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Performance and Passing Rate Differences of African American and White Prospective Teachers on Praxis™ Examinations

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Performance and Passing Rate Differences of African American and White Prospective Teachers on Praxis™ Examinations: A Joint Project of the National Education Association (NEA) and Educational Testing Service (ETS)

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Abstract

This report focuses on two aspects of teacher supply and quality: (a) the under-representation of racial/ethnic minorities, especially African Americans in the teaching pool, and (b) teacher candidates' performance on licensure assessments, including general skills tests in reading, writing, and mathematics (known as Praxis I®) and selected tests covering areas of content and pedagogy (known as Praxis II®). The report presents trends in the overall and minority teaching workforce, utilizes some of the available Praxis™ program data, combined with interviews of faculty and students involved in college and university teacher preparation programs, to address supply, achievement, and performance gaps between prospective minority and White teachers. African American candidates are the focal group in this report, in order to gauge the effect that Praxis has on the supply of prospective African American teachers and to generate ideas for closing gaps. Other minority Praxis test-taking populations in the selected states are not included because these are not large enough to produce sufficient data from which to make valid inferences.

The research was collaboratively planned and guided by National Education Association and Educational Testing Service to use Praxis data for addressing the following questions: (a) What are the trends in minority representation among teacher candidates, (b) What are the differences between majority and minority candidates' performance on both Praxis I and Praxis II, (c) Are the performance differences reflected in the state licensing pass rates of majority and minority candidates, and (d) What factors should be targeted to reduce racial/ethnic group performance differences on Praxis I and Praxis II.

Key words: achievement gap, Praxis I, teacher licensure, Praxis II, passing scores

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Introduction

Like many specialized occupations in the United States, the teaching profession is confronting the enormous challenges of supply and quality. These challenges are multidimensional and include complexities that consume substantial attention of national, state, and local education policymakers. Policymakers address teacher supply and quality from a variety of competing perspectives and with varying interests. Included among the key supply challenges, for example, are the availability of people to (a) replace retiring teachers, (b) replace teachers who leave the profession at a young age in order to pursue alternative careers, (c) teach advanced courses in high-demand subjects such as the sciences and mathematics, (d) fill the highly demanding but least desirable jobs in disadvantaged schools and communities, and (e) contribute to reducing the under-representation of minorities among actively credentialed teachers. Included among the challenges of quality are the following: (a) ensuring a match between the field and discipline of a teacher's training and the courses they are assigned to teach, (b) achieving diversity in the pool of people earning credentials by passing licensing, certification and career ladder examinations, (c) agreeing upon performance criteria for compensation, and (d) measuring the extent to which the students of each teacher achieve learning and performance standards established by the district, state, and the nation.

This report focuses on two aspects of teacher supply and quality: (a) the under-representation of racial/ethnic minorities, especially African American teachers, and (b) teacher candidates' reading, writing and mathematics skills, as represented by candidates' performance on Praxis™. The report satisfies an agreement between the National Education Association (NEA) and Educational Testing Service (ETS) to make use of some of the available data generated by the Praxis program, combined with information gathered by interviewing faculty and students who are involved in college and university teacher preparation programs, to address achievement and performance gaps between prospective minority and White teachers. African American candidates are the focal group in this report, in part because other minority Praxis test-taking populations in the states that were selected were too small to include.

NEA and ETS are involved in different but complementary aspects of teacher supply and quality. NEA seeks to ensure that the nation's schools have an adequate supply of qualified teachers, and ETS seeks to ensure that the academic achievements of teachers who enter the profession correspond with the knowledge, skills, and standards established by the states.

Performance on Praxis is used by the majority of states as one of several criteria for licensing new teachers and by many colleges and universities to admit students into teacher education degree programs. In 2006, NEA and ETS embarked on this project to examine candidates' performance on assessments of general knowledge and skills known as the Praxis I® Pre-Professional Skills Tests (PPST®) and selected specialty tests (known as Praxis II® Subject Assessments) in part to see if these factors contributed to the undersupply of minority teachers.

The following questions guided the research presented in this report:

1. What are the trends in minority representation among teachers?
2. How much of a difference exists between majority and minority candidates' performance on both Praxis I and Praxis II?
3. Are the performance differences reflected in the state licensing pass rates of majority and minority candidates?
4. What factors should be targeted in attempts to eliminate racial/ethnic group performance differences on Praxis I and Praxis II?

Before proceeding to the analyses of group performance differences on Praxis and the effects of Praxis on the supply of minority teachers, we present an analysis of trends in the overall and minority teaching workforce. In the end, the trend analyses taken together with the analyses of performance gaps and passing rates and the correlates of Praxis performance should help gauge the effect that Praxis has on the supply of prospective African American teachers and generate ideas for closing gaps.

Overall and Minority Trends in Teacher Supply in the United States

The overall supply of the nation's teacher workforce has been growing in size and diversity in recent years. Table 1 presents a summary of the positive trends for two points in time from 1994 to 2004 (Planty et al., 2007).

During that decade, while elementary and secondary school enrollments were increasing in the United States by 10%, the number of full-time teachers grew by nearly 20%. The demographic composition of the nation's teacher supply also grew younger and more racially and ethnically diverse. The number of teachers from under-represented minority groups increased as well over that period. During a time when the growth of students from minority

groups was steady, the teaching profession achieved more dramatic progress in attracting a larger number of younger and racial/ethnic minority teachers. Despite the gains, however, African American, Hispanic, and Native American populations remained severely under-represented in the teaching profession relative to the population of students. In 2003–2004, under-represented minority teachers made up only 17% of the public school teaching force, while minority students made up 42% of the public school enrollments (National Center for Education Statistics, 2006, 2007).

Table 1

Trends in Teacher Supply and Demographics From 1994 to 2004

Category	1994	2004
Teacher supply		
Full-time teachers	2.6 million	3.1 million
Teacher age and experience		
Proportion under age 30	12%	17%
Proportion with 3 or fewer years experience	13%	16%
Proportion with 4–10 years experience	21%	27%
Teacher race/ethnicity		
African American	7%	8%
Hispanic	4%	6%
Native American	0.7%	0.5%

Among the possible explanations for the continuing under-representation of some minority groups are the relatively low production of new baccalaureate degree recipients with an interest in teaching and the relatively low success rate of prospective teachers on the tests required for licensure.

Overall and Minority Bachelor's Degree Production in Education

After peaking in 1991 and leveling off in 1992 and 1993, both the number of education majors and the proportion that they comprised of total bachelor's degree recipients declined a bit in 1994 and then remained constant through 2006. During the same period, however, the overall proportion of bachelor's degrees awarded to under-represented minorities increased as did their representation of total bachelor's degrees awarded. In 1994, of all bachelor's degrees awarded in the United States, African American students represented 7% of degree recipients, Hispanic students 4%, and Native American students 0.5%. At the same time, of all bachelor's degrees awarded in education, African American students comprised 5%, Hispanic students 3%, and

Native American students 0.6% (Snyder, Dillow, & Geddes, 1996, Table 261). In 2006, the number of African American bachelor's degree recipients grew to around 10% of the nearly 1.5 million total bachelor's degrees awarded (all fields), Hispanic recipients to around 7%, and Native American recipients to 0.7%. Yet, African American bachelor's degrees recipients in education were only 6% of all bachelor's degrees in education, and Hispanic recipients were 5%. At 0.8%, Native American representation among degree recipients in education was roughly equal to their overall representation (Snyder, Dillow, & Hoffman, 2007, Table 275).

While the colleges and universities that annually award bachelor's degrees in the field of education continue to be the largest sources of new teachers, they are not the sole sources. Emily Feistritzer, president and founder of the National Center for Education Information (NCEI), estimated that around 35,000 new teachers each year now enter through alternative routes, and minorities comprise a much larger share of the alternative route population than they represent among bachelor's degree recipients in the field of education (NCEI, 2008). Alternative routes to teaching represent a large and growing enterprise, producing one third as many new teachers each year (approximately 108,000) as are produced by college and university bachelor's degree programs in the field of education (Planty et al., 2008). Consequently, the overall numbers of alternate route teachers, coupled with the apparent over-representation of minority alternate route teachers, suggests that alternative routes are making a substantial contribution to increasing the minority teacher supply.

Regardless of whether entry into the teaching system occurs through conventional or alternative routes, licensure examinations like Praxis are prominent in the screening and quality control processes. The extent to which the supply is affected by assessments used for admissions into teacher training programs, for degree qualification, and for earning licenses to practice is rather easy to judge at the local level and, therefore, may be a factor in setting admissions requirements for teacher preparation programs and cut scores for licensing. But because of the variety of requirements, standards, assessments/tests, and sources of teachers throughout the nation, it is more difficult to ascertain the effect of assessments nationally. Fully understanding the relationship of assessments to the supply, quality, and demographic composition of the teaching workforce requires starting with an examination of all assessments used for these purposes. We had access to one, the Praxis series of assessments, and conducted analyses and

used these findings as a means of introducing the process for such inquiries and to examine the issue in states where Praxis is being used.

Research Questions

The analyses in this report focused on group differences, primarily between African American and White prospective teachers, in performance on Praxis. The following questions were addressed:

- What are the performance differences between African American and White test-takers on basic skills and selected subject areas of Praxis?
- How are the background characteristics of Praxis examinees associated with performance and the performance differences between African American and White examinees?
- How do college and university faculty who are involved in preparing new teachers perceive the challenges to their students on Praxis examinations?
- What efforts are college and university faculty making to meet the examination challenges of minority test-takers?

The remainder of this report includes analyses of Praxis I and Praxis II tests and the related background characteristics of examinees, findings from interviews of students and faculty of teacher education programs at various minority-serving colleges and universities, and concluding commentary and recommendations.

Data Source and Sample

Rather than reviewing all 133 existing Praxis tests, ETS and the NEA selected 16 paper-and-pencil tests with relatively large volumes of test-takers.[1] These tests included the three PPST (or Praxis I) and 13 selected Praxis II tests in a variety of content areas. The sample for analyses included people who tested between November 2005 and November 2009, which spanned a total of 29 test administrations (20 for Praxis I).

Findings From Praxis I Analyses

The pool of Praxis I candidates was based on data from the 28 states where Praxis I was administered between November 2005 and November 2009 and a valid passing score was

documented. Nine of these states had unique requirements for licensure on all three Praxis I tests. These requirements involved using a composite score methodology consisting of an aggregate of the three Praxis I test scores. The distinction within these requirements was that some of these states did not require minimum scores on each of the three Praxis I tests as long as a specified composite score was reached. By contrast, other such states required both a minimum score on each Praxis I test and a minimum composite score. Nonetheless, candidates from these states were included in the analyses.

One key aspect of this study was that it included a sample of Praxis I first-time test-takers. In addition to test scores, the personal information that candidates provided on the Background Information Questionnaire (BIQ)[2] when they registered to take the tests comprised the core data for the analyses. Table 2 presents the overall population of initial Praxis I test-takers in each race/ethnicity group spanning November 2005 to November 2009. The total number of test-takers in the 28 states between November 2005 and November 2009 across the five prominent race/ethnicity groups of test-takers (White, African American, Hispanic, Asian American, and Native American) was about 133,000 for each of the three skills tests of reading, writing, and mathematics. The sample was pared down to select the first-time test-takers for each test who requested that their scores be submitted to a state department of education. First-time test-takers comprised roughly 60% of the total test-takers in the 28 states that administered Praxis I in the timeframe covered in this report.

Table 2

Sample Sizes and Percentages of All Praxis I First-Time Test-Takers (FTTTs) Between November 2005 and November 2009 by Race/Ethnicity

	Praxis I Reading				Praxis I Writing				Praxis I Mathematics			
Race/ethnicity	Total	%	FTTTs	%	Total	%	FTTTs	%	Total	%	FTTTs	%
White	104,378	80	65,782	83	103,997	79	65,792	84	103,108	78	64,637	84
African American	16,940	13	8,408	11	14,998	11	8,213	10	16,326	12	8,117	11
Asian American	5,594	4	2,251	3	5,026	4	2,244	3	4,901	4	2,198	3
Hispanic	3,358	3	1,901	2	3,311	3	1,909	2	3,472	3	1,887	2
Native American	863	1	450	1	889	1	457	1	862	1	435	1
Total	131,133		78,792		128,221		78,615		128,669		77,274	

Note. Percentages may not add up to exactly 100% due to rounding.

African American and White candidates made up the vast majority (about 95%) of the first-time test-takers in the 28 states, 11% and 84%, respectively. Due to the smaller numbers of Hispanic, Asian American, and Native American test-takers compared to African American and White test-takers, the focus of the analyses in this report was on the latter two groups of test-takers. In part, the relatively small representation of Hispanic and Asian American test-taking populations in this study reflected their low representation in states that require Praxis I. At about 11%, African American candidates in these 28 states represented a larger share of the first-time test-takers than they represented in the nation's teaching workforce in 2004 (8%) and even among baccalaureate degree recipients in the field of education in 2006 (10%).

Rather than limiting the sample to people who took all three Praxis I exams, we included everyone who took any of the three Praxis I tests for the first time. Approximately 8% of the examinees during the time frame of these analyses did not take all three Praxis I exams. To check if limiting our sample to people who took all three Praxis I exams made a difference, we conducted analyses comparing the mean scale scores of the 92% of our sample who took all three exams with the 8% of our sample who took only one or two of the three exams. No substantive differences in mean scale scores were detected. Therefore, the authors felt that the findings from any analyses using the individual test populations would extend to this common cohort representing 92% of our sample. Additionally, the research questions addressed individual Praxis I exams, so the common cohort of test-takers was not used for the analyses in this report. The population of first-time test-takers on the three Praxis I tests in the specified timeframe, and included for this report, ranged from 72,754 to 74,190 candidates, about 84% of whom were White and about 11% of whom were African American.

Descriptive analyses of African American–White candidate Praxis I score differences. The 28 states included in this study employ much the same approach to setting the passing score point (commonly referred to as the cut score). The standard setting methodology that they employ is presented in Appendix A. Every state independently chooses where to set the cut score on each test. For the present study, this decision was important because we examined both the differences in the scores between African American and White candidates on Praxis I and the consequences of these differences on the rates at which these candidates qualify for a state's license/credential to teach. For purposes of this study, if a candidate submitted scores to more than one state department of education for one administration and achieved the minimum

passing score in at least one state, we considered him or her to have passed that Praxis test. While Praxis I test scores are all reported on the same score scale of 150 to 190, the ranges of cut scores across the 28 states differ slightly: Praxis I Reading (170–178), Praxis I Writing (171–176), and Praxis I Mathematics (169–178). In each of these 28 states, students are required to pass each of the Praxis I exams to fulfill the testing requirements on the path to licensure.[3] Total scale scores were the dependent variables in all analyses in this report.

Table 3 presents the average scale scores for White and African American candidates on each of the three Praxis I exams with the differences expressed in standard deviation units,[4] also known as a standardized difference or effect size, sometimes represented by *d* (Cohen, 1988).[5]

Table 3

Praxis I Mean Scale Scores by Race/Ethnicity With Gaps Presented in Standardized Terms

	White (W) candidates			African American (AA) candidates			Std. gap
Praxis I test	*N*	Mean	*SD*	*N*	Mean	*SD*	
Reading	65,782	178.03	5.43	8,408	171.61	7.08	-1.14
Writing	65,792	175.96	4.17	8,213	171.97	4.23	-0.95
Mathematics	64,637	178.59	6.89	8,117	170.56	7.31	-1.16

Note. Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Because of the constricted scales used for the Praxis tests, the scale score differences may give the impression that differences are very small (4 to 8 points), and smaller than we are accustomed to seeing on large-volume standardized tests used by colleges and universities for assessing general skills for admission like the SAT® and GRE®. Camara and Schmidt (1999) examined African American–White test-taker score gaps in standardized terms on several different tests, as displayed in Table 4. The range was from 0.82 (ACT Reading) to 1.14 (LSAT).

