

# Examinee and High School Senior Performance on the GED Tests

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GED® Testing Service

One Dupont Circle NW, Suite 250

Washington, DC 20036-1163

(202) 939-9490

Fax: (202) 659-8875

[www.gedtest.org](http://www.gedtest.org)

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Examinee and High School Senior Performance on the GED® Tests

Carol E. George-Ezzelle

Yung-chen Hsu

GED® Testing Service of the American Council on Education

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## Examinee and High School Senior Performance on the GED® Tests

The 2002 Series Tests of General Educational Development (GED®) provide adults who did not complete a formal high school program the opportunity to certify their attainment of high school-level academic knowledge and skills at a level that surpasses that of 40 percent of traditional graduating high school seniors. Passing the GED battery of five content area tests and obtaining a state's high school credential or diploma promotes access to further education, better jobs, and the achievement of personal goals. The tests are administered at more than 3,200 Official GED Testing Centers throughout the U.S., Canada, and U.S. insular areas<sup>1</sup>. Since 2002, 600,000 to 700,000 candidates have taken the GED Tests each year; approximately 70 percent earn their state's high school credential or diploma by passing the GED Tests and meeting the eligibility requirements set by their state, territory, or province.

A question often asked by adult educators, administrators, teachers, admissions officers, and employers is “How does the performance of adults who take the GED Tests and/or hold a GED Tests credential compare with the performance of graduating high school seniors?” The purpose of the analyses reported here was to compare performance on the GED Tests, U.S. edition, across three groups of examinees: (a) graduating high school seniors in the GED Tests U.S. 2001 norm group, (b) GED Tests candidates who took one or more tests in the U.S. in 2002-2004, and (c) GED Tests candidates who passed the tests in the U.S. in 2002-2004. By comparing graduating high school seniors and GED Tests examinees, this report provides evidence of the academic value of the

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<sup>1</sup> Insular areas include American Samoa, Guam, the U.S. Virgin Islands, the Commonwealth of the Northern Mariana Islands, the Federated States of Micronesia, the Republic of the Marshall Islands, and the Republic of Palau.

GED Tests credential. This report also identifies several academic content and cognitive levels in which GED Tests examinees are likely to have difficulties.

Performance of the three groups was compared through comparison of standard scores, percentile rank distributions, and item difficulty statistics for the tests and each of the content and cognitive levels measured by the GED Tests. The results should be useful primarily to employers and admissions officers evaluating applicants who have a credential based on passing the GED Tests. Additionally, adult education administrators and teachers should find this information useful when planning and developing instructional programs for GED Tests candidates.

#### Description of the GED® Tests, U.S. Edition

The 2002 Series GED Tests reflect current high school curricula as well as content relevant to the workplace and community. This test series is the fourth edition in the 60-year history of the program. The previous editions were released in 1942, 1978, and 1988. The 2002 Series GED Tests, U.S. edition, reflect the standards developed at the national and state levels and those recommended by panels of experts representing the core academic disciplines of language arts, social studies, science, and mathematics.

The battery contains primarily multiple-choice items and has five content area tests: Language Arts, Writing, 50 multiple-choice items and an essay; Language Arts, Reading, 40 multiple-choice items; Social Studies, 50 multiple-choice items; Science, 50 multiple-choice items; and Mathematics, 40 multiple-choice items and 10 alternate format items. Success on the GED Tests requires the use of higher-order thinking skills quite similar to those identified in Bloom's taxonomy's as analysis, synthesis, and evaluation. These higher-level skills rely on the lower-order thinking skills of knowledge,

comprehension, and application. The contexts used to test these skills are designed to be relevant to adults, to be as practical and realistic as possible, and to reinforce key themes of global awareness and the impact of technology.

### *Language Arts, Writing*

The Language Arts, Writing Test has two parts. Part I requires candidates to demonstrate the ability to revise and edit workplace and informational documents. Part II assesses the candidate's ability to write an essay. The total time limit for this test, Parts I and II, is 120 minutes (75 and 45 minutes is recommended, respectively). A single score is reported that is based on the combination of both parts (the essay is weighted as approximately one-third of the total writing score).

