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Educational Attainment as a Proxy for Cognitive Ability in Selection: Effects on Levels of Cognitive Ability and Adverse Impact

Christopher M. Berry
University of Minnesota

Melissa L. Gruys
Washington State University—Vancouver

Paul R. Sackett
University of Minnesota

The authors examined the differences in mean level of cognitive ability and adverse impact that can be expected when selecting employees solely on educational attainment as a proxy for cognitive ability versus selecting employees directly on cognitive ability. Selection using cognitive ability worked as a more efficient cognitive screen. Imposing an educational attainment standard of at least 1 year of college, though, did result in noticeably higher levels of cognitive ability in potential applicant pools than did random selection, meaning that educational attainment does work as a cognitive screen. These results held not only in a nationally representative sample but also within and across 6 different occupational groups. Finally, adverse impact is examined for selection using educational attainment, compared with selection on the basis of cognitive ability.

Keywords: cognitive ability, educational attainment, adverse impact

Educational attainment is used in many organizations as one aspect of the employee screening and selection process. It may be used for a wide variety of reasons, as educational attainment may in different circumstances be viewed as a proxy for specific knowledge and skill, for personality characteristics such as persistence or motivation, or for cognitive ability, among others. The focus of this article is on the use of educational attainment as a proxy for cognitive ability.

Cognitive ability has long been demonstrated to be an important determinant of performance and training across a broad spectrum of jobs (Bobko, Roth, & Potosky, 1999; Hunter, 1986; Hunter & Hunter, 1984; Ree & Earles, 1991, 1992; Schmidt & Hunter, 1998). Hunter and Hunter (1984) and Schmidt and Hunter (1998) reported mean validities corrected for range restriction and measurement error of .53 and .51, respectively, for predicting job performance. Mean validity was found to be .56 when predicting performance in training (Schmidt & Hunter, 1998). Thus, if it is believed that educational attainment is an indicator of cognitive ability, organizations may choose to use it as a selection criterion in lieu of a more direct measure of cognitive ability. The suggestion that an educational attainment screening precludes a need for cognitive ability testing is one we hear with some frequency when discussing selection systems with employers. Thus, the establishment of minimum educational requirements may lead some employers to forgo cognitive ability testing because of the assumption that the use of educational standards ensures an adequate level of cognitive ability among selected employees. This may or may not be the case, and this article outlines the difference in the level of cognitive ability among those selected that can be expected when such an approach is taken.

In marked contrast to the position that screening for educational attainment precludes a need for ability testing is the position that not using an ability test signals a lack of concern about cognitive ability, as illustrated by the dispute over a police selection system in Nassau County (Dunnette et al., 1997; Gottfredson, 1997a, 1997b). This dispute received widespread attention when an op-ed piece was published in *The Wall Street Journal*, in which it was claimed that the way test developers attempted to alleviate adverse impact was to practically remove all cognitive screens from the Nassau County selection test, retaining only one measure with a cut score so low that virtually all candidates passed (Gottfredson, 1996). In this article we examine the position that not using a cognitive ability test means that the hiring organization is disregarding cognitive ability in the selection process. We distinguish between direct and indirect use of cognitive ability measures. Not using a cognitive ability test should not be equated with not screening for cognitive ability, as indirect measures of cognitive ability may be used. In this specific instance, Nassau County used a selection requirement of 1 year (32 semester credits) of college courses. Thus, to the extent that educational attainment is a proxy for cognitive ability, the selection system does indeed include a cognitive component.

Our goal in this study was to document the effects on the cognitive-ability level and on the majority–minority composition

Christopher M. Berry and Paul R. Sackett, Department of Psychology, University of Minnesota; Melissa L. Gruys, Department of Management and Operations, Washington State University—Vancouver.

Melissa L. Gruys is now at the Department of Management, Wright State University.

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Correspondence concerning this article should be addressed to Christopher M. Berry, Department of Psychology, University of Minnesota, Elliott Hall, 75 East River Road, Minneapolis, MN 55455. E-mail: berr0159@umn.edu

of an applicant pool when selection is based directly on cognitive ability versus when it is based on education. This article outlines the tradeoff between using a direct versus indirect ability measure. We emphasize that we are focusing on documenting the effects of using one measure versus the other (i.e., an ability measure or educational attainment) to clarify the consequences of such a choice. In other words, we document the consequences of a belief that screening for educational attainment precludes a need to screen for cognitive ability. It is certainly the case that both measures can be used jointly in a selection system. And it is certainly the case that many organizations use educational attainment for other purposes than as a proxy for cognitive ability, as in the case in which an educational requirement is set that specifies completion of a particular curriculum. As another example, the U.S. military uses an aptitude battery as a predictor of task performance and uses high school completion as a predictor of attrition (Sackett & Mavor, 2003). Thus, our examination of using ability versus attainment should not be taken as suggesting that one should use one instead of the other, or that the only role for educational attainment is as a proxy for ability.