When applied to the analyses of score gaps on the Praxis I tests presented in Table 3, rather large differences between African American and White test-takers are revealed. The data presented in Table 3 suggest that the Praxis I Reading score gap (1.14 *SD*s) between White and African American candidates is larger than that of the SAT and more like that for the GRE Analytical section. The gap in Praxis I Writing (0.95 *SD*s) is more comparable to the SAT, and

the gap in Praxis I Mathematics (1.16 *SD*s) is larger than that for the GRE Quantitative section. In terms of effect sizes, all standardized score differences on Praxis I tests are considered to be large (i.e., greater than 0.80).

Table 4

African American–White Test-Taker Performance Differences in Standardized Terms on Selected Large-Volume Standardized Tests

Exam	Standardized difference
SAT Verbal	-0.83
SAT Math	-0.92
ACT English	-0.89
ACT Mathematics	-0.88
ACT Reading	-0.82
GRE Verbal	-0.96
GRE Quantitative	-0.98
GRE Analytical	-1.11
GMAT Total	-1.03
LSAT	-1.14
MCAT Verbal Reasoning	-0.96

For licensure tests, which are pass/fail, group performance differences may not be much of an issue if the pass rates for the groups are not very different. In the case of Praxis I licensure assessments, however, the pass rates are indeed a reflection of the African American–White test-taker score gap. Table 5 shows that African American first-time test-takers had a significantly lower pass rate than White first-time test-takers on each Praxis I exam. The Praxis I Mathematics exam, which had the largest score gap, also had the largest gap in pass rate.

Table 5

Differences in Passing Rates on Praxis I Tests by Race/Ethnicity Group

	Reading	Writing	Mathematics
Percentage of first-time African American test-takers who passed	40.7	44.2	36.8
Percentage of first-time White test-takers who passed	81.5	79.5	78.2

Correlates of performance on Praxis I tests derived from the Background Information Questionnaire (BIQ). Beyond describing the differences in the Praxis I scores and passing rates between African American and White test-takers, the analyses were also intended

to identify characteristics and behaviors of test-takers that might be targeted by people who are making efforts to close the gaps. Several independent variables were selected based on four criteria: (a) their historic use in predicting performance on standardized tests (Messick, 1995), (b) their typical value and importance in helping to explain Praxis I test performance (Blue, O'Grady, Toro, & Newell, 2002; Sadovnik et al., 2008), (c) their typical value in explaining score differences among race/ethnicity groups and between gender groups (Nettles, Millett, & Einarson, 2001; Nettles, Millett, & Ready, 2003; Nettles, Perna, & Millett, 1998), and (d) their availability in the Praxis data system from test-taker responses on the BIQ.

The background variables available in the BIQ that were included in the analyses were the following: (a) undergraduate grade point average (UGPA), (b) enrollment status in a teacher education program, (c) candidate educational attainment, (d) socio-economic status (SES), as represented by the highest educational attainment of either the candidate's mother or father, (e) undergraduate major, classified into general interest areas of science, business, social science, education, and humanities, and (f) college/university selectivity, as measured by *Barron's Profile of American Colleges* (2009). Detailed descriptions of these variables are presented in Appendix B.

We calculated the proportions of candidates at each possible response level or range for each BIQ variable. Some categories for some BIQ variables were consolidated or omitted due to sample size considerations. We also calculated the standardized scale score gaps for each of the Praxis I tests for the BIQ variables at each possible response level or range. We also conducted regression analyses with selected BIQ variables to measure their influences as predictors of Praxis I performance. We specified race/ethnicity to interact with the other variables to assess how the relationship of these variables on Praxis I exam scores vary by race/ethnicity. Formulas for the statistical analyses are presented in Appendix C and details of the regression analyses are presented in Appendix D.

Undergraduate grade point average (UGPA). Table 6 presents comparisons of mean Praxis I scores arrayed by UGPA ranges of African American and White test-takers along with the standardized gaps by test. As UGPAs increase, so, too, do mean Praxis I scores. It is interesting that the score gaps follow the same pattern. As the UGPAs increase, the score gaps grow wider, such that the largest Praxis I score gaps are found among test-takers in the highest UGPA ranges.

Table 6

Praxis I Performance by Race/Ethnicity Group and Undergraduate Grade Point Average (UGPA) for First-Time Praxis I Test-Takers

	Frequency		Reading					Writing					Mathematics				
	W	AA	W		AA			W		AA			W		AA		
UGPA	%	%	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
1.5–1.99	< 1	1	173	7	169	7	-0.60	173	3	171	4	-0.55	175	7	169	7	-0.94
2.0–2.49	4	13	175	6	170	7	-0.86	174	4	171	4	-0.73	176	7	169	7	-0.92
2.5–2.99	22	36	176	6	171	7	-0.87	174	4	171	4	-0.78	177	7	170	7	-0.91
3.0–3.49	39	34	178	5	172	7	-1.00	176	4	172	4	-0.81	178	7	171	7	-1.09
3.5–4.0	35	16	180	5	173	7	-1.41	178	4	173	4	-1.04	181	6	172	8	-1.36

Note. AA = African American, W = White, UGPA = undergraduate grade point average.

Table 6 also reveals that the score gaps are larger in mathematics than in reading and writing overall and within comparable UGPA ranges. One indication of the large overall gap in mathematics is revealed by comparing scores across groups throughout the distribution of UGPA ranges. Among mathematics test-takers, the mean scale score of African American test-takers in each UGPA range, including the highest range (3.5 - 4.0), was lower than the mean Praxis I score in the lowest UGPA range (1.5 - 1.99) for White test-takers. The mean score for African American mathematics test-takers in the highest UGPA range was 172 compared to 175 for White test-takers in the lowest UGPA range. In reading, where the gaps were second largest among the three Praxis I tests, the mean score of African American test-takers in the highest UGPA range was below the White test-taker mean score in each of the other UGPA ranges with the exception of the lowest range. In both reading and writing, African American candidates in the highest UGPA range achieved an average Praxis I score of 173, equal to that among White candidates in the lowest UGPA range.

Part of the reason for the increasing score gap at successively higher levels of UGPA was that the rate of increase in the scores of African American candidates as UGPAs increased was not as large as the rate of increase in scores of their White counterparts. For example, in reading, the difference in average scores between the lowest and highest UGPA categories among African American test-takers was about 4 points, while for White test-takers it was 7 points. The differences between the highest and lowest UGPA categories were 2 and 5 points for African American and White candidates, respectively in writing, and 3 and 6 points, respectively in mathematics.

Enrollment status in teacher education program. Like UGPA, the racial/ethnic differences by teacher education degree program enrollment status are also interesting. The teacher education program enrollment frequencies across the different status indicators (currently, formerly, never) varied between African American and White Praxis I test-takers. About 54% of White test-takers compared to 37% of African American test-takers were currently enrolled in such programs at the time of taking the test, roughly 8% of White candidates compared to 14% of African American candidates were formerly enrolled, and 37% of White test-takers compared to 49% of African American test-takers had never been enrolled.

The large proportion of candidates who had never been enrolled in a teacher education program can be explained in part by four factors: (a) the tests are taken as part of entry

requirements for a teacher education program, which means that many candidates are taking the Praxis I exams as part of the admissions process; (b) the tests are taken by candidates who have established careers in fields other than teaching and are taking the Praxis I exams as part of their career change process to enter the teaching profession as undergraduates; (c) some states have waivers for Praxis I tests, whereby an SAT or ACT performance above a certain level is sufficient to exempt students from taking Praxis I as a requirement for entry into teacher education programs; and (d) the increasing presence of alternate route certification programs allows many students to enter the teaching profession with college major fields other than education. A question was added to the BIQ in July 2008 to inquire about the nature of a candidate's teacher preparation program. The large majority of candidates went through an undergraduate teacher education degree program (74%). A preliminary estimate suggested that approximately 8% of candidates in the Praxis I samples indicated preparation through an alternate route program. This proportion was only slightly less than that for those going through a master's degree program (9%). More data are needed to substantiate this finding.

The data presented in Table 7 tell a mixed story, and one that is not intuitive. There appeared to be *no* clear effect of enrollment status in a teacher education program on the gap between race/ethnicity groups. For all Praxis I tests, the gap between African American and White test-takers appeared smallest for those who had never enrolled in a teacher education program. Only on the mathematics exam did the gap decrease slightly for those formerly enrolled in a program compared to current enrollees.

Candidate educational attainment level. Table 8 presents the frequency distributions of test-takers by educational attainment level and the corresponding Praxis I mean scores and score gaps between African American and White test-takers. White candidates tended to be underclassmen when taking Praxis I while African American candidates were more often upperclassmen when taking Praxis I. Slightly more than half of the White test-takers (52%) compared to slightly more than a quarter of the African American test-takers (24%) were either freshmen or sophomores when they took the Praxis I tests. Additionally, our calculation of the age of test-takers using the test date and test-taker date of birth, both provided in the BIQ, revealed that African American prospective teachers were first taking Praxis I later in life (just over 30 years of age) than their counterpart White test-takers (about 25 years of age).

Table 7

Praxis I Performance by Race/Ethnicity Group and Enrollment Status in Teacher Education Programs for First-Time Praxis I Test-Takers

	Frequency		Reading					Writing					Mathematics				
	W	AA	W		AA			W		AA			W		AA		
Status	%	%	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
Currently	54	37	178	5	171	7	-1.20	176	4	172	4	-0.98	179	7	170	7	-1.23
Formerly	8	14	179	6	171	7	-1.44	177	5	172	5	-1.05	178	7	170	7	-1.19
Never	37	49	178	6	172	7	-1.00	176	4	172	4	-0.90	178	7	171	7	-1.06

Note. AA = African American, W = White.

Table 8

Praxis I Performance by Race/Ethnicity Group and Test-Taker Educational Attainment Level for First-Time Praxis I Test-Takers

	Frequency		Reading					Writing					Mathematics				
Education	W	AA	W		AA			W		AA			W		AA		
level	%	%	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
Freshman	24	8	178	5	173	7	-0.88	176	4	173	4	-0.83	180	6	174	7	-0.98
Sophomore	28	16	178	5	172	7	-0.96	176	4	172	4	-0.84	179	7	172	7	-1.01
Junior	15	18	177	6	171	7	-1.01	175	4	172	4	-0.84	177	7	170	7	-0.98
Senior	9	14	177	6	170	7	-1.15	175	4	171	4	-0.93	177	7	170	7	-1.03
Bachelor's degree	10	19	180	5	172	7	-1.38	177	4	172	4	-1.09	179	7	170	7	-1.19
Bachelor's degree +	9	17	180	5	172	7	-1.60	177	4	172	4	-1.14	179	7	170	7	-1.25
Master's degree	2	5	181	5	172	7	-1.67	178	4	172	5	-1.25	180	7	170	7	-1.35
Master's degree +	2	3	182	4	173	7	-1.69	179	4	174	5	-1.11	180	7	171	7	-1.26

Note. AA = African American, W = White.

The data presented in Table 8 resemble those shown in Table 6 with UGPA where the gap appears to widen as educational attainment level increases for each of the three Praxis I tests. At levels beyond the baccalaureate degree, the gaps are wider on the reading and mathematics tests.

Even though educational attainment level is associated with score differences on Praxis I, it could be that the relationship of educational attainment level differences to score differences is masking the age by educational attainment level differences between the two groups. While the average age of first-time test-takers among White candidates was about 5 years younger (about age 25) than African American candidates (about age 30), the differences in average ages of first-time test-takers between the two racial/ethnic groups within the four highest education attainment levels were smaller. For examinees with bachelor's degrees, African American candidates first took Praxis I about 4 years later (about age 34) than White candidates (about age 30), while for those with at least a bachelor's degree but who had not yet received a master's degree, the difference was around 3 years (about age 37 for African American candidates; about age 34 for White candidates). Beyond that level of degree attainment, the differences in test-takers' ages were trivial, so another factor like educational attainment level may be confounded a bit by age in explaining larger gaps on Praxis I tests. However, the data clearly showed that an association exists between age and educational attainment level.

At the higher education attainment levels (bachelor's degree and higher) for both racial/ethnic groups, a chi-square test detected a relationship ($p < .001$) between educational attainment level and enrollment status in a teacher education program. The data suggested that African American candidates with at least a master's degree taking Praxis I underperformed more compared to their White peers if they were then enrolled in a teacher education program, as effect sizes were higher (-1.74 for reading; -1.27 for writing; -1.36 for mathematics) than those reported in Table 8 for master's or beyond master's degree recipients across teacher education program enrollment status levels. These statistics were also true for those who were formerly enrolled in such programs, but not so for those never enrolled. The preparation of teacher education program candidates is examined from a qualitative perspective later in this report.

Socio-economic status (SES). The variable for SES in this study was the highest educational attainment of either parent. Table 9 presents African American and White test-taker mean scores on Praxis I Reading, Writing, and Mathematics along with the gaps in the scores arrayed by level of parental educational attainment. As expected, White test-takers were better

represented among categories of higher parental educational attainment beyond the baccalaureate degree than their African American counterparts. For example, around 21% of White test-takers' parents attained a graduate or professional degree compared to 15% of African American test-takers' parents. Roughly the same representations and differences existed between White and African American test-takers' parents (25% and 17%, respectively) who completed baccalaureate degrees. Conversely, a larger share of the parents of African American test-takers had completed a high school diploma or less than their White counterparts: 36% compared to 24%. Consistent increases in gaps occurred in writing and mathematics as SES level increased, except at the level of high school diploma.

Undergraduate major field. Table 10 presents in succession the Praxis I Reading, Writing, and Mathematics mean scores and gaps between African American and White test-takers in the sample arrayed by selected broad major field of study. The proportions of White and African American candidates who were science majors were comparable at 7%, and the gaps were among the largest across the three Praxis I tests. White and African American humanities majors were 8% and 7% of their respective group's test-takers and the gap was smallest in writing.

Nearly three quarters of White test-takers (72%) and two thirds of African American test-takers (67%) majored in education. Education majors achieved the lowest mean scores on each of the Praxis I tests, and the gaps in reading and mathematics, while still large, were only slightly narrower than for other majors. The gap in writing among education majors was similar to that for social science and humanities majors, and slightly lower than that for other majors.

The second largest representation of both African American and White test-takers majored in social sciences at 12% and 11%, respectively. Similar to the sciences, a small proportion of examinees majored in business, but a somewhat larger share of African American candidates (6%) than Whites (2%) were business majors. The gaps in these two major fields are not distinctive, and taken altogether, the score differences among the major fields raises questions about the extent to which curricula influence test performance. We present the curricular influence later in the report.

