into sentences along with words known to all participants, sentences such as "The man walked down the street with his GLIP and his GLOP on a leash". Later, tests were given to see how well the participants had learned the meanings of GLIP and GLOB or in what way GLIP and GLOB were most similar or the use of GLIP and GLOB in an analogy. African-Americans and Whites did not differ on such tasks. Why not? They did not differ because the dictum of "equal opportunity for exposure to information" was assured by the experimental procedures allowing the equality of races as to information processing ability (i.e. intelligence) to be empirically demonstrated. Why did the same groups differ on their knowledge of material supposedly learned over a lifetime? The theoretical presumption would be that they differed in knowledge acquired over a lifetime because equal opportunity for exposure to that information over a lifetime had not been assured by the culture in which the different racial-ethnic groups were raised.

A question may also be raised as to why some information processing tasks show racial-ethnic differences in performance while the tasks employed in the present study do not. The theory of intelligence as processing guiding the present study contains a two page discussion of the fact that some cognitive or information processing tasks that show racial differences are also quite subject to obvious cultural influences such as cutoff dates for school entry (Fagan, 2000, pp. 173–174). The point made in Fagan (2000) is that performance on tasks called information processing tasks may be culturally influenced. Thus one must be cautious in attributing racial differences in IQ to processing differences on the basis of any or all such tasks. Fagan (2000, p. 174) then goes on to point out that findings by Jensen (1993) as to racial differences on what are called complex information processing tasks (mental arithmetic) may also have a cultural basis, since age of school entry (a cultural factor) also alters performance on the speed of solution of mental arithmetic problems. The tasks used in the present study, tasks involving the acquisition of new verbal knowledge and the use of such knowledge in the solution of vocabulary, similarities, and analogies, are tasks more complex than any of the information processing tasks just noted (e.g. more complex than speed of mental arithmetic). Yet, African-Americans and White Americans did not differ on these complex verbal tasks when equal opportunity for exposure to the information underlying the tasks was experimentally assured. The fact that the racial-ethnic groups in the present study did not differ in performance had nothing to do with the simplicity or the complexity of the tasks. It had to do with the fact, noted above, that the dictum of "equal opportunity for exposure to information" was assured by the experimental procedures allowing the hypothesis of the equality of racial-ethnic groups as to information processing ability (i.e. intelligence) to be tested.

A final theoretical question that may be raised is whether the new learning tasks used in the present study are devoid of the general factor (*g*) and, thus, show no racial-ethnic differences in performance. Such is not the case. In accordance with the manner in which Jensen (1998) derives *g*, estimates of *g* in the present study were based on a principal factor analysis (un-rotated). In order to compare the *g* values based on the three subtests making up the brief SAT to the four subtests making up the new knowledge test, corrections were made for the fact that the two tests differed in number of subtests. To compare the *g* value obtained from the three subtests of the brief SAT, to a comparable *g* value for new learning, the four subtests making up the new learning test were grouped into four unique sets of three subtests and a principal component, un-rotated factor was derived for each set. The mean of those four *g* factors was used to estimate *g* for a three subtest version of the new learning test. The reliabilities of the *g* factors for the brief SAT and for the new learning test were then derived by a formula provided by Jensen (1998, pp. 99–100) employing the number of subtests and the eigenvalues of the first principal components. These estimates of reliability were used to obtain final, corrected (*G*) factors for the brief SAT, and the new learning test for the entire sample of 539 employed in the earlier analyses, for the racial-ethnic majority ($N=447$) and for the racial-ethnic minority ($N=92$). These computations revealed that both

the brief SAT and the new learning tests were each heavily loaded on *G* with values of 79.7% and 73.2%, respectively. Moreover, majority and minority participants showed equal *G* loadings on the brief SAT (79.6% and 77.3%, respectively) and on the culture-fair test of new learning (72.9% and 72.3%, respectively).

4.3. Practical significance

For economic as well as for educational purposes valid, unbiased estimates of intellectual ability are needed to meet the challenges of recruiting, selecting, assigning and promoting people to positions where they can function most effectively. Other recent attempts at the development of such a culture-fair test have been promising in finding that racial group differences in test scores can be substantially reduced (Naglieri, Rojahn, Matto, & Aquilino, 2005; Naglieri, Rojahn, & Matto, 2007; Sternberg, 2006). These reductions in performance disparities between races hold out the hope of fairer access to higher education on the part of racial minorities (Sternberg, 2006). In an earlier article, the hope was expressed that "culture-fair … tests that are based on processing may provide an objective means of selecting candidates for employment or for advanced education" (Fagan, 2000, p. 177). In fact, the present study increases that hope by providing evidence that a reliable, culture-fair test of information processing based on the ability to acquire new information is a valid predictor of academic achievement. Such a brief, cost-effective estimate of cognitive ability can be used in the selection of candidates for advanced education or training in complex situations and may provide an incentive to achievement and bolster the hopes of advancement on the part of minorities.

