Research Report

RACE AND GENERAL COGNITIVE ABILITY:
The Myth of Diminishing Returns to Education

Joel Myerson,1 Mark R. Rank,2 Fredric Q. Raines,3 and Mark A. Schnitzler4

1Department of Psychology, Washington University; 2George Warren Brown School of Social Work, Washington University;
3Department of Economics, Washington University; and 4Health Administration Program, School of Medicine, Washington University

Abstract—The impact of education on racial differences in general cognitive ability was assessed using data from the National Longitudinal Survey of Youth. To control for attrition during the educational process, we compared the scores of individuals who ultimately attained the same level of education but who were tested at different points in their educational careers. Multiple regression analyses revealed that education can have a strong positive effect on cognitive ability in both whites and blacks. Whites benefited more from education than blacks during the high school years, but blacks benefited much more than whites from a college education, substantially narrowing the gap between the races. These findings contradict the hypothesis that racial differences in intelligence are relatively immutable, in part because of the diminishing returns from increases in education.

On average, blacks in the United States tend to score significantly lower than whites on intelligence tests (e.g., Jensen, 1980; Reynolds, Chastain, Kaufman, & McLean, 1987), even when socioeconomic status (SES) is statistically controlled (Herrnstein & Murray, 1994; Loehlin, Lindsey, & Spuhler, 1975). According to Herrnstein and Murray and other researchers (e.g., Jensen, 1969, 1985), this is because the gap between blacks' and whites' test scores is largely due to genetic differences. With respect to education and racial differences, Herrnstein and Murray argued that the relationship between education and intelligence is negatively accelerated, and therefore efforts to improve educational quality or increase the amount of education beyond 12 years will pay increasingly diminishing returns in terms of raising intelligence or reducing racial differences. However, this claim is based on assumptions that go well beyond current knowledge, and the data cited by Herrnstein and Murray are open to quite different interpretations (e.g., Fischer et al., 1996; Hauser, 1995).

Only recently has consensus emerged on the fact that education influences intelligence (Neisser et al., 1996; for a review, see Ceci, 1991), and it is still unclear whether schooling has equivalent impact on different subgroups. With respect to secondary and postsecondary education in particular, analysis is complicated by the fact that amount of schooling may be positively related to intelligence test scores, not just because of the effects of education on cognitive ability, but also because educational level may reflect selective attrition of the less able (Herrnstein & Murray, 1994; Kaufman, 1990). Interestingly, although Herrnstein and Murray reported a significant effect of schooling on intelligence in their own analyses, they did not compare blacks and whites in this regard, nor did they attempt to control for selective attrition. Thus, their analyses shed no light either on the nature of the effect of education on intelligence or on whether there are racial differences in this regard.

From the perspective of educational policy, it is important to determine whether the relationship between education and intelligence is nonlinear, as Herrnstein and Murray (1994) hypothesized, and provides diminishing returns for increases in education, and also whether this relationship differs for blacks and whites. In conducting a test of Herrnstein and Murray's diminishing returns hypothesis, we used the same data set as they did; the same approach to the selection of respondents, construction of variables, and modeling techniques; and the same test of general cognitive ability, the Armed Forces Qualification Test (AFQT), which was administered to an exceptionally large nonmilitary sample as part of the National Longitudinal Survey of Youth (NLSY). For the present purposes, the unique advantage of this data set was that the longitudinal nature of the NLSY provided an opportunity to minimize the confound of educational attainment. Because data were available on individuals' ultimate educational attainment, it was possible to compare the test scores of individuals who all attained the same level of education but who were tested at different points in their educational careers.

One analysis was conducted on the data from individuals who ultimately graduated from high school but obtained no further schooling, and who had completed 8, 9, 10, 11, or 12 years of schooling at the time they were tested. A second analysis examined the data from individuals who ultimately graduated from college but received no postgraduate training, and who had completed between 8 and 16 years of education at the time they were tested. For each sample, we used multiple regression techniques to evaluate the form of the relationship between score on a test of general cognitive ability and educational level when tested. In addition, these analyses examined whether the linear and nonlinear components of the relationship between test score and number of grades completed differed significantly between blacks and whites.

METHOD

The NLSY is a nationally representative longitudinal survey of 12,686 young men and women who were between the ages of 14 and 21 as of January 1, 1979, when the study began. The data were gathered by the National Opinion Research Council under the supervision of Ohio State University's Center for Human Resources Research. Interviews with participants were conducted annually, and the survey maintained a retention rate of more than 90% through 1990. Information from the 1989 round of interviews was used to determine participants' ultimate educational attainment. The present analysis was restricted to data for black and white (non-Hispanic) individuals only.