Table 9

Praxis I Performance by Race/Ethnicity Group and Socio-Economic Status (SES) for First-Time Praxis I Test-Takers

	Frequency		Reading					Writing					Mathematics				
	W	AA	W		AA			W		AA			W		AA		
SES	%	%	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
< Some HS	2	10	177	6	169	7	-1.15	174	4	171	4	-0.78	175	7	168	7	-0.97
HS diploma	22	26	177	6	170	7	-1.09	175	4	171	4	-0.95	177	7	170	7	-1.14
Some post sec. ed.	14	17	178	5	173	7	-1.05	176	4	172	4	-0.85	179	7	172	8	-1.03
Associate's degree	10	11	177	6	171	7	-1.07	176	4	172	4	-0.85	178	7	170	7	-1.12
Bachelor's degree	25	17	178	5	173	7	-1.03	176	4	173	4	-0.86	179	7	171	7	-1.14
Some graduate or professional school	5	5	179	5	173	7	-1.10	177	4	172	4	-1.00	179	7	171	7	-1.20
Graduate/ professional degree	21	15	179	5	173	7	-1.17	177	4	173	4	-1.00	180	7	171	7	-1.26

Note. AA = African American, HS = high school, W = White.

Table 10

Praxis I Performance by Race/Ethnicity Group and Undergraduate Broad Major Field Classification for First-Time Praxis I Test-Takers

	Frequency		Reading					Writing					Mathematics				
	W	AA	W		AA			W		AA			W		AA		
Major	%	%	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
Science	7	7	180	5	173	7	-1.45	177	4	172	4	-1.08	183	6	175	8	-1.23
Business	2	6	180	5	173	7	-1.31	176	4	172	4	-1.01	180	7	172	7	-1.22
Social sciences	11	12	180	5	174	7	-1.28	177	4	173	4	-0.96	179	7	170	7	-1.23
Education	72	67	177	6	171	7	-1.14	175	4	171	4	-0.98	178	7	170	7	-1.19
Humanities	8	7	181	4	174	7	-1.34	178	4	174	5	-0.96	179	7	171	7	-1.21

Note. Those majoring in technology-related disciplines, those who were undecided, or those whose majors did not fit the five major groupings displayed in this table were removed from this analysis. AA = African American, W = White.

Selectivity of colleges and universities attended. The selectivity of the colleges and universities that candidates attend can be a useful prism through which to view candidates' scores and make racial/ethnic group comparisons on Praxis I scores for two reasons. First, given that Praxis I is a series of basic skills tests, it is more likely that test-takers attending more selective colleges and universities would achieve higher scores on Praxis I than their contemporaries attending less selective institutions. Second, the differing proportions of students between racial/ethnic groups attending more or less selective colleges and universities may be contributing to the overall African American–White test-taker score gaps on Praxis I.

Barron's Profile of American Colleges (2009) compiled a list of 4-year colleges and universities in the United States according to their degree of selectivity, ranging from noncompetitive to most competitive. Due to low sample sizes near the upper extremes of Barron's nine available categories, the four highest categories were consolidated for our analyses. Table 11 shows that the majority of African American and White test-takers attended midrange selective (competitive) colleges and universities, but a slightly larger proportion of White candidates in the sample were in that category of institutions. It is interesting, although not surprising, that a much smaller share of African American test-takers (14%) attended colleges and universities in the two most selective categories than White test-takers (28%) and that a larger share of African American test-takers attended schools in the two least selective categories: 30% compared to 15%.

Table 11 also presents the mean scores and gaps by degree of selectivity of the colleges and universities candidates attended. The pattern for both African American and White test-takers on each of the three Praxis I tests was that the more selective the colleges and universities, the higher the mean scores were. Consistent with analyses earlier and throughout the report, the largest overall gaps throughout the spectrum of selectivity of attended institutions generally appeared to be in mathematics, and the largest gaps were among candidates attending colleges and universities at higher levels of selectivity (competitive to very competitive, inclusive). Otherwise, there appeared to be no vast differences or patterns in the sizes of the gaps across the distributions of test-takers based upon the selectivity of the college or university they attended compared to the overall gaps discussed in this report.

Table 11

Praxis I Performance by Race/Ethnicity Group and Selectivity of the College or University for First-Time Praxis I Test-Takers

	Frequency		Reading					Writing					Mathematics				
	W	AA	W		AA			W		AA			W		AA		
Selectivity	%	%	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*	*M*	*SD*	*M*	*SD*	*d*
Noncompetitive	4	5	177	6	170	7	-1.00	175	4	171	4	-0.81	177	7	169	6	-1.20
Less competitive	11	25	177	6	171	7	-1.08	175	4	171	4	-0.91	178	7	170	7	-1.08
Competitive	51	49	178	6	172	7	-1.00	176	4	172	4	-0.86	178	7	171	7	-1.05
Competitive +	6	6	178	5	171	7	-1.42	176	4	172	5	-1.09	179	6	170	7	-1.41
Very competitive	19	9	179	5	174	6	-1.11	177	4	173	4	-0.89	180	7	172	8	-1.24
Very competitive +	9	5	181	4	176	6	-1.03	179	4	175	4	-0.96	182	6	174	8	-1.17

Note. AA = African American, W = White.

Regression model summary. The descriptive and comparative analyses suggested that the differences in the Praxis I scores of White and African American test-takers may be at least in part related to their differences in UGPA, teacher education program enrollment status, their own educational attainment, their parental educational attainment, undergraduate major, and selectivity of attending institution. The next issue addressed was the extent to which these factors were associated with candidates' performances and the relative weights that these had in predicting Praxis I scores.

We conducted regression analyses to ascertain how candidates' characteristics contributed to their performance on each of the three components of Praxis I and whether these relationships were different for African American and White test-takers. Given that each BIQ variable consists of multiple categories, these were consolidated to aid in conducting and interpreting the regression analyses.[6] We also used race/ethnicity as an interaction variable to identify group differences in the contribution of each predictor variable to the Praxis I test performance of each race/ethnicity group. The entry of variables was done in a stepwise fashion as presented in the previous descriptive analyses so that race/ethnicity was first, followed in succession by UGPA, teacher education program enrollment status, candidate educational attainment, candidate's parental educational attainment, undergraduate major, and selectivity of attending institution, and then the interactions of race/ethnicity with each of these variables in a similar order, for a total of 13 predictors. Not all predictors were statistically significant for each test. The full model results are displayed in Appendix D.

For ease of interpretation given the number of significant predictor variables, we decided that variables explaining at least 1% of the variance in each Praxis I scale score would be retained in the model. Race/ethnicity, UGPA, undergraduate major, and the selectivity of the attending institution met this criterion in the models for each of the three sets of Praxis I scores. Race/ethnicity, UGPA, undergraduate major, and attending institutional selectivity explained 17% to 22% of the variance in the scores for each of the Praxis I tests. Table 12 displays the reduced model results. Standardized regression coefficients are included to allow comparison of these results across the Praxis I tests.

Table 12

Summary of Stepwise Regression Results for First-Time Praxis I Test-Takers

	Reading					Writing					Mathematics				
Predictor	β	*SE*	Sig.	Std. β	r^2	β	*SE*	Sig.	Std. β	r^2	β	*SE*	Sig.	Std. β	r^2
Race/ ethnicity	-5.47	.07	< .01	-.28	.10	-3.21	.07	< .01	-.22	.05	-7.15	.11	< .01	-.29	.11
UGPA	2.71	.06	< .01	.20	.04	2.17	.04	< .01	.22	.07	2.67	.08	< .01	.16	.03
Major	-2.74	.06	< .01	-.20	.05	-1.46	.04	< .01	-.15	.02	-1.42	.07	< .01	-.09	.01
Selectivity	1.73	.06	< .01	.14	.02	1.66	.04	< .01	.18	.03	2.37	.07	< .01	.15	.03

Note. Please see Appendix C for more information about the terms used in this table. Sig. = significance of regression coefficient, Std. β = standardized regression coefficient, UGPA = undergraduate grade point average.

The analyses indicated that being an African American candidate and being an education major were associated with reduced Praxis I scores, while having a relatively high UGPA and attending a relatively selective college or university contributed to higher performance on Praxis I tests. The regression analyses revealed that White test-takers on average have a three to seven point advantage over their African American counterparts on Praxis I. Having a UGPA above 3.0 as opposed to below 3.0 or having a major other than education gives test-takers about a two to three point average increase in scores. Attending a selective college or university on average was associated with Praxis I scores that were two to three points higher than those attending a less selective college or university. Comparing the standardized beta coefficients across the reduced models, race/ethnicity consistently had the strongest effect, between -0.22 for writing and -0.29 for mathematics. UGPA had just as strong an effect as race/ethnicity upon writing and explained a larger proportion of variance in writing scores (7%) than race/ethnicity (5%).

The results of the regression models indicated that the significant predictors of Praxis I score performance (race/ethnicity, UGPA, selectivity of the attending school, and undergraduate major) were all aspects of a candidate's profile that were either not changeable or not very easily changed by the time he or she took the test. A case may be made, though, that undergraduate major, which may reflect rigor of preparation, was not fixed since about half of the White Praxis I test-taking sample was freshmen or sophomores compared to just under one-third of African American candidates. Since African American candidates tended to take Praxis I tests later in their academic careers, they may have had a greater likelihood of switching into the education domain from their original majors. Learning more about the path to the teaching profession and the curricula for African American candidates may provide further insight into changes that could be made toward helping to boost scores and reduce gaps.

The findings confirmed what has been traditionally observed, that the accumulation of human capital as represented by various background characteristics is related to higher test performance. Of note are results showing the largest racial/ethnic gaps in Praxis I Mathematics and how education majors scored lower than their peers who are studying other disciplines.

We now turn to some of the Praxis II tests and analyses similar to those that we conducted on the Praxis I tests to see if similar conclusions can be drawn and to discern whether the factors contributing to the performance differences on Praxis II are similar to those found on Praxis I. Gitomer, Brown, and Bonett (2008) studied the relationship between Praxis I test-taker

performance and Praxis II test-taker performance when taking various background variables into account. They found that candidates who struggled with Praxis I were likely to struggle with Praxis II as well.

Findings From Praxis II Analyses

The 13 high-volume Praxis II tests analyzed in this report represent various content areas, such as English, mathematics, and science; and pedagogy, including elementary education and principles of learning and teaching. Unlike Praxis I, due to differences in test adoption patterns for different tests, states that rely upon Praxis II tests may subscribe to only one Praxis II test or as many as needed to serve their purposes. It is therefore important to point out that the populations of Praxis I and Praxis II test-takers throughout this report were independent of one another, in part due to the short 4-year timeframe employed in the analyses. The degree of overlap, defined as those taking all three Praxis I tests and one of the Praxis II tests, ranged from 0.3% to 10.1%. The issues raised by Gitomer et al. (2008) regarding linking Praxis I performance to Praxis II performance cannot be as well addressed in this paper due to the constricted timeframe.

Table 13 summarizes the selected Praxis II tests along with the sample sizes of White and African American first-time test-takers.[7]

The range in testing volumes for White test-takers was from 100,622 examinees (Elementary Education: Content Knowledge) to 4,174 (Chemistry: Content Knowledge). Among African American examinees, the range was from 11,086 (Elementary Education: Content Knowledge) to 344 (Chemistry: Content Knowledge). African American test-takers ranged in representation from as high as 9.3% (Elementary Education: Content Knowledge) to as low as 4.7% (Elementary Education: Curriculum, Instruction, and Assessment). White candidates ranged in representation from as high as 90.9% (Elementary Education: Curriculum, Instruction, and Assessment) to as few as 81.5% of examinees (Elementary Education: Content Area Exercises).

Table 14 compares African American and White test-takers scores on the selected Praxis II tests. The African American and White candidate mean score differences varied among the 12 tests and was appropriately interpreted in the context of the scale score ranges of these tests (100–200). Just as with the analyses presented for Praxis I tests, examining these Praxis II data in terms of standardized differences rather than scale score differences was preferable.

Table 13

Sample Sizes of Selected Praxis II Tests by Race/Ethnicity Group for First-Time Praxis II Test-Takers

	White		African American		Total
Praxis II subject test	Sample	%	Sample	%	Sample[a]
Elementary education					
Elementary Education: Curriculum, Instruction, and Assessment	70,944	90.9	3,700	4.7	78,046
Elementary Education: Content Area Exercises	18,811	81.5	2,063	8.9	23,076
Elementary Education: Content Knowledge	100,622	84.6	11,086	9.3	118,993
Subject-specific					
English Language, Literature, and Composition: Content Knowledge	34,628	87.5	3,226	8.2	39,558
Mathematics: Content Knowledge	21,440	83.1	2,347	9.1	25,812
Middle School Mathematics	28,059	86.0	2,850	8.7	32,638
Social Studies: Content Knowledge	29,853	89.2	2,153	6.4	33,451
Chemistry: Content Knowledge	4,174	85.3	344	7.0	4,895
General Science: Content Knowledge	5,880	87.9	361	5.4	6,686
Middle School Science	13,119	89.6	848	5.8	14,635
Pedagogy					
Principles of Learning & Teaching K–6	47,182	88.0	3,921	7.3	53,639
Principles of Learning & Teaching 7–12	45,882	87.5	3,837	7.3	52,461

[a] Total comprises the same five race/ethnicity groups displayed in Table 2 (White, African American, Hispanic, Asian American, Native American).

The range of standardized differences was from 0.74 (Elementary Education: Content Area Exercises) to 1.41 (English Language, Literature, and Composition: Content Knowledge). Other areas with relatively large standardized differences were General Science: Content Knowledge (1.37); Elementary Education: Content Knowledge (1.27); Elementary Education: Curriculum, Instruction, and Assessment (1.25); and Mathematics: Content Knowledge (1.19). In examining the effect sizes, all gaps on the selected Praxis II tests were considered to be large

(0.80 and above) with the exception of Elementary Education: Content Area Exercises, which was considered to be medium (0.74) yet bordered on being large.

Table 14

Selected Praxis II Test Performance by Race/Ethnicity Group With Gaps Presented in Standardized Terms

	White			African American			
Praxis II subject test	*N*	Mean	*SD*	*N*	Mean	*SD*	Std. gap
Elementary education							
Elementary Education: Curriculum, Instruction, and Assessment	70,944	177	13	3,700	160	20	-1.25
Elementary Education: Content Area Exercises	18,811	159	9	2,063	152	10	-0.74
Elementary Education: Content Knowledge	100,622	166	15	11,086	147	17	-1.27
Subject-specific							
English Language, Literature, and Composition: Content Knowledge	34,628	178	14	3,226	158	17	-1.41
Mathematics: Content Knowledge	21,440	147	22	2,347	121	19	-1.19
Middle School Mathematics	28,059	165	18	2,850	149	16	-0.96
Social Studies: Content Knowledge	29,853	168	15	2,153	152	16	-1.10
Chemistry: Content Knowledge	4,174	162	20	344	141	22	-1.00
General Science: Content Knowledge	5,880	167	18	361	142	20	-1.37
Middle School Science	13,119	159	16	848	143	16	-0.97
Pedagogy							
Principles of Learning & Teaching: K–6	47,182	175	11	3,921	163	16	-1.06
Principles of Learning & Teaching: 7–12	45,882	174	10	3,837	163	13	-1.08

Note. Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Analyses of selected Praxis II tests in relation to academic major. We further analyzed selected Praxis II tests to see if education majors in both race/ethnicity groups performed below the levels of their counterparts in other majors, as had been observed for Praxis I tests. This issue,

which centers upon both the quality of achievement among people who pursue degrees in teacher education and the rigor of teacher preparation program curricula, were part of then current public policy discourse revolving around teaching quality. It also raised the question about the prevalence of teachers who were assigned to teach in subject areas in which they had not been certified. The Education Trust (2008) published a report describing how out-of-field teaching persists in key academic courses, particularly in high-poverty and high-minority schools. About one in six classes in the core academic subjects of English, mathematics, social studies, and science was taught by a teacher not certified in that subject area. When comparing school poverty levels, twice as many classes in high-poverty schools (27%) were taught by out-of-field teachers as in low-poverty schools (13%; The Education Trust, 2008).