A body of literature addresses the validity of educational attainment as a predictor of job performance (e.g., Ariss & Timmins, 1989; Bobko et al., 1999; Booth, McNally, & Berry, 1978; Ferris, 1982; Hoiberg & Pugh, 1978; Hunter, 1980; Hunter & Hunter, 1984; Lavigna, 1992; Plag & Goffman, 1967; Schmidt & Hunter, 1998; Webster, Booth, Graham, & Alf, 1978). Meta-analytic studies have shown education to have low validity levels when predicting job performance. Hunter and Hunter (1984) reported a mean validity level of .10, whereas Schneider (1994) reported results of two meta-analyses with mean validities of .13 and −.04. Because many validity studies include data for a single position and/or for a narrow range of closely related positions, artifacts such as range restriction (too little variance in education or cognitive ability for the samples) have not been consistently addressed. Thus, a large, nationally representative, longitudinal database was used in this study.

In this study we examined the use of educational attainment as a proxy for cognitive ability by setting common minimum educational standards to select employees. The mean level of cognitive ability among populations of potential applicants identified through the use of educational attainment as a selection criterion is compared with the mean level of cognitive ability among populations of potential applicants identified directly and solely on the basis of cognitive ability measures. In effect, we evaluated the assertion that imposing minimum educational requirements ensures adequate levels of cognitive ability on the part of selected employees. Additionally, to examine the adverse impact that can be expected when selecting employees using either selection criterion, we compared the differences in percentages of minorities and women that are included in the potential applicant pools when selection is based on educational attainment versus cognitive ability. In making these comparisons, we used a large, nationally representative longitudinal database. Because such a large and rich data source was available, it permitted an examination at the level of the general national labor force, as well as at the level of specific occupational groups.

Finally, it should be noted that some of the issues addressed in this study have been previously discussed by Gruys and Sackett (1998). This study goes beyond Gruys and Sackett's study in three main ways. First, this study uses data that are current through the year 2000 and is thus an update to the study by Gruys and Sackett. Second, this study addresses how educational attainment works as a proxy for cognitive ability across and within six different occupational categories. Third, this study addresses the differences in adverse impact that can be expected when selecting employees on the basis of educational attainment versus cognitive ability, an issue not addressed by Gruys and Sackett.

Method

Sample

The data used for this study were a subset of the National Longitudinal Survey of Youth (NLSY), 1979 Cohort, a nationally representative sample of over 12,000 individuals 35–43 years of age as of 2000 (Center for Human Resource Research, 1999). Collection of the longitudinal database began in 1979 and includes participant responses relating to a wide range of employment issues. The sample used for the present study was limited to participants for whom both a cognitive ability score and educational level attained through year 2000 were available. Initially, 7,660 individuals met these two criteria. Because NLSY greatly oversampled Blacks and Hispanics, 1,683 Blacks and 738 Hispanics were randomly removed to make the study sample's racial composition mirror the general population's racial composition (according to the year 2000 U.S. Census; U.S. Census Bureau) as closely as possible. This resulted in a final sample of 5,239 individuals. The average age of participants in the year 2000 was 41.8 years ($SD = 2.2$); 51.5% were female; and 72.5% were White, 12.7% were Black, 13.1% were Hispanic, and 1.4% were other.

Variables

General cognitive ability. The database included Armed Forces Qualification Test (AFQT) scores for 11,878 participants. The armed forces use the AFQT as a general predictor of trainability and as a primary criterion for enlistment eligibility. The AFQT is a composite score created from selected sections of the Armed Services Vocational Aptitude Battery (ASVAB). The ASVAB was administered to NLSY participants (16–23 years of age at the time) in 1980 for purposes of developing national norms for the test. The AFQT is a composite of word knowledge, paragraph comprehension, math knowledge, and arithmetic reasoning and is highly correlated with other ability measures (Center for Human Resource Research, 1999). This composite score was then statistically corrected for differences in age at the time of testing by regressing AFQT scores on age and computing a residual for each person. To take advantage of the nationally representative sample, we conducted the linear regression using all participants in the database for which AFQT scores were available ($N = 11,878$). Finally, using the 5,239 study participants, each AFQT score was converted into a standard score. These final, age-adjusted AFQT standard scores were used as this study's measure of general cognitive ability. The mean cognitive ability score for the study sample ($N = 5,239$) was 0.00 ($SD = 1.00$).

Educational attainment. The level of educational attainment for participants was collected using an item in the NLSY database that recorded the number of years of schooling completed. Participant responses to this item on the most recent survey (2000) were used to utilize the most current information on education. The maximum possible attainment level was "eight or more years of college." The median level of educational attainment for the sample was 12 years (meaning 12th grade). The database did not include information on the highest degree that had been received by participants or information about area of study. In our analyses we focused on six levels of educational attainment that could serve as proxies for various degree levels. Analysis was carried out for the following six levels of education standards for selection: 12 or more years of education (proxy

for high school diploma), 1 or more years of college, 2 or more years of college (proxy for associate's degree), 4 or more years of college (proxy for bachelor's degree), 6 or more years of college (proxy for master's degree), and 8 or more years of college (proxy for doctoral degree). These six proxies will be referred to throughout the rest of the article as educational attainment standards (EASs).

Occupation. Included in the database was an item that recorded what each respondent's occupation was at their current or most recent job, using the 3-digit 1970 Census codes as occupational labels. Participant responses to this item on the most recent survey (2000) were used to utilize the most current information on occupation.