The content areas in Part I of the Language Arts, Writing Test include organization (15 percent), sentence structure (30 percent), usage (30 percent), and mechanics (25 percent). The Part I questions are classified by the following question types: correction (45 percent), revision (35 percent), and construction shift (20 percent). The subject matter includes those topics with which the candidate is likely to be familiar. Part I passages are based on these types of documents: workplace and community documents that are part of an adult's everyday environment, "how to" texts that are documents providing instructions or directions, and informational texts that are documents providing an analysis of a particular topic.

In the Language Arts, Writing Test, Part II, candidates are provided with a single topic that asks them to present an opinion or an explanation regarding a situation about which adults would be expected to have some general knowledge. The topics are specifically chosen by GEDTS because they are found to be potentially interesting and

meaningful to writers and have desirable score distributions based on field-testing. No specialized knowledge is required in order to respond to a topic. Each essay is scored holistically on a four-point scale by two trained readers; a third reader also scores the essay if the first two readers' scores differ by more than one point.

### *Social Studies*

The Social Studies Test, U.S. edition, measures a candidate's skill in understanding, interpreting, and applying key history, geography, economics, and civics concepts and principles to visual and written academic and workplace contexts. It includes questions in each of the following areas: history (40 percent: national 25 percent; world 15 percent), geography (15 percent), civics and government (25 percent), and economics (20 percent). The Social Studies Test requires candidates to use higher-level thinking skills, which often require prior knowledge of important social studies concepts, principles, events, and skills. Questions are loosely based on four of the cognitive levels of Bloom's taxonomy: comprehension (20 percent), application (20 percent), analysis (40 percent), and evaluation (20 percent) skills.

Approximately 60 percent of the Social Studies Test questions relate to concepts and issues taken from a global or international perspective, and 40 percent address specific national settings. All Social Studies Test questions are multiple-choice questions based on one of the following three types of source materials: written text (40 percent), visual text (40 percent), and written and visual text (20 percent).

### *Science*

The Science Test measures the candidate's skill in understanding, interpreting, and applying concepts of physics, chemistry, life science, and earth and space sciences to visual and written text from academic and workplace contexts. The questions are based

on three of eight broad content area standards for grades 9–12 outlined by the National Science Education Standards. The content areas included are (a) life science (45 percent), (b) the physical sciences of chemistry and physics (35 percent), and (c) earth and space science (20 percent). The Science Test also supports the remaining five National Science Education Standards: unifying concepts and processes, science as inquiry, science and technology, science in social and personal perspectives, and history and nature of science. Questions are loosely based on four of the cognitive levels of Bloom’s taxonomy: comprehension, application, analysis, and evaluation skills.

Up to 60 percent of the questions on the Science Test are based on visual text (e.g., graphs, tables, charts, and diagrams); the remaining 40 percent are based on written text. Approximately 25 percent of all the questions on the Science Test are grouped into sets that are based on a visual or written text.

### *Language Arts, Reading*

The Language Arts, Reading Test is a passage-based, multiple-choice test that measures a candidate’s ability to comprehend and interpret workplace and literary reading selections and to apply those interpretations to new contexts. Within each test, 75 percent of the passages are literary texts and 25 percent are nonfiction texts. Literary texts include at least one selection from each of the following areas: poetry, drama, prose fiction published before 1920, prose fiction published between 1920 and 1960, and prose fiction published after 1960. Nonfiction texts include two selections representing two of the three following areas on a rotating basis: general nonfiction, critical reviews of visual and performing arts, and workplace and community documents.

The multiple-choice questions on the Language Arts, Reading Test are loosely based on four of the cognitive levels of Bloom's taxonomy: comprehension (20 percent), application (15 percent), analysis (30–35 percent), and synthesis (30–35 percent). As would be expected in high school instruction, higher cognitive levels receive more emphasis.