It was for that reason that certain Praxis II tests were selected for analyses similar to those presented earlier for Praxis I tests using background variables. The first set was related to elementary education. The second set was related to specific content areas and related concerns about out-of-field teaching noted as a focal point in The Education Trust report.

Elementary education exams with mathematics components. Given that the largest observed Praxis I gap between White and African American candidates was on the mathematics test, the first set of tests that we selected for analyses were those elementary education exams with mathematics components (Curriculum, Instruction, and Assessment [approximately 22% of test items] and Content Knowledge [approximately 25%]). Tables 15 and 16 show that the large majority of candidates on both tests reported education as their undergraduate major, and this group generally underperformed relative to students majoring in other fields. The largest race/ethnicity gaps were found among business majors.

Subject area tests in Mathematics, Social Studies, and English. The next set of tests analyzed corresponded to specific subject areas. These included Middle School Mathematics, Mathematics: Content Knowledge, Social Studies: Content Knowledge, and English Language, Literature, and Composition: Content Knowledge. In order to test the hypothesis that those who major in the discipline tend to perform better on Praxis II than those majoring in the field of education, we separated undergraduate majors into two groups: test-takers majoring in the discipline and their counterparts majoring in education. These findings are presented in the following tables and narrative.

Table 15

Elementary Education: Curriculum, Instruction, and Assessment (Elem Ed: CIA) Performance by Race/Ethnicity Group and Undergraduate Broad Major Classification Among First-Time Test-Takers

Elem ed: CIA undergraduate major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Science	889	1.5	181.02	12.72	83	2.7	161.71	20.38	-1.43
Business	1,665	2.7	178.42	13.40	173	5.6	157.21	19.62	-1.50
Social science	4,555	7.5	178.72	13.02	454	14.8	158.03	22.01	-1.47
Education	51,700	84.7	176.06	13.32	2,255	73.3	160.62	19.07	-1.13
Humanities	2,211	3.6	181.16	11.85	112	3.6	163.32	19.78	-1.44

Note. Those majoring in technology-related disciplines, those who were undecided, or those whose majors did not fit the five major groupings displayed in this table were removed from this analysis. Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Table 16

Elementary Education: Content Knowledge (Elem Ed: CK) Performance by Race/Ethnicity Group and Undergraduate Broad Major Classification Among First-Time Test-Takers

Elem ed: CK undergraduate major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Science	2,577	3.3	173.72	16.50	571	7.0	152.69	17.59	-1.26
Business	3,481	4.5	169.08	15.27	799	9.8	146.45	16.70	-1.46
Social science	10,373	13.4	169.08	15.75	1,627	20.0	148.51	17.93	-1.28
Education	55,649	71.7	164.87	15.06	4,663	57.2	145.11	17.23	-1.30
Humanities	5,576	7.2	170.40	16.19	487	6.0	148.88	16.77	-1.33

Note. Those majoring in technology-related disciplines, those who were undecided, or those whose majors did not fit the five major groupings displayed in this table were removed from this analysis. Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Middle School Mathematics and Mathematics: Content Knowledge. Table 17 displays the performance by race/ethnicity and undergraduate major on the Middle School Mathematics test.

Table 17

Middle School Mathematics Performance by Race/Ethnicity Group and Undergraduate Broad Major Field Classification Among First-Time Test-Takers

Middle school math	White				African American				Std.
undergraduate major	*N*	%	Mean	*SD*	*N*	%	Mean	*SD*	gap
Science	2,610	11.4	172.48	17.69	616	28.1	152.50	17.22	-1.14
Business	2,212	9.6	165.12	16.71	476	21.7	146.63	14.73	-1.13
Social science	2,403	10.5	164.14	17.74	266	12.1	147.33	17.05	-0.95
Education	14,831	64.6	163.96	17.01	764	34.9	148.08	15.24	-0.94
Humanities	915	4.0	167.84	18.47	69	3.1	151.71	18.42	-0.87

Note. Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

The majority of candidates were education majors, yet the second largest group was science majors. Table 17 also shows that science majors performed better than candidates who majored in other fields and that education majors performed generally as well as their counterparts in business and social sciences. According to the responses provided in the background questionnaire, the major of mathematics is grouped under the larger science domain. As displayed in Table 18, only White mathematics majors performed better than mathematics education majors on the middle school mathematics Praxis II test.

The data in Table 18 indicate that the 782 White candidates who were mathematics majors accounted for 30% of those classified as science majors among White candidates. Comparatively, the 268 African American candidates who were mathematics majors accounted for about 44% of those classified as science majors among African American candidates. The data in Table 18 also indicate that very few education majors who took this test majored specifically in mathematics education. The results on the test show that the gap between racial/ethnic groups was slightly smaller among mathematics majors. There were no significant differences in performance between mathematics majors and mathematics education majors among both White and African American test-takers.[8]

Table 18

Middle School Mathematics Performance by Race/Ethnicity Group for Mathematics Education Majors and Mathematics Majors Among First-Time Test-Takers

Middle school math refined major	White				African American				Std. gap
	N	%[a]	Mean	*SD*	*N*	%[a]	Mean	*SD*	
Mathematics education	715	4.8	174.04	16.70	93	12.2	153.23	14.15	-1.27
Mathematics	782	30.0	174.83	18.47	268	43.5	152.98	16.82	-1.21

Note. Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

[a] The % column is calculated by dividing the sample size for the refined major (e.g., mathematics education or mathematics) by the sample size for the higher-order major (education or science) displayed in Table 17.

Tables 19 and 20 show comparable results for the Mathematics: Content Knowledge test, which included more science majors than education majors among test-takers, particularly among African American candidates. In Table 19, unlike the results shown for the Middle School Mathematics test, education majors in both race/ethnicity groups did better than their counterparts in business and social science, but still lagged behind science majors.

Table 19

Mathematics: Content Knowledge (CK) Performance by Race/Ethnicity Group and Undergraduate Broad Major Field Classification Among First-Time Test-Takers

Mathematics: CK undergraduate major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Science	7,561	44.0	153.19	20.79	955	52.5	126.65	19.38	-1.29
Business	1,269	7.4	135.65	21.30	303	16.7	112.87	13.93	-1.13
Social science	848	4.9	136.71	21.77	107	5.9	114.94	13.84	-1.03
Education	7,498	43.7	145.02	21.57	454	25.0	119.57	17.68	-1.19

Note. CK = content knowledge, Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Table 20

Mathematics: Content Knowledge (CK) Performance by Race/Ethnicity Group for Mathematics Education Majors and Mathematics Majors Who Were First-Time Test-Takers

Mathematics: CK refined major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Mathematics education	5,393	71.9	151.25	18.93	286	63.0	124.45	18.54	-1.42
Mathematics	4,995	66.1	154.32	20.46	543	56.9	128.29	19.13	-1.28

Note. CK = content knowledge, Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

As with the Middle School Mathematics test, the racial/ethnic gap for Mathematics: Content Knowledge was only slightly smaller among mathematics majors than mathematics education majors, yet it was still large. The results showed slightly higher scores among mathematics majors compared to mathematics education majors with small effect sizes (0.16 for White candidates, 0.20 for African American candidates).

Social Studies: Content Knowledge. Social studies may be placed in the domain of social science. Table 21 displays the performance by race/ethnicity and undergraduate major on the Social Studies: Content Knowledge test. The table shows that the majority of the test-takers majored in a social science field compared to education.

Education majors underperformed on the Social Studies: Content Knowledge test relative to their counterparts in social science. The widest gap was also among business majors, who comprised a small proportion of the test-takers for this exam (3% of White candidates and 7% of African American candidates). Table 22 shows a performance comparison between social studies majors and social studies education majors. The frequency of social studies as a major was actually quite low and more African American candidates majored in history and political science, which are listed as separate categories.

Test-takers who majored in history or political science performed better than general social studies majors. The performance among history majors, in particular, is relevant because the gap was the smallest among the listed specializations and was comparable to the gap among social studies education majors.

Table 21

Social Studies: Content Knowledge (CK) Performance by Race/Ethnicity Group and Undergraduate Broad Major Field Classification Among First-Time Test-Takers

Social Studies: CK undergraduate major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Business	727	3.1	171.22	15.30	111	6.8	150.12	17.82	-1.35
Social science	13,870	59.9	169.52	14.33	1,065	65.3	153.35	16.01	-1.12
Education	8,569	37.0	165.21	14.09	454	27.9	150.55	14.75	-1.04

Note. CK = content knowledge, Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Table 22

Social Studies: Content Knowledge (CK) Performance by Race/Ethnicity Group for Social Studies Education Majors and Social Studies, History, and Political Science Majors Among First-Time Test-Takers

Social studies: CK refined major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Social studies ed.	6,701	78.2	167.08	13.16	292	64.3	153.48	14.02	-1.03
Social studies	2,128	15.3	166.63	13.79	121	11.4	149.91	14.83	-1.21
History	8,963	64.6	169.93	14.14	540	50.7	155.18	16.13	-1.03
Political science	1,579	11.4	173.29	13.84	219	20.6	155.65	15.52	-1.26

Note. CK = content knowledge, Ed. = education, Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

English Language, Literature, and Composition: Content Knowledge. English was included under humanities. Table 23 displays the performance by race/ethnicity and undergraduate major on the English Language, Literature, and Composition: Content Knowledge test.

Even though the gap was smallest among social science majors, as a group, humanities majors performed best on this test. Table 24 presents data comparing the performance of English education and English majors on the test.

Table 23

English Language, Literature, and Composition: Content Knowledge (CK) Performance by Race/Ethnicity Group and Undergraduate Broad Major Field Classification Among First-Time Test-Takers

English: CK undergraduate major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
Business	426	1.6	173.58	15.23	97	4.1	150.10	16.81	-1.51
Social science	2,226	8.2	177.20	14.23	264	11.3	157.28	18.33	-1.35
Education	10,159	37.4	174.97	14.24	708	30.2	155.14	15.81	-1.38
Humanities	14,347	52.8	180.58	13.52	1,272	54.3	160.55	16.52	-1.45

Note. CK = content knowledge, Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

Table 24

English Language, Literature, and Composition: Content Knowledge (CK) Performance by Race/Ethnicity Group for English Education Majors and English Majors Among First-Time Test-Takers

English: CK refined major	White				African American				Std. gap
	N	%	Mean	*SD*	*N*	%	Mean	*SD*	
English education	6,748	66.4	177.76	12.84	459	64.8	158.38	15.11	-1.49
English	12,718	88.6	180.59	13.49	1,195	93.9	160.56	16.24	-1.46

Note. CK = content knowledge, Std. gap = the standardized gap in mean scores between African American and White candidates (AA − W).

The data suggested that while the gap was approximately equal between English education majors and English majors, White test-takers majoring in English performed slightly better on this test than English education majors, with an effect size of 0.21, yet the difference was not as large for African American test-takers (0.14).

Finally, while scores tell one story, it was also useful to examine passing rates on these content tests based on the specificity of undergraduate majors. Table 25 presents a summary of passing rates on the mathematics, social studies, and English tests described in this section.

Table 25

Summary of Passing Rates by Race/Ethnicity Group on Mathematics, Social Studies (SS), and English Praxis II Tests Among First-Time Test-Takers

	White		African American		Pass rate gap
	Total *N*	% pass	Total *N*	% pass	
Middle school math overall	28,059	80.0	2,850	48.2	-31.8
MS math - math ed. majors	715	90.9	93	59.1	-31.8
MS math - math majors	782	89.3	268	59.0	-30.3
Mathematics: CK overall	21,440	72.6	2,347	25.3	-47.3
Math CK - math ed. majors	5,393	83.1	286	34.6	-48.5
Math CK - math majors	4,995	82.1	543	36.1	-46.0
Social studies: CK overall	29,853	83.9	2,153	47.6	-36.3
SS CK - social studies ed. majors	6,701	86.3	292	54.5	-31.8
SS CK - social studies majors	2,128	81.7	121	45.5	-36.2
SS CK - history majors	8,963	85.3	540	52.8	-32.5
SS CK - political science majors	1,579	90.7	219	56.6	-34.1
English: CK overall	34,628	88.7	3,226	46.4	-42.3
English - English ed. majors	6,748	91.4	459	51.6	-39.8
English - English majors	12,718	90.7	1,195	51.0	-39.7

Note. CK = content knowledge, MS = middle school, SS = social studies, Pass rate gap = the gap in passing rates between African American and White candidates (AA − W).

The analyses presented in Table 25 suggest that majoring in a discipline/content area instead of education within that same discipline/content area was not related to higher passing rates for candidates in general, particularly for Social Studies: Content Knowledge. The one exception was for African American candidates on Mathematics: Content Knowledge where the passing rate was higher for mathematics majors compared to mathematics education majors. These findings did not appear to confirm the added value of undergraduate major field of study in explaining Praxis II performance, which had been established earlier in the section of Praxis I performance.

It is also worth mentioning that the range of gaps in passing rates on these Praxis II tests was similar overall to those found for Praxis I tests. However, the gaps in passing rates on the Mathematics: Content Knowledge test were larger than the mathematics gap for Praxis I. Because of the limited overlap between our samples of test-takers taking Praxis I and Praxis II,

the analyses were limited. But, we hypothesize that the apparent mathematical-related differences detected on Praxis I Mathematics carry through into Praxis II mathematics tests. These differences are likely related to academic factors beyond those captured in the BIQ like student preparation and curricula and may also be related to nonacademic factors, such as anxiety toward the subject which has been shown to intensify with age (Hembree, 1990).

The results for the Praxis II mathematics tests were also interesting because of three points noted by The Education Trust (2008) in relation to teacher knowledge: (a) there seems to be a strong link between teachers' knowledge of mathematics and student achievement; (b) student success in mathematics is the most reliable predictor of success in college and the workplace; and (c) national and international data indicate that many U.S. students lack the mathematics knowledge and skills to compete in the global economy.

In order to see if the correlates identified in analyses of Praxis I tests applied to the Praxis II tests selected in this section, we performed regression analyses similar to those that we conducted on Praxis I tests. The scale score for the selected Praxis II test was the dependent variable, and the background variables of race/ethnicity, UGPA, major, and attending institutional selectivity were the independent variables. The regression analyses are presented in Appendix D.

The results were similar to those found for Praxis I in that race/ethnicity explained the most variance in the scale scores of the selected Praxis II tests, and in a similar range of 4% to 10%. UGPA explained slightly less variance in Praxis II scores (1% to 3%) than it did for Praxis I (3% to 7%). The candidate's undergraduate major and selectivity of his or her attending institution explained comparable proportions of the variance in scores as for Praxis I. Since the scales of Praxis II scores are quite different (100 to 200) than the Praxis I score scales (150 to 190), the standardized regression coefficients are most relevant in comparing these model results to those previously shown in Table 12. The results showed that as with Praxis I, race/ethnicity had a similar effect on Praxis II scores as on Praxis I scores, namely that scores of African American candidates were likely to be lower than those of White candidates. While the signs of the standardized regression coefficients were the same for UGPA, major, and attending institutional selectivity, the magnitudes of these effects were generally smaller than those for Praxis I. While the results in the beginning of this section indicated that major field of study was a significant factor influencing Praxis II performance, the regression results showed that it was

less of a factor when students attended similarly selective colleges and universities and were of the same race/ethnicity.