More than 93% of the NLSY participants took the AFQT in 1980, the year that it was administered as part of the NLSY. The AFQT consists of select portions of the Armed Services Vocational Aptitude Test (ASVAT) that serve as the test of general cognitive ability for the armed services of the United States. According to the Armed Forces 1989 convention, the AFQT score is the sum of the raw scores on the word knowledge, paragraph comprehension, arithmetic reasoning, and

Address correspondence to Joel Myerson, Department of Psychology, Campus Box 1125, Washington University, One Brookings Dr., St. Louis, MO 63130; e-mail: jmyerson@artsci.wustl.edu.
Table 1. Multiple regression model for high school graduates

<table>
<thead>
<tr>
<th>Variable</th>
<th>Coefficient</th>
<th>t ratio</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Constant</td>
<td>-3.175</td>
<td>-3.062</td>
<td>.002</td>
</tr>
<tr>
<td>Black</td>
<td>1.375</td>
<td>0.724</td>
<td>.468</td>
</tr>
<tr>
<td>Socioeconomic status</td>
<td>0.171</td>
<td>8.079</td>
<td>.000</td>
</tr>
<tr>
<td>Age</td>
<td>-0.034</td>
<td>-1.985</td>
<td>.047</td>
</tr>
<tr>
<td>Education</td>
<td>0.337</td>
<td>2.663</td>
<td>.008</td>
</tr>
<tr>
<td>Education-squared</td>
<td>-0.019</td>
<td>-2.070</td>
<td>.039</td>
</tr>
<tr>
<td>Black × education</td>
<td>-0.343</td>
<td>-2.114</td>
<td>.035</td>
</tr>
<tr>
<td>Black × education-squared</td>
<td>0.013</td>
<td>2.087</td>
<td>.038</td>
</tr>
</tbody>
</table>

Note. N = 2,003, 23% black. R² = .317.

We conducted multiple regression analyses in which the dependent variable was AFQT score and the independent variables were age at the time of testing, parental SES, education (number of grades completed at the time of testing), and education-squared. In these and subsequent analyses, AFQT score and SES were normalized so as to have a mean of zero and unit variance in the total sample (i.e., they were converted to standard deviation units). SES was based on the mean of at least three of four indicators measured in standard deviation units: mother’s education, father’s education, family income, and parental occupation (Duncan’s Socioeconomic Index). Age was included to control for possible maturational differences in AFQT score. Education and education-squared terms were both included in the regression models so that the nonlinear as well as the linear effects of this variable could be assessed. A reduced model in which AFQT score was regressed on SES, age, education, and education-squared was compared with a full model that also included an indicator variable (set equal to zero for participants who identified themselves as being white and set to one for those who identified themselves as black) and both linear and nonlinear interaction terms. Comparing the full and reduced models provided a test of separate regressions for blacks and whites.

RESULTS

We first examined the effect of education on the sample of NLSY participants who had graduated from high school but obtained no further education as of 1989 and who had completed between 8 and 12 years of schooling when they were tested in 1980. Comparison of the full and reduced models indicated that the effect of education on AFQT score differed significantly for blacks and whites, F(2, 1995) = 128.35, p < .001, and therefore only the results for the full model are reported (Table 1). The effect of education predicted by the regression model is shown in Figure 1. There was a steeper increase in AFQT score with grade level for whites than for blacks, and for whites only the increase was negatively accelerated. More specifically, the increase in AFQT score predicted by the regression model for whites who entered high school at age 14 and graduated 4 years later was approximately 0.5 SD, but for blacks the predicted increase was less than half that size. Thus, although high school education had a generally positive effect on AFQT scores, the effect was considerably greater for whites than for blacks, widening the gap between the races until by the completion of high school, the estimated white-black difference had increased to nearly 6.9 SD.

We next examined the effect of education on the sample of NLSY participants who had graduated from college as of 1989 and who had completed between 8 and 16 years of schooling when they were tested in 1980. Again, comparison of the full and reduced models indicated that with age and SES statistically controlled, the effect of education on AFQT score differed significantly for blacks and whites, F(2, 715) = 4.19, p < .01, and therefore only the results for the full model are reported (Table 2). Figure 2 shows the predicted effect of education on the sample of college graduates. Education had quite different effects on the AFQT scores of black and white students during the high school years.
years. More specifically, the increase in AFQT score predicted by the regression model for whites who entered high school at age 14 and graduated 4 years later was approximately 0.3 SD, but for blacks there was no increase. Although the scores for black future college graduates appear to decrease initially, this decrease is not significant, as all the values for the high school years are well within the prediction interval for the initial data point.