Age. Participants' age as of 1981 was used to adjust the AFQT scores for differences in age.

Gender. In 1979, the first year of the NLSY, the gender of each participant was recorded (Center for Human Resource Research, 1999).

Race. Race of respondents was grouped into four mutually exclusive categories (Hispanic, Black, White, and other).

Procedure

Four sets of analyses were conducted. The first set of analyses addressed selection directly on the basis of educational attainment or cognitive ability. Ability means were calculated for each of the six EASs. Thus, for instance, to examine the effects of setting an attainment standard of 2 years or more of college, we averaged the ability scores of all participants meeting or exceeding the attainment standard. To compare the mean level of cognitive ability in potential applicant pools resulting from selection on the two criteria, we calculated mean ability for participants who would have been eligible for hire given various common selection ratios solely on the basis of cognitive ability. For instance, if the selection ratio were set at 40%, mean ability would be calculated using the top 40% of cognitive ability scores in the sample. These ability means resulting from selection directly on cognitive ability were then compared with the ability means resulting from selection on the basis of each of the six EASs.

The second set of analyses addressed the notion of the implicit selection ratio that exists when any given educational standard is imposed. For example, if an organization requires applicants to have completed at least 8 years of college, then the implicit selection ratio that is imposed is the percentage of the prospective applicant pool that meets or exceeds that educational standard. For instance, in the sample used for this study, only 1.6% had completed 8 or more years of college. Thus, the implicit selection ratio corresponding to this educational standard would be 1.6%. It then makes sense to ask what the mean level of cognitive ability for the top 1.6% of scorers on cognitive ability would be and compare this with the mean level of cognitive ability for the top 1.6% in educational attainment (those with 8 or more years of college). The above comparison essentially holds the selection ratio constant and compares the mean ability resulting from selecting on educational attainment versus ability. Another strategy is to hold the mean ability constant and compare the selection ratios needed on ability and on attainment to reach this mean. Therefore, to make each of the above comparisons, mean ability was first calculated for participants who would have been eligible for selection on cognitive ability alone, given each of the EAS-derived implicit selection ratios. These means were then compared with the mean ability for all participants who met the EASs from which the implicit selection ratios for cognitive ability were derived. Finally, the cognitive ability selection ratios needed to attain ability means comparable to those obtained through selection using EASs were calculated.

The third set of analyses addressed the adverse impact against minorities and women that can be expected when selecting employees on the basis of educational attainment, as compared with selecting employees on the basis of cognitive ability. The percentage of Whites and the percentage of men meeting each minimum educational standard were calculated. Also calculated were the percentages of Whites and men meeting the cognitive ability cutoffs as derived from each of the implicit selection ratios corresponding to the minimum educational standards. These percentages of Whites and men were then compared with the percentages of Blacks, Hispanics, and women that would meet the same aforementioned educational and cognitive ability standards. Adverse impact ratios were calculated using these percentages to illustrate the difference, in terms of negative impact against women and minorities, when each separate selection criterion is used.

These adverse impact calculations are based on the assumption of variation in the applicant pool on educational attainment. Operationally, it is not uncommon for organizations to specify a desired EAS, and thus individuals below that EAS do not enter the applicant pool. Others consider educational attainment as one factor in a decision, sometimes identifying a given level of educational attainment as desirable, but not necessary, for entry into the applicant pool. Our adverse impact analyses can be viewed as examining the effect of using an EAS as the basis for entry into an applicant pool that will subsequently be screened further using other methods.

The above analyses were based on the entire NLSY study sample, representing the entire labor market. These analyses (specifically the third set of analyses) were then repeated for specific occupational groupings. This reflects the notion that it was not realistic to expect the entire national population to be the potential pool of applicants for any job. For a given job, there are persons who potentially would apply for said job and there are persons who would not. It was assumed, for instance, that someone who presently falls into the occupational category of "manager/official/proprietor" would not apply for the same jobs as would someone who presently falls into the occupational category of "craftsmen/foremen". Therefore, more realistic populations of potential applicants were created by subgrouping the full sample by occupational category, such that the pool of potential applicants for managers, for example, were those persons who are presently managers.

Finally, because the first three sets of analyses do not address the scenario in which the employer screens using both EASs and cognitive ability, a fourth set of analyses were undertaken, using a multiple-hurdles approach. First, all participants with 4 or more years of college were selected. Next, various cognitive-ability selection ratios were applied to the applicant pool resulting from selection on the EAS. Mean ability was calculated for the applicants meeting each of the cognitive-ability selection ratios in the final selection hurdle. This analysis demonstrates the increment that can be obtained by adding cognitive-ability screening to an applicant pool resulting from screening using an EAS.

Results

The correlation between educational attainment level and cognitive ability in the present sample was .63 ($p < .01$). This correlation is higher than those of .34 and .44 reported by Plag and Goffman (1967) and by Waldman and Avolio (1991), respectively. These two prior studies did not, however, use nationally representative databases. In the NLSY database used for this study, there is likely more range both in cognitive ability and in educational attainment.