The quantitative analyses in this report have focused on race/ethnicity group differences (primarily between African American and White prospective teachers) in their performance on high-volume Praxis I and Praxis II tests. Using descriptive statistics (e.g., mean scores and effect sizes) and regression analyses, performance differences between African American and White test-takers were within expectations based on various demographic indicators and other characteristics beyond simply examining race/ethnicity. These differences tended to be similar across the variety of Praxis tests. Other sources for the differences were beyond the scope of available background data. For that reason, we also conducted a qualitative analysis.

The next section of the report presents what a sample of minority-serving institution faculty considers to be some of the challenges and their efforts to help remedy the problem of under-representation of minority teachers among those holding or achieving certification.

On-Site Campus Interviews

The qualitative component of the research involved visits to seven campuses to interview teacher education faculty and students. Staff from ETS and NEA conducted the interviews. While exploratory in nature, the purpose was to gain firsthand knowledge from the faculty about the challenges that their students confronted when taking licensure tests and to elicit their ideas for improving student performance. ETS periodically hears unsolicited concerns from Praxis test-takers about their testing experiences, but this was the first time an in-depth exploration was conducted to explore issues with those who prepare teacher candidates.

The campus-based interviews engaged faculty in structured conversations regarding their concerns and activities related to preparing their students to become licensed teachers. In addition to specific questions regarding preparation for Praxis, faculty views about the benefits of the licensure process for higher education and the teaching profession were also elicited. Professors described the ways the licensure testing process affected their course syllabi and curricula design. The interviewers were also interested to hear from students about their experiences with Praxis testing. These interviews yielded information about their preparation and testing processes.

Teacher candidates arrive at higher education with varying backgrounds, levels, and types of preparation. Among the many factors that are typically found to be related to their

educational achievement and performance are the curricula and opportunities that they experienced in high school, their college grades, their parents' educational levels, and their social class (Nettles, Millett, & Oh, 2009). Faculty of teacher preparation programs, as in other institutions, must accommodate the variety of backgrounds, preparation, and achievements that students bring to their classrooms and work toward equipping their students to pass the teacher licensure tests and to excel as teachers. These circumstances suggest that a variety of teaching strategies may be required. The interviews were valuable for the specific information revealed on how students were being prepared to succeed on their teacher licensing exams and in their teacher education programs, and also for identifying needs and opportunities for the concerted efforts of colleges and universities to help prepare students. Much of the interviews centered on the efforts to align campus coursework, workshops, and special study sessions with the content of the Praxis exams.

Selection Process

In order to focus attention on African American, Hispanic, and Native American candidates who are likely to experience the greatest challenges in their teacher education programs, we sought to identify a small sample of higher education institutions that mainly serve these populations. We included three Historically Black Colleges and Universities (HBCUs), two Hispanic-serving Institutions (HSIs), one majority institution with a large Native American enrollment, and one urban majority institution with a diverse minority population.

The criteria for selecting the seven institutions included the following:

- Accreditation by the National Council for the Accreditation of Teacher Education (NCATE)
- Location in a state that uses Praxis tests for licensure
- Graduation of at least 40 teacher candidates each year
- Presence of an active teacher education program

The rationale for selecting the programs based on the number of graduates was that such institutions, by virtue of the presence of the academic field of teacher education, demonstrate the commitment to preparing teachers. Even though institutions without teacher education programs

per se often engage in preparing teachers, the institutions that explicitly offer teacher preparation programs often give priority status to educating and preparing future teachers.

Geographic distribution and public-private representation were also important considerations. Satisfying the former objective was somewhat challenging because Praxis is not used in several southwestern states or in some of the most densely populated states, such as California, New York, and Illinois, where the Hispanic population is large. Efforts to include private minority-serving institutions were ultimately unsuccessful because most of them are small and do not graduate 40 teacher candidates per year, and many of them do not have teacher education programs.

By examining campus websites for the breadth of teacher education programs and by reviewing the number of Praxis test-takers who sent their score reports to their home institutions, we identified seven universities that met our criteria, using an initial 1-year extract of Praxis candidates from the larger sample used throughout this report. The teacher preparation programs of the seven colleges and universities show a large variation in demographic diversity among enrollments.

As a group, these institutions are all major producers of teachers for their respective regions, whether these are large urban school districts or within the state as a whole. Four of the seven HBCUs and other minority serving institutions that participated in this NEA-ETS investigation ranked among the nation's top 50 producers of minority graduates with baccalaureate degrees in education.

Planning and Implementing the Campus Visits

For each campus selected, an NEA or ETS interviewer contacted the dean of the school of education by telephone, describing the project and seeking her or his desire to participate. (See Appendix E for the telephone script inviting campuses to participate). Follow-up e-mails confirmed the visiting team, possible dates, agendas, and desired campus participants for the site visits. While the goal was to have more or less uniform visits, this was not always possible given academic schedules, faculty and administrators' responsibilities, and student availability.

The interview teams conducted 1-day site visits of 3 to 5 hours at each of the seven campuses during April and May 2006. The composition of the research teams varied by site, but for most visits, both ETS and NEA were represented. The teams interviewed more than 50 faculty and administrators, including deans of education, deans of arts and sciences, chairs of

elementary education, secondary education, curriculum and instruction, assessment coordinators, directors of math clinics, directors of undergraduate studies, directors of licensure, and faculty from a number of disciplines. On some campuses, and when the institutions suggested, the teams also interviewed students.

Using an interview guide (see Appendix F) as a starting point, each interviewing team found that the proposed topics led to far-ranging discussions regarding the challenges faced by minority students, the amount of commitment displayed by students to careers in teaching, and the degree to which faculty and administrators were willing to shape their curriculum to support student success in the quest for licensure. We learned of a variety of approaches including required semester-long Praxis preparation courses, optional weekend workshops, and making test preparation materials available, both in print and electronically. In many of the institutions, faculty were encouraged (sometimes required) to take appropriate Praxis licensure tests themselves in order to gain more knowledge about the tests and in turn better prepare their students to take the tests themselves. The colleges and universities sometimes allocated funds to faculty to pay the fees required to take the tests. In some cases, arts and sciences colleagues also took the tests (e.g., for mathematics and English) since these faculty played a major role in preparing teacher candidates in these fields. Several teacher education faculty described incorporating some of the Praxis practice materials directly into their courses in order to increase the degree of student comfort. Details about what was learned from the site visit interviews follow here.

Observations and Findings: What We Learned From the Campus Interviews

Keeping in mind the context provided by the quantitative data, we turn now to the results of the qualitative analysis. In our examination of campus challenges and perceptions, we sought to explore the following:

- University approaches to address the need for Praxis preparation
- Common campus-based misconceptions about Praxis tests
- The major hurdles faced in efforts to close achievement gaps on Praxis tests

Since this field work design was nonrepresentative and nonrandom, we were careful about the extent to which we try to generalize conclusions from the information gained during the interviews. The design does, however, represent a useful way to converse with college and

university faculty and administrators about the challenges faced by their students. ETS will build on these interviews and consider ways to expand and improve the dialogue.

Praxis-specific preparation within/outside the curriculum. No uniform Praxis preparation program was observed across the campuses visited. Each institution developed its own preparation program in accordance with its own traditions, perspectives, and ideas, and its views of its students' needs for support. The colleges and universities visited in this inquiry, however, used two basic models for Praxis support. The first was to integrate Praxis content directly into their credit coursework. For example, one campus described how professors in science education required students to practice constructing and responding to Praxis-like questions in science education courses. This model seemed more prevalent for Praxis II support but was also observed for Praxis I.

The second model was to provide free-standing Praxis preparation, either in the form of a test preparation course or Praxis clinics. This type of Praxis support varied from a comprehensive approach, as in the test preparation course, to a more independent study arrangement. In the latter cases, diagnostic tools were used to identify students who were then referred to existing labs or clinics to address particular weaknesses. The free-standing Praxis model incorporated both diagnostic and remedial components. Institutions also used the PLATO Simulated Pre-Professional Skills Test, created by PLATO Learning to identify areas of weakness, and then provided clinics to address those weaknesses. The faculty reported the frequent use of counseling to address test anxiety issues, and the faculty at one school noted that this anxiety seemed to be more prevalent among African American students.

Although the PLATO program seemed to be the preferred tool used for Praxis support, faculty at several colleges and universities discussed its inadequacies. The most common complaint was the lack of test preparation questions. This issue was raised both about PLATO and in reference to ETS. Faculty at one university reported offering to work with the company that marketed PLATO as a way of helping shape the program's responsiveness to its students' needs, as well as to identify "bugs" in the program.

Using Praxis study materials and programs. The primary resources used across the seven campuses to help students prepare for Praxis are PLATO (a Praxis I online tutorial), ETS Tests at a Glance (TAAGs),[9] free downloadable test descriptions, and for-purchase ETS Study Guides and retired tests. TAAGs were deemed to be useful for reading and essays in Praxis I.

Textbooks were thought to be more useful for mathematics. ETS Study Guides for Praxis II were not seen as particularly useful, and one interviewee commented that the length of reading passages in the Study Guide books did not match the lengths of the reading passages on the actual tests. This was a concern because students often complain about the length of the passages, and faculty/administrators pointed out that practice was one of their methods of making the students more comfortable. According to our interviewees, this lack of comparability between the tests and preparation books limited the usefulness of this practice tool.

While several of the colleges and universities reported circulating the ETS Institutional Summary Reports (ISR), they found them not specific enough to be really useful. This, plus the length of time between administering the tests and receiving score reports combined to make it difficult for colleges and universities to easily diagnose their students' problems. Faculty lamented what they saw as a shortage of released items and indicated that having more released items would allow them to work better with their students, diagnose problems, and provide needed remediation.

Supplemental courses, workshops, and clinics. Four of the seven campuses (including all three of the HBCUs) required a Praxis I introductory course for admission to the teacher education program. In most cases, this was a semester-long course that covered reading, writing, and mathematics. Instructors used practice questions and tests to diagnose weaknesses and design interventions for improvement. On one campus, at the end of the introductory course, students took the Praxis I exam together, as a cohort. The university funded their first attempt at Praxis I, so that in addition to the natural desire to do well on the test, there was a financial incentive.

Tutors and math and writing clinics were available on most of the campuses. In addition, some institutions provided Praxis-specific tutorials, including Saturday workshops. Students reported that study groups helped them, as did workshops about how to read the questions and about time management. One institution described its collaboration with a local magnet school as a way to encourage future teachers. To help those who were then teaching in neighboring areas, but not yet permanently certified, one campus provided yearly workshops to local schoolteachers on the Praxis tests required in that state. Over a 10-month period, faculty worked with the school district's television station to develop a series of videotapes in which faculty from the various academic disciplines discussed the Praxis II subject tests and reviewed information that was

provided in the TAAGs. They also talked about what materials and study guides were available to prepare or to gain subject matter proficiency necessary for successful performance on the tests.

Faculty. The degree to which teacher education faculty had direct experience with the Praxis tests varied widely. One college/university actively urged its faculty to take the tests by setting aside funds to support the activity. Others merely encouraged it, with varying degrees of success. Faculty members who had taken the tests reported that they gained a better understanding of what was expected of their students; several of them also commented that they had incorporated Praxis-like items into their own classroom tests as a way to prepare students. On one campus, the faculty interviewed objected to the notion of any direct test preparation in their classrooms; they instead chose a stand-alone course to improve the preparation of their teacher candidates.

Close cooperation between arts and sciences (A&S) faculty and teacher education faculty was universally recognized as a goal for teacher education programs, particularly in the secondary certification disciplines. Most schools reported some degree of cooperation, but it was uneven, with some A&S departments actively participating and others doing so less enthusiastically. The nature of the cooperation ranged from, for example, one joint faculty meeting per year to a Praxis coordinating group across the academic divisions. Some faculty reported working together with A&S colleagues on grants and team-teaching courses. When significant cooperation with A&S was achieved, the faculty at the schools of education reported improvements and increased success in raising passing rates.

As part of the site visit discussions, faculty were asked if they had ever written test items or served on test development committees for ETS. Very few had participated in these activities, but many indicated that they would be interested in serving on test development committees and receiving training in item development. They were invited to send their curriculum vitae and contact information to the ETS visiting team member and were promised that additional information would be forthcoming.[10] The interviewees encouraged ETS to reach out more proactively to education faculty, especially those serving in schools with a significant minority enrollment, to work with them on developing and reviewing Praxis tests. Similarly, very few faculty had ever participated at the state level in content review panels for the licensure tests. This was seen as an issue needing further attention.

Consistently, faculty saw Praxis I as a barrier to recruiting and retaining minority teacher candidates. They believed this was especially problematic given regional and national teaching shortages and the under-representation of minority teachers within an increasingly diverse K–12 student population. The administrators and faculty at the institutions visited cited perceived test bias and inadequate preparation in math and reading comprehension in rural and urban K–12 schools as causes for lower Praxis I pass rates on the part of minority and nontraditional teacher candidates. Analyses of the testing results described earlier in this report shed more light on a number of factors that influence the performance of minority candidates on Praxis I.

Faculty of color who were interviewed believed that an increase in test items with relevance to the minority experience could help to close the gaps. They believed that this increase could be accomplished through greater involvement of minority educators in the test development process, both as item writers and reviewers.

Students. On most campuses, we interviewed faculty about their students, as well as some students themselves. The responses that follow are grouped according to their source.

Faculty on their students. Chief among the comments from faculty were those that focused on students' high school academic deficiencies and students' lack of motivation to prepare for Praxis tests. All mentioned a serious challenge to all efforts at providing Praxis support: how to make sure that minority students take full advantage of services offered. In spite of the fact that many minority students arrived with educational deficiencies, they often had to be pushed to go to the labs and to devote the necessary time to the work required to pass the tests. These students tended to cite more pressing priorities as an explanation for not pursuing the work in the Praxis courses and labs. The faculty and administrators associated this with attitudinal issues, but also with demographic differences, because these students tended to be younger and with fewer financial resources—and therefore less free study time—than the students of other racial/ethnic groups.

Some faculty reported employing a variety of motivational tools to encourage participation, and all of them reported doing lots of "hand holding" and encouragement to help their students "get over the hump." A particularly compelling model on one campus was that of a full-time staff member dedicated to supporting and encouraging teacher education students.

Specific areas of deficiency[11] were identified as basic mathematics (especially geometry, fractions, decimals, and percentages, and word problems in particular), reading comprehension

and processing information, application of knowledge to a problem, time management, and attention to detail. Word usage and idioms were identified as specific areas of concern in writing, as was the length of the reading passages. Vocabulary was an issue for English-language learners (ELLs). In general, faculty felt that students should read more.

Students on themselves. In addition to customer service complaints, access issues, and cost challenges, students offered the following comments about their performance and achievement on Praxis:

- Time limits are a problem for all, but especially for nonnative speakers of English, many of whom seemed to be unaware of the availability of accommodations through the *Primary Language Not English* program that allows for up to 50% additional testing time.
- Short readings that often contain vocabulary/idioms unfamiliar to those who have not been raised in the United States are viewed as problematic. Some words are seen as rare and archaic, and some topics are unfamiliar to minority students.
- Some older, career changers who did not attend K–12 schools in the United States lack background in U.S. history and cultural history. They thought questions on these topics on Praxis I should be avoided.
- Online essay practice is a big help, as are face-to-face study groups.
- It is difficult to pull out the actual arithmetic problem from word problems.
- More training in test-taking strategies is needed.