The difference in the effect of education on black and white students reversed dramatically during college. Although the white students made gains during the college years, the black students benefited more than four times as much, increasing their scores more than 0.7 SD from the time of entering college until the time of graduation 4 years later. The gap between whites and blacks was estimated at more than 1 SD when they entered college, but by the time of college graduation, this difference had shrunk by approximately one half. Note that the reason for this shrinkage was not because continuing education beyond high school yielded diminishing returns for white students, but rather because the gains made by black students accelerated positively.

**DISCUSSION**

With selective attrition, SES, and age all statistically controlled, education produced significant increases in the scores of both black and white students, those who were college bound as well as those who were not, on a test of general cognitive ability (i.e., the AFQT). Between the beginning and end of high school, the scores of white future high school graduates increased more than twice as much as the scores of black future high school graduates. The scores of white future college graduates also increased significantly during the high school years, whereas the scores of black future college graduates showed no increase during this period. In contrast, it was the black college students who made the largest gains between the end of high school and college graduation, with their test scores increasing more than four times as much as those of white college students.

It is important to consider any possible explanations of these findings in the context of the whole pattern of results. If one were to consider only the high school graduates, for example, a possible explanation for the racial differences might be that blacks do not benefit as much from high school because they are of lower cognitive ability. However, consideration of both the high school and the college graduates included in this study argues strongly against that possibility. Blacks who went on to graduate from college showed no increase in their test scores during the high school years, yet these students were presumably of high ability.

Similarly, if one were to consider only racial differences in the impact of a college education, a possible explanation might be that black college students benefit more because those who graduate college are a select subset of the blacks who enter college, whereas whites who graduate college are a less select group. It is certainly true that there is greater attrition among black college students than among white college students in general, as well as among NLSY participants (Herrnstein & Murray, 1994). However, this fact only makes the failure to profit from high school by the highly select group of black future college graduates all the more remarkable, and raises the possibility that the increases they showed in college resulted from the removal of whatever may have been handicapping them during high school.

What might be the source of such a handicap? Our tentative answer to this question is based on the fact that the quality of secondary education differs for blacks and whites, even after controlling for socioeconomic differences (e.g., Card & Krueger, 1992a, 1992b; Coleman, 1990; Jaynes & Williams, 1989; Yinger, 1995). Much of the difference in secondary school environments may be traced back to a pattern of de facto residential segregation that results in substantial segregation in public education (Orfield, 1993; Rivkin, 1994). The pattern of residential segregation tends to hold even when SES is taken into account, so that students from black and white families with the same income may be exposed to very different public-education experiences (Farley & Frey, 1994; Massey & Denton, 1993; Massey & Hjortna, 1995).

It is not surprising, then, that as black and white students complete more grades in high school environments that differ in quality, the gap in cognitive test scores widens. At the college level, however, where black and white students are exposed to educational environments of comparable quality (National Center for Education Statistics, 1995), many blacks are able to make remarkable gains, closing the gap in test scores. Others, of course, may enter college with a disadvantage that cannot be overcome rapidly enough, contributing to the higher dropout rate among black students.

Herrnstein and Murray (1994) suggested that education in the United States has reached the point where further increments in amount and quality will pay diminishing returns, particularly with respect to racial differences. In contrast, the present findings suggest that variations in amount and quality of education that are within the range commonly observed in this country can have a profound impact. In some cases (e.g., secondary education), these variations may act to exacerbate racial differences in intelligence test scores, whereas in other cases (e.g., postsecondary education), such variations may act to substantially reduce racial differences.
Race and General Cognitive Ability

Unfortunately, the present analyses also suggest that standardized tests of academic ability used in college admissions are taken at the point when racial differences are most pronounced. In the present data, the largest difference between white and black students who would go on to graduate college was estimated to occur in the senior year of high school, precisely when admissions tests are commonly taken. As indicated by the much higher scores (and smaller racial differences) observed by the end of college, the high school test scores of the future black graduates greatly underestimated their potential.

In conclusion, the present results reveal that the relationship between grades completed and cognitive test scores is not negatively accelerated, at least for black students. In fact, for the black students who would later graduate from college, the relationship between the number of grades completed and cognitive test scores appeared to be positively accelerated. Although blacks gained much less than whites during high school, they improved at a much greater rate than whites during college, dramatically narrowing the gap in test scores. One can only speculate what the results might have been if the experiences of blacks and whites prior to college had not been so different. Nevertheless, the present findings indicate that, rather than producing diminishing returns, increasing the amount and the quality of education shows considerable promise as a means of reducing racial differences.

Acknowledgments—We would like to thank Lisa Jenkins and Jeremy Manier for their valuable comments.

REFERENCES


(RECEIVED 5/8/97; ACCEPTED 9/16/97)