In Table 1 we present the mean ability of the populations of potential applicants meeting the six common EASs and compare these with the mean ability of the potential applicant pools resulting from setting various selection ratios directly on cognitive ability. This table illustrates the difference in mean ability that can be expected when the two selection criteria are used. For instance, although only 1.6% of this sample has completed 8 or more years of college, that 1.6% still has a mean ability comparable only to those at or above about the 70th percentile of cognitive-ability scores in this sample. Put another way, if selecting solely on cognitive ability, one would have to set the selection ratio only

Table 1
Comparison of Mean Level of Cognitive Ability by Selection Ratio and by Educational Attainment Levels

Selection ratio	Cognitive ability score using selection based on cognitive ability		Cognitive ability score using selection based on educational attainment		Educational attainment standard
	M	*SD*	*M*	*SD*	
10%	1.66	.15			
20%	1.44	.26			
			1.25	.64	8 or more years of college
30%	1.24	.36			
			1.17	.64	6 or more years of college
40%	1.05	.46			
			0.95	.74	4 or more years of college
50%	0.86	.55			
			0.69	.85	2 or more years of college
60%	0.68	.65			
			0.57	.89	1 or more years of college
70%	0.50	.74			
80%	0.33	.83			
90%	0.16	.92			
			0.12	.97	12 or more years of education
95%	0.08	.97			

Note. $N = 5{,}239$. Cognitive ability is measured as the z score of the age-adjusted Armed Forces Qualification Test score for each participant.

near 30% to attain a level of cognitive ability in employees comparable to that obtained by setting a minimum EAS of a doctoral degree.

It is also interesting that the ubiquitous EAS of a high school diploma only succeeds in obtaining a mean ability among those selected comparable to selecting on cognitive ability and using a 90%–95% selection ratio. In terms of cognitive ability of applicants, setting a minimum educational requirement of a high school diploma does not provide very much information and is not much more efficient than random selection.

Table 2 provides further comparisons of selection on the basis of EASs versus cognitive ability. As an example to illustrate the information in Table 2, we use the EAS of 4 or more years of college in the full sample. First, the table gives the implicit selection ratio resulting from this EAS (i.e., 24.8% of the sample would be screened in using this EAS). Second, the table gives the mean ability level (0.95) resulting from setting this EAS. Third, the table gives the mean ability level (1.34) that would result if the same selection ratio (i.e., 24.8%) had been used to screen on ability directly. In other words, Table 2 documents the gain in ability resulting from screening out the same proportion of the applicant pool on ability as were screened out on attainment. Fourth, the table gives the selection ratio on ability (45.3%) that would result in the same level of ability as obtained with the four-year attainment screen. In other words, one can get a selected pool with a mean ability level of 0.95 by either selecting the top 24.8% on educational attainment or selecting the top 45.3% directly on ability.

Table 2 clearly shows the difference between the two selection criteria, in terms of the resulting mean ability of those selected. As long as the EAS is such that at least 1 year of college is required, it would be more efficient to select directly on cognitive ability. Table 2 outlines these results for both the full sample and for the six specific occupational groups, making it clear that the pattern of findings for the full sample is mirrored closely in the different occupational groups.

Although using educational attainment is not as efficient of a cognitive screen as using an ability measure directly, it is clear that attainment does act as a cognitive screen. The rightmost column of Table 2 displays the mean ability that was observed in each sample when a 100% selection ratio was used (this being the equivalent of selecting employees randomly, or on a first come, first serve basis). By comparing the mean ability for each EAS with that for random selection, it is obvious that, especially once a 1-year-college requirement or higher was set, minimum educational standards provided a noticeably higher level of ability than did random selection. Results in Table 2 show this to be the case across six very different occupations.

The above results make clear the difference in cognitive ability in the applicant pool that can be expected when an EAS versus cognitive ability is used to screen employees. It is recognized that this does not take into account the scenario in which an employer might use both cognitive ability and educational attainment in conjunction. Thus, we provide an example to demonstrate the increment in mean ability resulting from screening for ability among those already screened for attainment. We selected a prototypic situation, namely, setting a requirement of 4 or more years of college, which produced a mean ability of .95 in the full sample. We then calculated the increment in mean ability of implementing an additional cognitive-ability screen at selection ratios that vary from 10% to 90% in 10-point increments. The resulting mean ability levels for the nine selection ratios were as follows: 90% =

Table 2

Comparison of Mean Level of Cognitive Ability by Educational Attainment Standard and by Implicit Selection Ratio Corresponding to the Educational Standard for the Full Sample and Six Different Occupations