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References

Bridgeman, B., & Buttram, J. (1975). Race differences on nonverbal analogy test performance as a function of verbal strategy training. *Journal of Educational Psychology*, *67*, 586–590.

Cooper, R. S. (2005). Race and IQ: Molecular genetics as Deus ex machina. *American Psychologist*, *60*, 71–76.

Cronbach, L. J. (1960). *Essentials of Psychological Testing.* New York, NY: Harper & Row.

Fagan, J. F. (2000). A theory of intelligence as processing: Implications for society. *Psychology, Public Policy, and Law*, *6*, 168–179.

Fagan, J. F., & Holland, C. R. (2002). Equal opportunity and racial differences in IQ. *Intelligence*, *30*, 361–387.

Fagan, J. F., & Holland, C. R. (2007). Racial equality in intelligence: Predictions from a theory of intelligence as processing. *Intelligence*, *35*, 319–334.

Gottfredson, L. S. (2005). What if the hereditarian hypothesis is true? *Psychology, Public Policy, and Law*, *11*, 311–319.

Helms, J. E. (2007). Implementing fairness in racial-group assessment requires assessment of individuals. *American Psychologist*, *62*, 1083–1085.

Hunt, E., & Carlson, J. (2007). Considerations relating to the study of group differences in Intelligence. *Perspectives on Psychological Science*, *2*, 194–213.

Jensen, A. R. (1980). *Bias in mental testing.* New York: The Free Press.

Jensen, A. R. (1981). *Straight talk about mental tests.* New York: The Free Press.

Jensen, A. R. (1985). The nature of the black–white difference on various psychometric tests: Spearman's hypothesis. *The Behavioral and Brain Sciences*, *8*, 193–219.

Jensen, A. R. (1993). Spearman's hypothesis tested with chronometric information processing tasks. *Intelligence*, *17*, 47–77.

Jensen, A. R. (1998). *The g factor: The science of mental ability.* London: Praeger.

Martinson, T. H. (2000). *Everything you need to know to score high on the GRE.* New York: Macmillan.

Naglieri, J. A., Rojahn, J., Matto, H., & Aquilino, S. A. (2005). Black–White differences in cognitive processing: A study of the planning, attention, simultaneous, and successive theory of intelligence. *Journal of Psychological Assessment*, *23*, 146–160.

Naglieri, J. A., Rojahn, J., & Matto, H. (2007). Hispanic and non-Hispanic children's performance on PASS cognitive processes and achievement. *Intelligence*, *35*, 568–569.

Newman, D. A., Hanges, P. J., & Outtz, J. L. (2007). Racial groups and test fairness, considering history and construct validity. *American Psychologist*, *62*, 1082–1083.

Nisbett, R. E. (2005). Heredity, environment, and race differences in IQ, a commentary on Rushton and Jensen (2005). *Psychology, Public Policy, and Law*, *11*, 302–310.

Robinson, A., & Katzman, J. (2002). *Cracking the SAT.* New York: Random House.

Rushton, J. P., & Jensen, A. R. (2005). Thirty years of research on race differences in cognitive ability. *Psychology, Public Policy, and Law*, *11*, 235–294.

Rushton, J. P., & Jensen, A. R. (2005). Wanted: More race realism, less moralistic fallacy. *Psychology, Public Policy, and Law*, *11*, 328–336.

Skuy, M., Gewer, A., Osrin, Y., Khunou, D., Fridjhon, P., & Rushton, J. P. (2002). Effects of mediated learning experiences on Raven's Matrices scores of African and Non-African university students in South Africa. *Intelligence*, *30*, 221–232.

Sternberg, R. J. (2005). There are no public policy implications, a reply to Rushton and Jensen (2005). *Psychology, Public Policy, and Law*, *11*, 295–301.

Sternberg, R. J. (2006). The Rainbow Project: Enhancing the SAT through the assessments of analytical, practical, and creative skills. *Intelligence*, *34*, 321–350.

Sternberg, R. J., Grigorenko, E. L., & Kidd, K. K. (2005). Intelligence, race, and genetics. *American Psychologist*, *60*, 46–59.

Sternberg, R. J., Grigorenko, E. L., Ngorosho, D., Tantufuye, E., Mbise, A., Nokes, C., et al. (2002). Assessing intellectual potential in rural Tanzanian school children. *Intelligence*, *30*, 141–162.

Suzuki, L., & Aronson, J. (2005). The cultural malleability of intelligence and its impact on the racial/ethnic hierarchy. *Psychology, Public Policy, and Law*, *11*, 320–327.

te Nijenhuis, J., van Vianen, A. E. M., & van der Flier, H. (2007). Score gains on g-loaded tests: no g. *Intelligence*, *35*, 283–300.

Williams, W. M. (2000). Perspectives on intelligence testing, affirmative action, and educational policy. *Psychology, Public Policy, and Law*, *6*, 5–19.