Findings gleaned from our conversations with faculty during our campus visits, as well as the testing results discussed earlier, pointed to the need for interventions to compensate for academic deficiencies resulting from poor educational preparation. The reported lack of alignment and articulation with area high schools seemed to be a particularly disturbing deficit. Since Praxis I concentrates on content learned in high school, or so-called basic skills, strengthening the connections between high school and teacher education programs at colleges and universities may have a significant impact on minority passing rates. This strategy deserves attention, particularly since all of the schools believed that Praxis I had more of a negative impact on the minority teacher pipeline than Praxis II.

State Policies Pertaining to Praxis Tests

Faculty on nearly all of the campuses visited mentioned that increased emphasis on their Praxis programming efforts was the result of changes in their respective state's certification policies. These included increases in the passing score or requirements to use Praxis as a gatekeeper for licensure. In spite of the schools' efforts to change their programs in response to the policy changes, many of the faculty and administrators interviewed indicated concern that changes in state policies with regard to Praxis tests had the danger of further decreasing an already small pool of minority teachers, as well as increasing the percentage of minorities who entered through alternative certification routes, where Praxis I is not required. Many complained that their respective state's policies were developed without their input.

Many faculty were not aware that each state uses a different array of Praxis tests and passing scores. Each state's Board of Education or the Professional Standards Board selects the tests that will be required for licensure and then sets passing scores on these tests through an extensive standard setting-study process that involves representative groups of faculty and practitioners who make judgments about the test items and forms. Neighboring states may—and often do—require different tests. Because of different passing scores in different states and limited reciprocity, a student who passes the test in one state could be considered failing in a different state. The variation in passing scores gives rise to questions regarding the relationship of a passing score to the quality and effectiveness of teachers who pass the test.

Conclusion

While the potential benefit of combining quantitative and qualitative research and analyses in a single study to address critical policy issues is often acknowledged, rare is the occasion to read such an endeavor in the literature. This study combines the two approaches to address the critical test score gaps between majority and minority test-takers on Praxis. The research sought evidence to support actions that can be taken to reduce the gaps.

The score gaps in all educational assessments seem acute and Praxis is no exception. Given the racial/ethnic imbalance in representation in the teaching profession, the challenge is especially troubling for teacher licensure tests. Because Praxis is the licensing test of choice for the majority of states, it is particularly useful and timely to examine the larger issue of score gaps and passing rates by making use of the teacher licensure tests most frequently selected by the states.

At around 8% of the total teaching workforce in the United States, African American teachers are severely under-represented relative to the 13% that they comprise in the adult population. Their representation among the teaching workforce is half of their representation among the school-age population (Planty et al., 2008, p. 85, Table 5.1). While alternatives to the conventional routes to the teaching profession are growing, the primary source of new teachers continues to be the colleges and universities that award bachelor's degrees in the field of education. As long as the proportion of bachelor's degree recipients in the field of education continues so that African American awardees represent 6% of all awardees, their under-representation in the nation's teaching workforce will continue to be below the 13% that they represent in the adult population.

Trends in the teaching workforce suggest that a growing share of new teachers is emerging through alternative routes. Even though it is clear that the number of alternative routes as well as the number of people in them have been increasing in recent years and that they are contributing more to the overall supply of new teachers, it is difficult to judge their contributions to addressing the shortage of African American teachers for the following reasons:

- While gaining in popularity, these alternate route programs combined produce roughly one third as many new teachers as conventional teacher education programs but it is not known what percentage of new African American teachers are being produced through alternative routes.
- The longevity of alternative route teachers as practicing teachers relative to their contemporaries is not known either overall or among African Americans.
- Surveys of alternative route teachers tend to report the proportion that minorities represent, but they disaggregate minority alternative route teachers sufficiently to distinguish African American alternative route teachers from those from other minority groups.

Regardless of the education or training path people take on the way to becoming a teacher, Praxis and other licensure tests and the standards of quality that are represented by each state's passing scores also play a prominent role in addressing the problem of the under-representation of African American teachers. African American test-takers comprised 5% to 11% of the Praxis volumes in the 28 states during the period covered in the analyses presented in this

report, and they represented roughly between 5% and 13% of the test-takers who met the test score required to be licensed across the Praxis tests covered in this report.

Given the currently limited supply of African American teachers, any leak in the pipeline is problematic. It is also problematic because, like people who pursue alternative routes, the people who take Praxis and other licensing tests represent the only known supply pool that is truly interested in becoming teachers. Even baccalaureate degree recipients in the field of education cannot be considered interested and committed to becoming teachers until they register to take required licensing tests.

The analyses in this report revealed very large score gaps between African American and White teacher candidates on selected Praxis I and selected Praxis II tests. The overall gaps, however, between African American and White test-takers on Praxis I appeared to be as large as the gaps that are commonly observed on the SAT and GRE. The Praxis I Writing gap appeared to be somewhat narrower than gaps on the SAT and GRE, the reading gap was comparable, and the mathematics gap seemed larger. Rather wide gaps also existed on the majority of the selected Praxis II tests as well.

Teacher licensing test scores and the passing rates are but two indicators of African American Praxis test-takers' under-achievement that need to be addressed. The data presented in this report revealed lower UGPAs of African American test-takers that mirror the differences observed in their Praxis I scores. The relationship between undergraduate grades and Praxis test scores suggested that the supply of new African American teachers obtaining licenses would be similar regardless of whether states used GPAs or Praxis test scores as the primary criterion for licensure. If grade inflation were not a likely consequence, and if GPAs could be standardized across disciplines and institutions, states might be tempted to try relying upon grades to license candidates. Employing Praxis as a licensure criterion relieves the burden that GPAs and the faculty who award them would have to bear.

The strong relationship that we observed between Praxis I scores and UGPA suggested that the key to increasing the supply of African American teachers among those who are interested in pursuing a license by taking the tests is to focus upon strengthening their academic preparation for and achievement in college. Improving grades and school performance are important, yet these are not the most important factors. In fact, the finding in this study, that as

African American and White test-takers' grades increase so too did the gaps on Praxis I, suggested that other factors are at work as well.

This phenomenon of test score gaps widening among candidates with higher grades may be due in large part to the higher rate of African American candidates attending and earning their grades in less selective/competitive colleges and universities than their White contemporaries. This widening gap may also be a function of the economic status and standing of individual test-takers, which may also play a part in their preparation for higher education and the selectivity of the colleges and universities they attend. Preparing for and attending a selective college or university may be outside the financial reach of too many prospective teachers and outside of the reach of more African American candidates than White candidates. While preparing to attend more selective institutions may not be an option or even an interest to many students who are preparing to become teachers, it is an issue that should be on the minds of faculty and policymakers as a matter to consider in their efforts to close gaps in performance. Interestingly, although having a larger proportion of African Americans attend more selective colleges and universities may contribute to narrowing the test score gap, given that gaps were larger among students attending more selective institutions, this is unlikely to solve the score gap problem.

Although the relationships between test-taker characteristics and performance on each of the three Praxis I tests varied, it is noteworthy that the relationships of SES, like selectivity of undergraduate institutions, and UGPA were consistently found to be prominent factors associated with Praxis I scores of African American candidates. While race/ethnicity and being a noneducation major were found to be highly relevant in predicting all three Praxis I scores, this combination was especially prominent in predicting mathematics scores. Given that the Praxis I score gaps in mathematics were the widest and were wider than gaps on other tests like the SAT and GRE, it is imperative that we examine further why, after controlling for the other background characteristics, being an African American prospective teacher is still a significant factor. This examination meant that even when African American test-takers attended similarly selective colleges and universities, had a parent with comparable educational attainment, achieved similar undergraduate grade point averages, were in similar major fields, and were at comparable stages of the educational process as their White counterparts, they were still likely to have a score seven points lower on the Praxis I Mathematics test compared to their White contemporaries.

Learning that a substantial share of the differences in mathematics scores on Praxis I can be attributed to race/ethnicity was quite illuminating. That information means that perhaps efforts to understand the gap in mathematics, in particular, require a more refined and nuanced examination of variables within the African American test-taking population than are available in the BIQ. Variables that could be considered include the following: the number of mathematics courses taken in high school and college as well as the content and quality of those courses, teachers, and faculty, African American students' orientation to mathematics prior to college, and the GPAs earned in mathematics courses during high school and college. The same strategy should be followed for examining the effects of race/ethnicity upon the score gaps in writing and reading. The BIQ variables, while useful for gaining general insight, are not precise enough and are insufficiently elaborate to explain all the differences in scores.

The differences between African American and White test-takers go beyond their scores, and these differences need closer scrutiny for their possible connection to the score gaps. African American Praxis I test-takers in this study were older on average, took the test at a later stage in their academic careers, and were more often already bachelor's degree recipients. African American test-takers were also from lower SES backgrounds and were less likely to be attending a selective college or university than their White counterparts. Gitomer et al. (2008) posed the question of whether Praxis I was an obstacle to pursuing a teaching career or was actually measuring content and skills essential for later success. Their analyses used 3 years of Praxis I and Praxis II performance data to focus on the ability of candidates to pass selected required Praxis II licensure tests, namely English, mathematics, social studies, and elementary education, after taking Praxis I. Candidates were classified into two groups: Successful (meeting or surpassing the median passing score used across states) or Borderline (not exceeding the median passing score or meeting it only after taking one or more of the Praxis I tests multiple times).

The findings indicated that passing Praxis I successfully on the first attempt increased the chances of passing Praxis II compared to those who struggled to pass Praxis I. These results were reported for all test-takers and by subgroups. African American test-takers who successfully passed Praxis I the first time were just as likely to pass their Praxis II exams as White test-takers with similar success on Praxis I and similar undergraduate GPAs. These findings suggest that when African American students enter their teacher education programs with a skill base from pre-kindergarten through Grade 12 (P-12) and do not struggle to pass Praxis I tests, the

difference around program success and Praxis II performance virtually disappears. For those in the Borderline group, however, struggles with Praxis I are indicative of later difficulty, namely with Praxis II tests.

Anticipating the limitations of the BIQ variables for explaining the gaps and considering possible strategies for improvement gave added value to the qualitative component of this study. In addition to gaining an understanding of the views of faculty and students in some leading institutions that are also among the leaders in training new teachers, the qualitative study also helped to identify new variables for potential use in the BIQ and elsewhere for attempting to explain and address the score gaps between African American and White test-takers. This study represented a novel approach that can be employed by researchers who are interested in the greater understanding that might be gleaned from conversations with faculty and students.

While many efforts are being made by organizations and by teacher education faculty to help minority candidates succeed on their licensure exams, it is clear from interviews with faculty and students that more needs to be learned and more action taken. Based on information gathered for this study from faculty, students, and expert observers, many aspects of preparation could be improved. These improvements in preparation should result from the following:

- Better alignment of high school curricula with Praxis I skills
- Helping teacher candidates understand that the skills and knowledge assessed on Praxis tests are important for teaching
- Helping teacher candidates build skills and knowledge, understand how they will be tested, and understand how they can use strategies for successful demonstration of their abilities in a demanding testing situation
- Helping teacher candidates understand what is on each test, how they can prepare, and where they may go to seek helpful and authentic practice material

Many students need guidance through the materials and study processes, either in groups or in one-on-one settings. It is clear that the commitment from some faculty is high and that they believe an array of materials can help.

As is true of most studies about teacher supply, attrition is often the result of students' or practicing teachers' desires to switch fields or careers to seek higher salaries, or family-related issues that are independent of licensure assessments. Torres, Santos, Peck, and Cortes (2004),

through The Education Alliance at Brown University, reported on aspects of recruitment, development, and retention among minority teachers. Among the issues related to retention even before these candidates enter classrooms are the lack of acknowledgement of these candidates' diverse backgrounds within preparatory programs. The focus would then seem to shift back to the P-12 system to identify the weak links in the chain. As part of the recruitment process, Haselkorn (2000) suggested the formation of clubs, programs to build up career awareness, and visits by high school students to college campuses that have teacher preparation programs. Partnerships between high schools and colleges and universities can also assist in this regard. Banks (2002) recommended that community colleges in particular be viewed as sources of untapped potential to increase the pool of prospective teachers.

Ingersoll (1999) recommended individualized diagnostic assessments to help faculty select appropriate courses and determine the amount of necessary academic support for students, to provide tutoring and focused advisement, and to monitor progress to help improve their academic experiences. Once in classrooms, The Education Alliance report (Torres et al., 2004) suggested mentoring as a key factor in retention to help promote individual teacher self-efficacy, so as to not just retain minority teachers in the profession, but to reduce the amount of transfer (Smith & Ingersoll, 2003).

The evidence is robust that the supply of minority teachers is affected by more than their success on licensure exams. Other questions also need to be continuously addressed including the following: Do similar differences exist related to other requirements such as program completion, GPA, coursework, and student teaching requirements? Are a disproportionate number of minority teachers leaving the classroom once they are in the profession? The chain can be broken in numerous places, and while the observations reported in this report on Praxis performance differences are just one clue to answering these questions, it is important to understand the other links and weaknesses in the supply chain as well.

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Notes

[1] Praxis I tests given by computer were not considered for the analyses in this paper.

[2] Please refer to http://www.ets.org/Media/Tests/PRAXIS/pdf/01361reg.pdf for a list of questions.

[3] Exceptions are states using composite scoring methodologies where no minimums are necessary on any test as long as the composite score for all three tests is met.

[4] The inclusion of information about standard errors (i.e. the ratio of the standard deviation to the square root of the sample size) can also be useful in interpreting descriptive data. This information is available from the authors upon request.

[5] Please see Appendix C for more details on the use and interpretation of this statistic.

[6] Please see Appendix B for how the BIQ variables were consolidated for the regression analyses in this paper.

[7] The Early Childhood Education title was dropped from analysis because the score range (200–800) was vastly different from the other Praxis II titles compared in this report (100–200), which makes comparative interpretations difficult.

[8] This was calculated by comparing the means *within* race/ethnicity groups rather than *between* race/ethnicity groups.

[9] See http://www.ets.org/praxis/prepare/materials/test_prep to download ETS TAAGs.

[10] The names of interested faculty members were quickly conveyed to the Praxis test development leaders for possible recruitment as item writers and reviewers, and several have already been engaged to review items.

[11] See Appendix G for an overview by Lloyd Bond, Senior Scholar at the Carnegie Foundation for the Advancement of Teaching, on how students process the questions on a Praxis exam.

List of Appendices

Appendix A

Primer on Standard Setting

A standard-setting study produces a passing score recommendation. A passing score is the minimum test score that a test-taker needs to achieve to pass the particular licensure test and be awarded a license to teach. Each state sets its own passing score. ETS does not set passing scores; that is, the responsibility of each state's licensing agency.

Standard-setting studies serve two purposes. First, they are designed to identify the level of knowledge for a teacher candidate to be considered minimally qualified for independent, beginning practice. The level of knowledge is represented by a minimum test score candidates need to achieve. Second, the studies are designed to reconfirm the relevance (validity) of the test content for teachers in the adopting state.

Different standard-setting approaches are used for different test structures. That is, there is a preferred standard-setting method for multiple choice (MC) test items and another for constructed response (CR) test items. ETS recommends and implements a modified Angoff method for MC items and a Benchmark method for CR items, both of which are defined later in this appendix. One or more ETS standard-setting specialists conduct and facilitate each standard-setting study. For each study, a technical report is produced that describes the selection and representativeness (i.e., balance of backgrounds by gender, race/ethnicity, and other characteristics) of the participants involved and summarizes the standard-setting methods and results.