Variable	Years of education						
	8+ years college	6+ years college	4+ years college	2+ years college	1+ year college	12+ years education	Random selection
Full sample (n = 5,239)							
Selection ratio—ed	1.6%	7.5%	24.8%	39.3%	47.7%	90.3%	100%
M cog—ed	1.25	1.17	0.95	0.69	0.57	0.12	
SD cog—ed	0.64	0.64	0.74	0.85	0.89	0.97	
M cog—cog	1.92	1.72	1.34	1.06	0.91	0.16	0.00
SD cog—cog	0.06	0.13	0.30	0.55	0.53	0.92	1.00
Selection ratio—cog	29.7%	33.7%	45.3%	59.7%	66.5%	92.7%	100%
Professional/technical (n = 1,024)							
Selection ratio—ed	6.6%	24.5%	59.0%	77.7%	83.1%	99.1%	100%
M cog—ed	1.29	1.16	1.01	0.85	0.81	0.65	
SD cog—ed	0.64	0.66	0.74	0.82	0.84	0.91	
M cog—cog	1.88	1.68	1.29	1.04	0.96	0.66	0.65
SD cog—cog	0.08	0.16	0.39	0.56	0.63	0.89	0.91
Selection ratio—cog	59.2%	69.5%	80.1%	89.1%	91.6%	99.5%	100%
Managers/officials/proprietors (n = 855)							
Selection ratio—ed	1.1%	10.1%	37.3%	52.5%	62.1%	95.6%	100%
M cog—ed	—	1.19	1.00	0.85	0.76	0.44	
SD cog—ed	—	0.65	0.69	0.74	0.78	0.87	
M cog—cog	—	1.72	1.34	1.12	0.98	0.46	0.38
SD cog—cog	—	0.12	0.31	0.43	0.51	0.84	0.91
Selection ratio—cog	—	47.3%	60.7%	70.8%	77.2%	96.7%	100%
Clerical (n = 689)							
Selection ratio—ed	0.1%	1.4%	13.8%	31.6%	43.2%	95.7%	100%
M cog—ed	—	—	0.70	0.29	0.18	−0.04	
SD cog—ed	—	—	0.81	0.87	0.87	0.84	
M cog—cog	—	—	1.31	0.94	0.74	−0.01	−0.07
SD cog—cog	—	—	0.24	0.39	0.46	0.81	0.85
Selection ratio—cog	—	—	46.0%	74.3%	82.1%	97.8%	100%
Service/sales (n = 790)							
Selection ratio—ed	0.4%	2.4%	15.4%	31.2%	40.9%	89.1%	100%
M cog—ed	—	1.10	0.78	0.47	0.32	−0.14	
SD cog—ed	—	0.71	0.75	0.86	0.89	0.93	
M cog—cog	—	1.77	1.29	0.92	0.73	−0.10	−0.26
SD cog—cog	—	0.12	0.28	0.43	0.52	0.88	0.95
Selection ratio—cog	—	23.2%	38.4%	54.1%	62.5%	91.8%	100%
Craftsmen/foremen (n = 576)							
Selection ratio—ed	0.0%	0.5%	5.3%	16.9%	25.8%	83.8%	100%
M cog—ed	—	—	0.83	0.39	0.29	−0.09	
SD cog—ed	—	—	0.74	0.84	0.83	0.85	
M cog—cog	—	—	1.57	1.16	0.94	−0.03	−0.25
SD cog—cog	—	—	0.17	0.33	0.40	0.78	0.87
Selection ratio—cog	—	—	30.9%	55.2%	62.0%	88.4%	100%
Operative (n = 525)							
Selection ratio—ed	0.0%	0.2%	3.5%	8.2%	14.9%	79.3%	100%
M cog—ed	—	—	0.85	0.39	0.13	−0.46	
SD cog—ed	—	—	0.75	0.94	0.93	0.83	
M cog—cog	—	—	1.48	1.19	0.91	−0.36	−0.59
SD cog—cog	—	—	0.23	0.32	0.40	0.77	0.82
Selection ratio—cog	—	—	16.6%	33.7%	46.5%	81.2%	100%

Note. Cognitive ability is measured as the z score of the age-adjusted Armed Forces Qualification Test score for each participant. Dashes represent values calculated using sample sizes of 10 or less. Selection ratio—ed = implicit selection ratio (ISR) resulting from setting educational attainment standards (EASs); Cog—ed = cognitive ability score of participants who met the EAS; cog—cog = cognitive ability score of participants selected on cognitive ability using ISR; Selection ratio—cog = ISR resulting from setting cognitive ability standards comparable to each EAS; ed = education; cog = cognitive.

1.12, 80% = 1.25, 70% = 1.35, 60% = 1.45, 50% = 1.53, 40% = 1.61, 30% = 1.69, 20% = 1.77, and 10% = 1.86. Although we present specific findings for just this one scenario, we note that the same pattern of results is found in other settings. With this illustration we highlight strongly that it is not the case that one must select on either ability or attainment, and that screening on ability in an applicant pool already screened on attainment can result in substantially higher mean ability in the selected group.

Finally, in Tables 3 and 4 we compare selection on the basis of EASs versus directly selecting on cognitive ability, in terms of the adverse impact that can be expected to be caused by these two selection criteria. Table 3 first reports the selection ratios for the White subsample that result from using the implicit selection ratio for each specified level of educational attainment (these implicit selection ratios are in Table 2). Again using 4 or more years of college as an example, Table 2 shows that this EAS produces a 24.8% selection ratio in the full sample. Table 3 then shows that in the White subsample this EAS produces a selection ratio of 28.9%, but that 31.2% of the White subsample would be screened in if a cognitive ability selection ratio were used that is the same as the EAS selection ratio. Table 3 also shows that this EAS produces a Black–White adverse impact ratio of .51. (Note that from this information one can find the Black subsample's selection ratio, as this value is 51% of the 28.9% White selection ratio, or 14.7%.) Screening on cognitive ability with the same selection ratio produces a Black–White adverse impact ratio of .12, which can be used to derive the Black selection ratio, 3.7% (i.e., .037 = .12 × .312). Table 3 then gives comparable results for the White–Hispanic comparison.

Table 3 clearly shows that there are substantially lower levels of adverse impact when selection is based on educational attainment rather than when it is based on cognitive ability, except when the selection ratio is set very high (e.g., when an EAS of 12 or more years of education is used). This is generally the case both in the full sample and in each of the six occupational subsamples.

We use the same format in Table 4 as in Table 3 but compare the two selection criteria in terms of their expected adverse impact against women. According to the four-fifths rule, in the full sample, adverse impact against women when selecting directly on cognitive ability is observed only when very low implicit selection ratios, corresponding to a master's or doctoral degree, are used. When selecting on the basis of EASs, this adverse impact is alleviated at the master's degree EAS, but is still found, and even exacerbated, at the doctoral degree EAS. This same basic pattern holds for the six occupational subgroups.

Discussion

Some organizations assume that by implementing minimum educational standards they are selecting employees indirectly on the basis of cognitive ability. Whereas this is true to an extent, the results of this study clarify the degree to which mean levels of cognitive ability for potential applicant pools achieved through educational attainment requirements differ from the mean levels of cognitive ability achieved when selection is based on cognitive ability using the same selection ratio. These differences were substantial.

This result does not imply that organizations that choose to screen employees on the basis of educational attainment rather than on the basis of cognitive-ability measures are ignoring cognitive ability completely in the selection process. There is a substantial correlation of .63 between educational attainment and cognitive ability. Thus, selection on the basis of education will yield higher levels of cognitive ability on the part of selected employees than will selection on the basis of a device that is not so strongly related to cognitive ability. Therefore, by imposing EASs, organizations are indirectly addressing applicants' level of cognitive ability to some degree, and the results of this study outline the general pattern that can be expected when this is done. This becomes especially salient in situations such as the aforementioned Nassau County selection test controversy. Although it has been posited that Nassau County ignored cognitive ability in their selection system (Gottfredson, 1996, 1997a, 1997b), according to the results of this study, this was not the case. Nassau County used an EAS of 1 year of college to select employees, which this study has documented works as a cognitive screen to some degree. At the same time, screening using an EAS is a less efficient screen than directly using a measure of cognitive ability.

Of particular note is the fact that the present study compared the mean level of cognitive ability obtained by screening on cognitive ability versus screening on an EAS when the selection ratios are set to be the same for the two selection criteria. For example, Table 2 shows that for the full sample, imposing a requirement of 1 year of college results in a selection ratio of 47.7% and a mean level of cognitive ability of 0.57; in contrast, selecting the top 47.7% of the pool on the basis of a direct measure of cognitive ability results in a mean ability of 0.91. The comparison of 0.91 versus 0.57 is relevant when the same selection ratio is used for the two measures. The difference between the mean level of ability obtained by direct testing versus using an EAS would be quite different if the selection ratios were not comparable. Continuing the above example, imagine that the organization considering a 1-year college requirement has an applicant–opening ratio permitting a 25% selection rate. As above, using the 1 year of college EAS results in a mean ability among those selected of 0.57. The opportunity to apply a more stringent selection ratio (i.e., 25%) when using a direct measure of ability means that a higher mean level of ability among those selected is possible; Table 2 shows that with a selection ratio of 25%, the mean ability among those selected would be 1.34. Thus, it is important to recognize the conditions under which a comparison of ability testing and EASs is appropriate.

This also applies for a comparison of the adverse impact results for EASs versus cognitive ability. For instance, our adverse-impact results are dependent on our decision to compare the two selection criteria at a given selection ratio. It is conceded that the adverse impact values differ if the selection ratios are not held constant. For instance, if an organization imposes a 4-years-of-college EAS, this results in an implicit selection ratio of 24.8% and a Black–White adverse impact ratio of .51. If the same selection ratio is used with a cognitive ability score, the Black–White adverse impact ratio is .12. The comparison of .51 and .12 is relevant when the selection ratios are the same. On the other hand, an organization may wish to know the adverse impact from using a cognitive-ability cutoff that will result in the same mean level of cognitive ability in the applicant pool as does the 4-years-of-college EAS. Such a cognitive cutoff will result in an adverse impact ratio of .22. So, when the two criteria are compared in this way, the adverse

Table 3
Comparison of Selection and Adverse Impact Ratios of White, Black, and Hispanic Persons Based on Educational Attainment Standard Versus Cognitive Ability as Derived From the Implicit Selection Ratio Corresponding to the Educational Standard