Panel Formation

For each method, the state (licensing agency) selects a panel of teachers and teacher educators to serve on the standard-setting panel. ETS works closely with the licensing agency to identify the appropriate types and numbers of educators from the state. ETS supplies the licensing agency with written descriptions of recommended qualifications and demographic characteristics of educators. Panels typically consist of 10 to 15 people, the majority of whom are practicing, licensed teachers in the content area covered by the test; teacher educators, who prepare teacher candidates, often are also represented. States are encouraged to select a panel of educators that reflect the diversity in the state (e.g., racial/ethnic, gender, geographic, and setting).

ETS reviews the nominations and identifies those panelists who meet the criteria. The state licensing agency is then asked to confirm and approve the panel composition. ETS convenes the panel and conducts the study using the method suitable for the type of test being reviewed by the panel.

Angoff Method of Standard Setting

This method is used for multiple-choice (MC) test items—items for which there is a single correct answer. In brief, this method necessitates that each panelist review each test item and judge the percentage of a hypothetical group of 100 minimally qualified test-takers who would answer the item correctly. For each item, panelists record the percentage (e.g., 10%, 20%, 30% . . . 90%) of the 100 hypothetical test-takers who would answer the item correctly. The judgments for each panelist (across items) are summed, and the average across panelists is computed. This average represents the passing score study value. Before rendering their item judgments, panelists take the test and self-score it, define the knowledge and skills of minimally qualified test-takers, receive appropriate training, and practice making standard-setting judgments. Panelists are also asked to verify that the test content is valid for use in that state.

Benchmark Method of Standard Setting

ETS uses the Benchmark method for items that require constructed responses. In this method, each panelist reviews the item, scoring rubric, and examples of candidates' responses that are clearly illustrative of the scale points on the scoring rubric for an item. Panelists are then asked to identify which benchmark response (scale point) is most likely to be earned by a minimally qualified test-taker. If a test consists both of MC and constructed-response (CR) items, the recommended number of points from the MC section is combined with the points from the CR section to arrive at the test-level recommended passing score. For an exclusively CR test, the passing score is the average number of points recommended by the panel.

Before rendering their item judgments, panelists respond to the CR items and self-score them, define the knowledge and skills of just-qualified test-takers, and receive appropriate training for and practice making standard-setting judgments. Panelists are also asked to verify that the test content is valid for use in that state.

Standard-Setting Reports

Approximately 6 weeks after the standard-setting study is completed, the state receives a study report documenting who participated, the procedures and methods, and the results. The report also includes information about the standard error of the test and passing score recommendations within one and two standard errors of the panel's recommendation. States may use this information and other state-specific information to decide on the operational passing score.

Appendix B

Description of Selected Background Variables and Classifications Used in the Quantitative Analyses of Praxis I and Selected Praxis II Tests

1. *Race/ethnicity*. Five general categories of ethnicity were used: White, African American, Hispanic, Asian American, and Native American. White and African American candidates were used in the predictive analyses.
2. *Undergraduate grade point average (UGPA)* was reported in six categories, five of which were used in this report: 1.5–1.99, 2.0–2.49, 2.5–2.99, 3.0–3.49, and 3.5–4.0. The two condensed categories were 3.0 and greater, and less than 3.0.
3. *Teacher education program enrollment status* consisted of three types: current, formerly, and never. In predictive modeling, the comparison is made between current and not current (i.e., formerly and never).
4. *Candidate educational attainment level* was reported in nine categories, eight of which were initially used in the analyses: freshman, sophomore, junior, senior, earned bachelor's degree, bachelor's + credits, earned master's degree, and master's + credits. The reduced categories were less than a college senior, and college senior and higher.
5. *Parent educational attainment (proxy for SES)* was the higher educational attainment level between both parents based on the following categories: some high school or less, high school diploma, some post-secondary education, associate degree, bachelor's degree, some graduate or professional school, and graduate or professional degree. The two condensed categories were less than a bachelor's degree, and bachelor's degree and above.
6. *Undergraduate major.* Close to 100 categories exist, so these were consolidated to represent domains similar to those found in the career interest research literature (Emmerich, Rock, & Trapani, 2004). These groupings were science, technology, business, social science, education, and humanities. For predictive modeling, noneducation majors were one group and education majors were the other group.

7. *Institutional selectivity status.* Based on the 2009 *Barron's Profile of American Colleges* ratings of schools, six different classifications were used: noncompetitive, less competitive, competitive, competitive +, very competitive, and very competitive + (included most competitive and most competitive + as well). In the predictive models, competitive and lower selective schools were one group and those at competitive + and higher were the other group.

Appendix C

Statistical Formulas

The statistics displayed in the data tables throughout the report included traditional descriptive statistics such as category frequencies and percentages, test score means, and standard deviations. Effect sizes (Cohen, 1988) were computed to reflect differences between groups on a particular variable in standardized rather than absolute terms. The formula for effect size is:

$$d = M_1 - M_2 / \sigma_{pooled} \quad \text{(C1)}$$

where M_1 and M_2 represent the mean scores for the two groups being compared and σ_{pooled} represents the pooled standard deviation between the two groups, which is represented as the root mean square of the two standard deviations. The magnitude of the effect size was grouped into the following categories: small (0.20–0.49), medium (0.50–0.79), large (0.80 and above).

Linear regression analyses were performed using the Praxis I or selected Praxis II scale score as the dependent variable and the re-coded background variables as independent variables. The analyses were conducted in a stepwise fashion, so that the unique contribution of each additional variable could be assessed in order to determine whether its effect in predicting Praxis I or selected Praxis II scale scores was significant. First, a test for the overall significance of the regression model was needed to assess the adequacy of the model.

The relative significance of each predictor variable was determined by looking at a ratio showing the relation between the regression weight (beta) and its standard error, called a *t*-statistic:

$$t = \beta / SE(\beta) \quad \text{(C2)}$$

This value was then compared to a value of approximately $\pm$ 1.96, where larger values indicated a nonzero or significant effect in predicting the Praxis I or selected Praxis II scale score. Given differing scale score distributions across the Praxis I and selected Praxis II tests, standardized regression coefficients helped to further explain the effects of the predictor variables. The formula to obtain such values was

$$\beta ' = r_{XX}^{-1} r_{YX} \quad \text{(C3)}$$

where r_{xx}^{-1} represents the inverse of the inter-correlation matrix of the predictor variables and r_{YX} represents the inter-correlation matrix of each predictor variable with the dependent variable, Praxis I or selected Praxis II scale score. These two matrices were multiplied together to get the standardized regression coefficients.

Appendix D

Summary of Regression Analyses Using Praxis I and Selected Praxis II Tests and Background Information Questionnaire (BIQ) Variables

Table D1

Summary of Full Regression Results for Praxis I Reading

		Stepwise selection		Parameter estimates			
Step	Predictor	r^2	Total r^2	β	*SE*	Sig.	Std. β
1	Race/ethnicity	0.10	0.10	-2.84	0.31	-9.20	< .01
2	Major	0.05	0.15	-2.57	0.08	-33.21	< .01
3	UGPA	0.04	0.19	2.73	0.07	37.32	< .01
4	Selectivity	0.02	0.21	1.64	0.06	25.23	< .01
5	Parent highest ed.	< .01	0.22	0.71	0.06	11.05	< .01
6	Race/ethnicity× candidate highest ed.	< .01	0.22	-2.59	0.22	-11.69	< .01
7	Teacher ed. program enrollment	< .01	0.22	0.48	0.06	7.47	< .01
8	Candidate ed. level	< .01	0.22	0.53	0.08	7.02	< .01
9	Race/ethnicity× major	< .01	0.22	-1.36	0.24	-5.56	< .01
10	Race/ethnicity× parent highest ed.	< .01	0.22	0.65	0.21	3.08	< .01
11	Race/ethnicity× UGPA	< .01	0.22	-0.59	0.21	-2.85	< .01
12[a]	Race/ethnicity× teacher ed. program enrollment	< .01	0.22	-0.45	0.21	-2.12	0.03

Note. Ed. = education; Sig. = significance of regression coefficient; Std. β = standardized regression coefficient; UGPA = undergraduate grade point average.

[a] The interaction between race/ethnicity and selectivity was not significant and was dropped from the model at Step 13.

Table D2

Summary of Full Regression Results for Praxis I Writing

		Stepwise selection		Parameter estimates			
Step	Predictor	r^2	Total r^2	β	*SE*	Sig.	Std. β
1	UGPA	0.07	0.07	2.24	0.06	< .01	0.23
2	Race/ethnicity	0.05	0.12	-2.18	0.14	< .01	-0.14
3	Selectivity	0.04	0.16	1.58	0.05	< .01	0.17
4	Major	0.02	0.18	-1.48	0.05	< .01	-0.15
5	Parent highest ed.	0.01	0.19	0.82	0.05	< .01	0.09
6	Race/ethnicity × candidate ed. level	< .01	0.19	-0.90	0.15	< .01	-0.04
7	Race/ethnicity× UGPA	< .01	0.19	-0.85	0.16	< .01	-0.04
8[a]	Teacher ed. program enrollment	< .01	0.19	0.23	0.05	< .01	0.03

Note. When interactions of race/ethnicity with another BIQ variable were significant and the main effect of the BIQ variable was not significant, the main effect was not re-inserted into the final model as typically done in regression analysis. This was true in the case of candidate education level. Ed. = education, Sig. = significance of regression coefficient, Std. β = standardized regression coefficient, UGPA = undergraduate grade point average.

[a] Candidate education level and the interactions of ethnicity with enrollment in a teacher education program, parent highest education, major, and selectivity respectively were not significant and were dropped from the model at Step 9.

Table D3

Summary of Full Regression Results for Praxis I Mathematics

		Stepwise selection		Parameter estimates			
Step	Predictor	r^2	Total r^2	β	*SE*	Sig.	Std. β
1	Race/ethnicity	0.11	0.11	-3.55	0.38	< .01	-0.14
2	Selectivity	0.03	0.14	2.36	0.09	< .01	0.15
3	UGPA	0.03	0.16	2.83	0.09	< .01	0.17
4	Major	0.01	0.17	-1.86	0.10	< .01	-0.11
5	Candidate ed. level	0.01	0.18	-1.10	0.10	< .01	-0.07
6	Parent highest ed.	< .01	0.18	0.92	0.08	< .01	0.06
7	Race/ethnicity × UGPA	< .01	0.18	-1.89	0.27	< .01	-0.05
8	Race/ethnicity × candidate ed. level	< .01	0.18	-1.84	0.29	< .01	-0.06
9	Teacher ed. program enrollment	< .01	0.18	0.48	0.08	< .01	0.03
10	Race/ethnicity× teacher ed. program enrollment	< .01	0.18	-0.86	0.27	< .01	-0.02
11	Race/ethnicity× major	< .01	0.18	-0.92	0.31	< .01	-0.03
12[a]	Race/ethnicity× selectivity	< .01	0.18	-0.91	0.32	< .01	-0.02

Note. Ed. = education, Sig. = significance of regression coefficient, Std. β = standardized regression coefficient, UGPA = undergraduate grade point average.

[a] The interaction between race/ethnicity and parent highest education was not significant and was dropped from the model at Step 13.

Table D4

Summary of Regression Results for Praxis II Elementary Education Tests

	Elementary education: Curriculum, instruction, & assessment					Elementary education: Content knowledge				
Predictor	β	*SE*	Sig.	Std. β	r^2	β	*SE*	Sig.	Std. β	r^2
Race/ Ethnicity	-14.20	.28	< .01	-.21	.04	-17.44	.21	< .01	-.30	.09
UGPA	7.17	.19	< .01	.15	.02	7.01	.16	< .01	.16	.03
Major	-3.27	.16	< .01	-.09	.01	-4.67	.13	< .01	-.13	.02
Selectivity	3.30	.12	< .01	.11	.01	5.96	.12	< .01	.17	.03

Note. Please refer to Appendix C for more information on the formulas used for this table. Sig. = significance of regression coefficient, Std. β = standardized regression coefficient, UGPA = undergraduate grade point average.

Table D5

Summary of Regression Results for Praxis II Mathematics Tests

	Middle school mathematics: Content knowledge					Mathematics: Content knowledge				
Predictor	β	*SE*	Sig.	Std. β	r^2	β	*SE*	Sig.	Std. β	r^2
Race/ Ethnicity	-15.35	.48	< .01	-.23	.05	-23.63	.61	< .01	-.29	.08
UGPA	3.93	.36	< .01	.08	.01	8.12	.45	< .01	.13	.02
Major	-2.70	.27	< .01	-.07	.01	-2.73	.34	< .01	-.06	.00
Selectivity	5.47	.26	< .01	.15	.02	9.92	.34	< .01	.22	.05

Note. Please refer to Appendix C for more information on the formulas used for this table. Sig. = significance of regression coefficient, Std. β = standardized regression coefficient; UGPA = undergraduate grade point average.

Table D6

Summary of Regression Results for Praxis II Social Studies and English Tests

	Social studies: Content knowledge					English language, literature, and composition: Content knowledge				
Predictor	β	*SE*	Sig.	Std. β	r^2	β	*SE*	Sig.	Std. β	r^2
Race/ Ethnicity	-13.38	.41	< .01	-.21	.04	-18.04	.34	< .01	-.32	.10
UGPA	6.30	.24	< .01	.17	.03	7.06	.26	< .01	.16	.03
Major	-3.81	.20	< .01	-.12	.02	-4.09	.18	< .01	-.13	.02
Selectivity	4.32	.19	< .01	.14	.02	5.06	.18	< .01	.17	.03

Note. Please refer to Appendix C for more information on the formulas used for this table.

Sig. = significance of regression coefficient, Std. β = standardized regression coefficient, UGPA = undergraduate grade point average.

Appendix E

Script Inviting Campuses to Participate in the Joint Research Project of the National Education Association (NEA) and ETS to Understand Achievement Gaps in Teacher Licensure and Certification Tests

Good morning or afternoon. My name is _____. I am calling on behalf of the National Education Association and Educational Testing Service. The National Education Association (largest teacher union in the United States) and the Educational Testing Service (world's largest testing and measurement company) are involved in a joint research project focused on achievement gaps among teachers seeking licensure. To that end, we would like to invite your campus to participate in this research by helping us to understand achievement gaps in teacher licensure tests and to identify ways to narrow these gaps. Your campus has been selected because our information suggests that

- you graduate significant numbers of *minority* teacher candidates,
- your institution is NCATE-accredited, and
- the state where you are located requires your students to take the Praxis series of tests for licensure.

Here's what we plan to do as part of the project we are asking your campus to participate in.

Using data from ETS's Praxis series of teacher licensure tests, NEA and ETS have agreed to pursue research jointly to answer the following questions:

- Where do the achievement gaps lie on Praxis?
- Is the gap the same on all of the highest-volume tests?
- What are the characteristics of people who do well or poorly on these tests?
- How can ETS and NEA intervene to narrow the gaps?