Race	Years of education					
	8+ years college	6+ years college	4+ years college	2+ years college	1+ year college	12+ years education
Full sample						
White (n = 3,800)						
EAS	1.9%	9.0%	28.9%	42.8%	50.9%	92.5%
CA	2.1%	9.8%	31.2%	48.5%	57.9%	95.4%
Black (n = 666)						
EAS	0.32	0.36	0.51	0.74	0.82	0.94
CA	0.00	0.02	0.12	0.20	0.24	0.76
Hispanic (n = 688)						
EAS	0.79	0.46	0.47	0.68	0.75	0.88
CA	0.14	0.29	0.34	0.38	0.42	0.84
Professional/technical						
White (n = 814)						
EAS	7.0%	26.3%	62.5%	80.2%	84.7%	99.4%
CA	7.9%	29.0%	66.3%	86.1%	90.7%	99.6%
Black (n = 90)						
EAS	0.47	0.55	0.66	0.85	0.91	0.99
CA	0.00	0.00	0.22	0.32	0.44	0.98
Hispanic (n = 101)						
EAS	1.13	0.68	0.76	0.85	0.92	0.99
CA	0.38	0.48	0.61	0.63	0.68	0.97
Managers/officials/proprietors						
White (n = 687)						
EAS	0.7%	10.5%	38.3%	52.8%	62.3%	95.7%
CA	1.3%	11.3%	40.5%	56.7%	66.1%	97.3%
Black (n = 68)						
EAS	2.14	0.56	1.00	1.14	1.04	1.00
CA	0.00	0.00	0.40	0.47	0.53	0.88
Hispanic (n = 79)						
EAS	3.57	0.96	0.79	0.89	0.06	0.98
CA	0.00	0.67	0.75	0.71	0.77	0.94
Clerical						
White (n = 481)						
EAS	0.2%	1.6%	16.2%	30.8%	41.6%	96.5%
CA	0.2%	1.9%	18.7%	41.0%	54.5%	98.8%
Black (n = 89)						
EAS	0.00	0.69	0.76	1.31	1.38	1.02
CA	0.00	0.00	0.06	0.19	0.27	0.92
Hispanic (n = 105)						
EAS	0.00	0.63	0.30	1.00	1.01	0.95
CA	0.00	0.00	0.10	0.23	0.28	0.89
Service/sales						
White (n = 530)						
EAS	0.4%	2.3%	15.0%	30.3%	40.2%	89.0%
CA	0.4%	2.1%	15.0%	31.0%	40.6%	89.1%
Black (n = 144)						
EAS	0.50	0.57	0.65	0.83	0.88	0.98
CA	0.00	0.24	0.64	0.71	0.77	0.97
Hispanic (n = 107)						
EAS	0.50	0.39	0.58	0.82	0.87	0.98
CA	0.00	0.24	0.65	0.71	0.77	0.96

Table 3 (*continued*)

Race	Years of education					
	8+ years college	6+ years college	4+ years college	2+ years college	1+ year college	12+ years education
Craftsmen/foremen						
White (n = 440)						
EAS		0.7%	6.7%	18.0%	27.5%	85.5%
CA		0.5%	6.6%	20.7%	30.9%	89.3%
Black (n = 56)						
EAS			0.54	1.19	1.17	1.00
CA				0.09	0.17	0.62
Hispanic (n = 74)						
EAS				0.53	0.49	0.84
CA				0.13	0.26	0.82
Operatives						
White (n = 329)						
EAS		0.3%	4.5%	8.1%	15.1%	80.4%
CA		0.3%	5.2%	11.6%	21.6%	89.7%
Black (n = 99)						
EAS			0.67	1.23	0.93	1.04
CA			0.19	0.17	0.09	0.68
Hispanic (n = 87)						
EAS				0.85	1.07	0.83
CA				0.20	0.21	0.68

Note. Cognitive ability is measured as the z score of the age-adjusted Armed Forces Qualification Test score for each participant. Numbers in percentages are selection ratios. Numbers without percentages are adverse impact ratios. EAS = educational attainment standard; CA = cognitive ability.

impact lessens from .12 to .22. In short, our comparison of ability and EAS is conditioned on a comparable selection ratio; differing results are found when the comparison is conditioned on a comparable mean level of ability among selectees.

Another contribution of this study was to show, using a nationally representative database, that the patterns of results held across six different occupations. These occupations ranged from those considered relatively cognitively demanding (i.e., professional/technical) to those considered less so (i.e., craftsmen/foremen). Thus, the pattern of findings from this study should not be viewed only in the context of the labor force in general, or one specific type of occupation, but instead should be viewed in the context of a whole range of very different occupations in different industries, all with very different cognitive demands. Therefore, regardless of the applicant pool that exists for a particular organization or position, the findings of this study, in terms of the expected cognitive ability of the applicant pool, are most likely applicable.

There are several important caveats about the findings of this article. First, we focused on educational attainment as a proxy for cognitive ability, and thus compared outcomes when selection was based on educational attainment versus cognitive ability. In operational use, there is no reason why one must choose one to the exclusion of the other. If both measures are available, organizations would be best served to consider the possible use of both measures. For instance, an organization screening on educational attainment could further screen those meeting the educational standard using a cognitive-ability measure. Second, whereas we focused on attainment as a proxy for ability, attainment may relate to valued organizational outcomes in other ways. For example, as noted in the introduction, the U.S. military finds high school completion to be a useful predictor of attrition. Thus, the mean level of ability resulting from the use of an attainment standard may not be an index of the full value of the standard in some settings. This article is limited to the narrower issue of the degree of substitutability of attainment versus using an ability test when the goal is selecting for ability. Third, in this study, educational attainment is operationalized in terms of number of years of schooling completed. We acknowledge that a more specified attainment measure may produce different outcomes (e.g., the mean ability of individuals with four or more years of college majoring in engineering may differ from those majoring in education). Note though, that there are many instances in which a generic educational attainment requirement is used (e.g., a firm requiring a college degree, with major unspecified, for a management trainee, or a police department requiring the completion of 1–2 years of college credits). In short, we do acknowledge the variety of differing ways in which educational attainment requirements are used, and do not claim that the present study exhausts all possibilities. Finally, we note that when self-report educational attainment data are used in an applied setting, there may be concern that a small percentage of applicants embellish their credentials. Self-report data were used in this study, and the reported educational attainment still reflected cognitive ability to a fairly high degree. The NLSY participants may not be as motivated to embellish as would a job applicant, though, so in applied settings some attention to the source and accuracy of educational attainment data may be warranted.

In this article, the use of educational attainment as a proxy for cognitive-ability measures in the selection of employees has been examined. If organizations are interested in selecting employees

Table 4
Comparison of Selection and Adverse Impact Ratios of Women and Men Based on Educational Attainment Standard Versus Cognitive Ability as Derived From the Implicit Selection Ratio Corresponding to the Educational Standard

Gender	Years of education					
	8+ years college	6+ years college	4+ years college	2+ years college	1+ year college	12+ years education
Full sample						
Men (n = 2,541)						
EAS	2.2%	7.8%	24.5%	37.5%	45.0%	88.5%
CA	1.8%	8.9%	27.2%	41.9%	49.6%	89.7%
Women (n = 2,698)						
EAS	0.50	0.94	1.03	1.09	1.12	1.04
CA	0.78	0.69	0.83	0.88	0.92	1.01
Professional/technical						
Men (n = 423)						
EAS	10.9%	28.9%	62.9%	79.2%	83.7%	99.1%
CA	9.2%	33.6%	66.7%	83.0%	86.1%	99.5%
Women (n = 601)						
EAS	0.34	0.77	0.90	0.97	0.99	1.00
CA	0.51	0.54	0.80	0.89	0.94	0.99
Managers/officials/proprietors						
Men (n = 489)						
EAS	1.4%	11.6%	42.1%	57.8%	67.8%	95.8%
CA	1.4%	12.1%	43.4%	60.3%	69.9%	95.7%
Women (n = 366)						
EAS	0.36	0.67	0.73	0.78	0.80	0.99
CA	0.36	0.61	0.67	0.70	0.74	1.00
Clerical						
Men (n = 115)						
EAS		0.9%	15.7%	34.8%	41.8%	94.8%
CA		0.9%	15.7%	36.5%	47.0%	96.5%
Women (n = 574)						
EAS		2.00	0.88	0.90	1.05	1.02
CA		1.55	0.85	0.84	0.90	0.99
Service/sales						
Men (n = 299)						
EAS	0.7%	3.3%	22.4%	39.8%	48.8%	92.6%
CA	0.3%	2.7%	24.4%	42.8%	52.2%	89.6%
Women (n = 491)						
EAS	0.29	0.55	0.50	0.65	0.74	0.94
CA	1.33	0.74	0.40	0.56	0.65	0.99
Craftsmen/foremen						
Men (n = 517)						
EAS		0.6%	5.4%	16.8%	25.3%	83.5%
CA		0.4%	5.0%	17.0%	25.7%	83.8%
Women (n = 59)						
EAS			0.94	1.11	1.21	1.04
CA			1.26	0.90	0.99	1.01
Operatives						
Men (n = 366)						
EAS			3.2%	8.6%	14.1%	78.6%
CA			3.6%	8.7%	16.7%	81.1%
Women (n = 159)						
EAS		0.6%	1.25	0.84	1.18	1.03
CA		0.6%	0.86	0.79	0.64	0.93

Note. Cognitive ability is measured as the z score of the age-adjusted Armed Forces Qualification Test score for each participant. Numbers in percentages are selection ratios. Numbers without percentages are adverse impact ratios. EAS = educational attainment standard; CA = cognitive ability.

who have the highest levels of cognitive ability, imposing minimum educational requirements will not achieve the results desired. On the other hand, imposing an EAS beyond the high school graduation level does result in a considerably higher mean level of ability among those selected than does random selection. Thus, the fact that an organization does not use a cognitive ability test should not be interpreted as indicating organizational indifference to cognitive ability. In addition to describing the levels of cognitive ability that can be expected when selecting the use of educational attainment, the results of this study also point out that using educational attainment can decrease adverse impact when compared with selecting directly on cognitive ability. For many organizations this may be a very important goal. For other organizations the reduction in cognitive ability of their applicants, and the subsequent loss of criterion-related validity, would be valued more highly than the potential improvements in adverse impact. This is a judgment call to be made by the organization.

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