The project is divided into four parts:

1. Preliminary research/analysis of the Praxis I and Praxis II tests
2. Site research at higher education institutions using Praxis I for entrance into teacher preparation programs and Praxis II for teacher licensure
3. Analysis of results and recommendations for interventions

4. Publicizing results of the study and recommended interventions

Preliminary Research and Analysis

- Identify highest volume Praxis II tests (paper based and computer based) with the most significant performance gaps.
- Analyze paper-based and computer-based data from Praxis I tests in mathematics, reading, and writing to yield most significant performance gaps.
- Characterize testing candidates with low performance on both sets of tests (from performance data and biographical data collected at time of registration)

Provided you agree to participate, the researchers and educators involved in this project will visit your campus for the following purposes:

- To work with teacher education faculty to examine local indicators of student performance
- To identify test areas where minorities have the greatest problems
- To identify interventions that have been used successfully to address the problem areas
- To examine linkages between schools of education and schools of arts and sciences designed to supplement content provided by school of education
- To investigate campus practices that have been known to improve performance
- To investigate how the curriculum is designed and revised to address identified problems

No confidential information will be released.

The information we obtain from you and your colleagues will be analyzed and included in future plans for interventions and in reports to be disseminated nationally.

Timeframe to Visit Campuses

Preliminary research/analysis: 3 months (August, September, October)

Site visits: spread over a 6-month period (March, April, May, August, September and October 2006)

We would like to speak with you and members of your teaching staff who are involved in preparing teachers. Ideally, we would spend an afternoon and a morning on your campus, speaking with teacher education faculty as a group and with some particularly key people individually. We would ask you to identify who those key faculty members would be.

In the hope that you are willing to have your campus participate, I'd like to schedule a time for our visit. Our group of visitors will be three or four people. Can you give me a few dates when our visit would be convenient for you?

Appendix F

National Education Association (NEA)/Educational Testing Service (ETS) Interview Guides

The following provides a summary of the interviews conducted between NEA, ETS, and four different audiences within each of seven schools selected for qualitative analysis. These audiences included deans, department chairs, university faculty, and students. The interview guides were divided into four main sections: an introduction, an overview of the school or department, questions about achievement gaps, and general questions about Praxis tests. All interviews concluded with final thoughts and a closing.

Introduction (Common to All Audiences)

Representatives from the National Education Association (NEA) and Educational Testing Service (ETS) are talking with administrators and faculty in colleges of education to discuss achievement gaps between the majority Praxis test-takers and those from African American, Hispanic, and Native American populations. The objective of the research is to understand key issues related to this gap and, in an effort to develop solutions, identify and understand efforts that have been effective in closing the gaps.

Thank you for taking the time to talk with us.

Overview: Part 1 (Deans Only)

- What is the basic structure of your education program?
- What academic programs are included?
- What are the requirements for admission?
- What core courses must all students take?
- In what areas do you graduate most students?
- Are alternate route programs available?
- What is the current enrollment in the school of education?
- What percentage of current enrollees are Caucasian _____, Asian American_____, African American _____, Hispanic _____, and Native American_____?

- Approximately, how many students from each group graduate from your program each year? Caucasian _____, Asian American_____, African American _____, Hispanic _____, and Native American_____?
- Our records indicate that your college/school has been very successful in graduating students from African American, Hispanic, and/or Native American populations. What would you say have been your "keys to success"?

Overview: Part 2 (To All Audiences but Students)

Deans

How do you measure success of students for your college/school?

- How often are students assessed?
- What kinds of assessments are given? Who develops them (faculty, administration, outside vendor)?
- How is the assessment information used? As you are using the assessment information, do you segment the data by ethnic group and examine results separately?

Department Chairs/Center Directors

Describe the offerings of your department/center, including information about core courses required for majors, etc.

How do you measure success of students for your center/department?

- How often are students assessed?
- What kinds of assessments are given? Who develops them (faculty, administration, outside vendor)?
- How is the assessment information used? As you are using the assessment information, do you segment the data by ethnic group and examine results separately?

Faculty

- How do you use available institutional assessment data in your classes?

Achievement Gaps (All Audiences but Students)

Deans

- Have you identified any subjects and/or skill areas required for success in teaching that are more problematic for students from African American, Hispanic, and Native American populations than for those from the majority group? Please describe what aspects of these areas tend to show the largest gaps and explain why you think the differences exist.
- Have you identified any subjects and/or skill areas required for success in teaching that seem to be problematic for all students, with few observed differences between ethnic groups? Please describe what aspects of these areas tend to present more problems and explain why this area presents difficulties for students in general.
- Please describe any programs or interventions that are specifically designed to improve the performance of students who are having trouble mastering the required materials. Describe the successes that these programs/interventions have had. (If not addressed, PROBE—how have you assessed this program/intervention?)
- Have any of these programs or interventions been particularly successful in boosting performance of students from African American, Hispanic, and Native American populations and thereby reducing the gap? Please describe how they have achieved this success.
- Have changes been made to the curriculum with the aim of improving student performance, especially the performance of African American, Hispanic, and Native American students?
    - If yes, what changes have been made and how successful have they been?
- Does the college/school of education work with other academic programs within your university to help improve minority student performance?
    - If yes, what specifically is being done?
- Can you identify education policies within the last 5 years that have affected your teacher education program? If so, explain how.

- How have state policies about teacher testing affected your institution's success in the preparation of new teachers, especially those who will work in low performing schools? Please provide an example.
- Does your institution participate in item-development and item-review processes related to the Praxis tests? If so, who from your institution serves in this capacity? Has it been helpful in guiding your teacher preparation program?
- What suggestions would you have for our organizations as we attempt to develop programs designed to close the achievement gaps between the majority populations and the three ethnic groups?

Department Chairs and Center Directors

- Have you identified any subjects and/or skill areas required for success in teaching that are more problematic for students from African American, Hispanic, and Native American populations than for those from the majority group? Please describe what aspects of these areas tend to show the largest gaps and explain why you think the differences exist.
- Have you identified any subjects and/or skill areas required for success in teaching that seem to be problematic for all students, with few observed differences between ethnic groups? Please describe what aspects of these areas tend to present more problems and explain why this area presents difficulties for students in general.
- Please describe any programs or interventions that are specifically designed to improve the performance of students who are having trouble mastering the required materials. Describe the successes that these programs/interventions have had. (If not addressed, PROBE—how have you assessed this program/intervention?)
- Have any of these programs or interventions been particularly successful in boosting performance of students from either African American, Hispanic, and Native American populations and thereby reducing the gap? Please describe how they have achieved this success.

- Have changes been made to the curriculum with the aim of improving student performance, especially the performance of African American, Hispanic, and Native American students?
    - If yes, what changes have been made and how successful have they been?
- Does the center/department work with other academic programs within your university to help improve minority student performance?
    - If yes, what specifically is being done?
- What suggestions would you have for our organizations as we attempt to develop programs designed to close the achievement gaps between the majority populations and the three ethnic groups?

Faculty

- Have you identified any subjects and/or skill areas required for success in teaching that are more problematic for students from African American, Hispanic, and Native American populations than for those from the majority group? Please describe what aspects of these areas tend to show the largest gaps and explain why you think the differences exist.
- Have you identified any subjects and/or skill areas required for success in teaching that seem to be problematic for all students, with few observed differences between ethnic groups? Please describe what aspects of these areas tend to present more problems and explain why this area presents difficulties for students in general.
- Please describe any programs or interventions that are specifically designed to improve the performance of students who are having trouble mastering the required materials. Describe the successes that these programs/interventions have had. (If not addressed, PROBE—how have you assessed this program/intervention?)
- Have any of these programs or interventions been particularly successful in boosting performance of students from African American, Hispanic, and Native American populations and thereby reducing the gap? Please describe how they have achieved this success.

- Have changes been made to the curriculum with the aim of improving student performance, especially the performance of African American, Hispanic, and Native American students?
    - If yes, what changes have been made and how successful have they been?
- What suggestions would you have for our organizations as we attempt to develop programs designed to close the achievement gaps between the majority populations and the three ethnic groups?

Praxis Tests (All Audiences)

Deans

- Does the college/school of education currently have any programs that are specifically designed to help students prepare for Praxis tests?
    - If yes, please describe what is being done.
- What is the college/school of education faculty's role in preparing students for the Praxis tests?
- To what extent have students and faculty from your college/school of education participated in the ETS Praxis Workshop Program?
- To your knowledge, what percentage of the faculty in your college/school of education has taken the Praxis test themselves?
- How are you using the Institutional Score Report that ETS provides to inform your Praxis preparation and intervention strategies? PROBE if not mentioned: We are particularly interested in how you use the detailed category score information and the detailed score information by quartile. Can you describe how you use these sections of the report?
- To what extent do faculty in your college/school of education make use of the resources on the ETS website, specifically Tests at a Glance (TAAGs)? Are they used elsewhere in your college/school of education? If yes, please describe how.

- To what extent do faculty in your college/school of education make use of the Praxis Study Guides? Are they used elsewhere in your college/school of education? If yes, please describe how.
- To what extent do faculty in your college/school of education make use of the Praxis Diagnostic Preparation Program? Are they used elsewhere in your college/school of education? If yes, please describe how.

Department Chairs and Center Directors

- Does the center/department currently have any programs that are specifically designed to help students prepare for Praxis tests?
    - If yes, please describe what is being done.
- What is the center/department faculty's role in preparing students for the Praxis tests?
- To what extent have students and faculty from your center/department participated in the ETS Praxis Workshop Program?
- To your knowledge, what percentage of the faculty in your center/department has taken the Praxis test themselves?
- To what extent do faculty in your center/department make use of the resources on the ETS website, specifically Tests at a Glance (TAAGs)? Are they used elsewhere in your center/department? If yes, please describe how.
- To what extent do faculty in your center/department make use of the Praxis Study Guides? Are they used elsewhere in your center/department? If yes, please describe how.
- To what extent do faculty in your center/department make use of the Praxis Diagnostic Preparation Program? Are they used elsewhere in your center/department? If yes, please describe how.
- How are you using the Institutional Score Report that ETS provides to inform your Praxis preparation and intervention strategies? PROBE if not mentioned: We are particularly interested in how you use the detailed category score information and

detailed score information by quartile. Can you describe how you use these sections of the report?

Faculty

- Do you do anything in your classes that is specifically designed to help students prepare for Praxis tests?
    - If yes, please describe.
    - If yes, do you prepare and present the materials? If not, where do you find the content?
- Have you participated in the ETS Praxis Workshop Program? If yes, how useful was it to you and how can it be improved?
- Have you taken the Praxis exam? Has exposure to the test assisted you in preparing your students for it? Please explain.
- Do you make use of the resources on the ETS website, specifically Tests at a Glance (TAAGs)? If yes, please describe how you use these resources. How useful have you found them to be? How can they be improved?
- Do you make use of the Praxis Study Guides? If yes, please describe how you use these resources. How useful have you found them to be? How can they be improved?
- Do you make use of the Praxis Diagnostic Preparation Program? If yes, please describe how you use these resources. How useful have you found them to be? How can they be improved?
- How are you using the Institutional Score Report that ETS provides to inform your Praxis preparation and intervention strategies? PROBE if not mentioned: We are particularly interested in how you use the detailed category score information and detailed score information by quartile. Can you describe how you use these sections of the report?

Students

- How many of you have had both Praxis I & II? All the rest of you have taken Praxis I, right?
- What steps did you take to prepare yourself for the Praxis test(s)?
- Do you make use of the resources on the ETS website, specifically Tests at a Glance (TAAGs)? If yes, please describe how you use these resources. How useful have you found them to be? How can they be improved?
- What support did you receive in preparing to take the test?
- What additional support would you like to have had?
- How comfortable were you when you took the Praxis test? Did you feel confident that you could handle the material on the test? Or did you feel anxious about it?
- For those you who felt anxious about the test, what do you think could have helped to reduce your anxiety?
- What areas of the test(s) did you find were most difficult?
- Why do you think there is an achievement gap between minority and White students?
- What suggestions would you have for our organizations as we attempt to develop programs designed to close the achievement gaps between the majority populations and the three ethnic groups?

Final Thoughts and Other Issues (All Audiences)

Before we conclude our discussion, are there any other issues or challenges that the college/school of education is facing, especially in relation to the performance of African-American, Hispanic, and Native American students that we haven't discussed?

- If yes, what are they and how are you meeting those challenges?

Closing (All Audiences)

Thank you very much for your time. Please feel free to contact us if you have any questions or would like to continue our discussion.

Appendix G

Lloyd Bond Findings and Recommendations

An HBCU steering committee, made up of 10 HBCU presidents, commissioned Lloyd Bond, Senior Scholar at the Carnegie Foundation for the Advancement of Teaching, to visit several HBCU campuses in 2003–2004 in order to investigate student performance on Praxis tests. Bond and colleagues administered Praxis items informally to a group of students on each campus. Following the administration, he asked the students to describe their solution strategies, in order to better understand the ways that African American students process test content. Specifically, the intent was to examine the extent of students' declarative (recall of facts) and procedural (application) knowledge and skills in key areas measured by Praxis I.

Bond's summary findings and recommendations from his previously unpublished research appear below.

Findings

- Students' responses to sample items indicated the typical problems associated with taking standardized tests: test anxiety; lack of time-management skills; lack of familiarity with the content, format, and purpose of standardized tests; a tendency to either misread items, read too much into items, or failure to read items fully and carefully; and a tendency to miss key words and phrases.
- For reasons not yet completely understood, the knowledge that many students possessed about arithmetic, algebra, and basic geometry was largely inert knowledge that was unusable in problem solving. While several students could recall many of the basic concepts associated with the series of problems used in the exercise, there appeared to be a disconnect between their ability to recall facts and their ability to bring the concepts forward in an integrated way to perform basic math operations.
- Many students who were unsure of their own knowledge and skill, substituted "close enough" for the "correct solution." In other words, many confused estimation problems with problems that required a unique, correct answer.
- Many students were seriously inefficient in their test-taking strategies. They tended to spend inordinate amounts time on subproblems of the main problem that should have required seconds of mental arithmetic instead of becoming major digressions.

Students were not comfortable with mental arithmetic. Most students relied on a step-by-step approach to solving math problems. This strategy is probably a direct result of the culture of teaching that has traditionally valued a student's ability to demonstrate an understanding of all steps required to solve a math problem. This approach, however, runs counter to the testing culture, which requires efficiency in responding to math items. For example, students struggled with items requiring no more than estimation or rounding and they tended to know only one way to solve a math problem. Many of the students were so far removed from their high school math courses (and so little practiced in routinely doing mental calculations) that they had not "automated" simple procedures such as the times tables.

- Frequently, we encountered considerable anger at the entire process—some of it directed at the test, some directed at the faculty and institution, and some simply diffused. There may be no easy solution to this problem, but students must be made to realize that the tests are a hurdle that they themselves must jump. Blaming others will get them nowhere.

Recommendations

Bond urged institutions to find ways to strengthen their students' basic skills in math, writing, grammar, and reading comprehension that are needed for Praxis I. Additionally, he felt that students must be made to understand that facility with these skills is not optional if they wish to teach. In relation specifically to testing, he found that students needed more practice with the kinds of items included in the tests they will take and that they needed to develop realistic views about the purposes, content, format, and demands of these standardized tests. It is essential, he noted, that educators find ways to help students internalize commonly known test-taking skills—legitimate cognitive abilities, not tricks—that have grown out of the paper-and-pencil testing culture. The students' reliance on a step-by-step approach to math problems, failure to mark key words and phrases in reading passages, lack of guessing strategies, etc., are indicative of the need for such internalization. Finally, Bond called for a deepening of faculty understanding of the tests, resulting ultimately in solutions at the curriculum and faculty level.