### *Mathematics*

The Mathematics Test is divided into two equally weighted parts. Each part consists of 25 questions and allows the candidate 45 minutes of total test time. On Part I, the candidate may use the Casio *fx-260* calculator to compute answers. A calculator is provided for each candidate at the Official GED Testing Center. Because estimation and mental math are critical skills, use of a calculator is not permitted on Part II of the test. A math formulas page is provided as a reference for the candidate during the test.

Four major content areas are tested on the Mathematics Test. Each area includes approximately 20–30 percent of the questions. The content areas are number operations and number sense; measurement and geometry; data analysis, statistics, and probability; and algebra, functions, and patterns. Cognitive skills are tested through the use of questions at the following levels: procedural (20 percent), conceptual (30 percent), and application/modeling/problem solving (50 percent).

Eighty percent of the mathematics questions are multiple choice, and the remaining (20 percent) questions require candidates to construct an answer. For these constructed-response questions, the candidates must record answers on either standard or coordinate plane grids. Both parts of the Mathematics Test have multiple-choice, standard grid, and coordinate plane grid questions. Question sets, items related to a

common stimulus, constitute approximately 25 percent of the questions on the Mathematics Test. Visual text formats are used in approximately 50 percent of the questions.

### Reporting of GED® Test Battery Results

GED Test Battery results are reported as standard scores and percentile ranks. Standard scores and percentile ranks have been used since the beginning of the GED testing program to relate the level of achievement for an individual GED Tests candidate to that demonstrated by recent high school graduates. The normalized standard score scale for U.S. editions of the GED Tests in this report is based on the performance of U.S. graduating high school seniors in the 2001 norm group. The score scale ranges from a minimum of 200 to a maximum of 800 and has a mean of 500 and a standard deviation of 100. Half of the seniors earn standard scores above 500 and half earn scores at or below 500, about two-thirds of all U.S. graduating high school seniors earn standard scores between 400 and 600, and standard scores lower than 300 or higher than 700 are earned by only about 2 percent of graduating high school seniors.

Norms, or normative scores, refer to scores that provide information about an examinee's performance in comparison to the score distribution of a reference group or norm group (Crocker & Algina, 1986). Examinees taking the GED Tests are provided with percentile ranks that describe their test performance in comparison to that of graduating high school seniors. It is important to maintain norms that reflect the performance of recent high school graduates. The norms are reestablished with every new test series that represents a change in content and often within a test series because of perceived changes in the achievement levels of graduating high school seniors. Since its

inception, the GED Tests have undergone norming studies conducted in 1943, 1955, 1967, 1977, 1980, 1987, 1996, and 2001. Each establishment of new norms reflected a new set of standards met when passing the GED Tests and obtaining a GED Tests credential. A norming study will be conducted within the 2002 Series GED Tests in 2007. Test scores reported to GED Tests candidates are based on the performance of graduating high school seniors from the most recent norming study. Therefore, the standard scores and percentile ranks for all English-language GED Tests, U.S. edition, taken between January 1, 2002, and December 31, 2007, are based on the performance of U.S. graduating high school seniors in 2001.

Each state, province, territory, and insular area establishes its own eligibility and minimum score requirements for issuance of their high school credentials based on passing the GED Tests. However, the American Council on Education (ACE), the parent organization of GED Testing Service, requires that passing score requirements be set at a minimum battery total standard score of 2,250 (corresponding to an average of at least 450) and a minimum individual test standard score of 410 on each of the five tests in the battery. This requirement, which took effect January 1, 2002, represents the reasoned judgment by ACE that passing score requirements should be neither so high as to represent levels of achievement far above that demonstrated by recent high school graduates (and, as such, arbitrarily unfair to adult candidates) nor so low as to threaten the credibility of the GED Tests credential. It is estimated that 60 percent of graduating high school seniors would pass the GED Test Battery on their first attempt. For purposes of college admissions and employer requirements, high school credentials based on passing the GED Tests are accepted by an estimated 76 percent of colleges and

universities (College Board, n.d.) and 90 percent of U.S. employers (Society for Human Resource Management Online Poll Results, 2002).

## Method

### *Samples*

Three groups of examinees were included in the analyses: (a) graduating high school seniors in the GED U.S. 2001 norm group, (b) GED Tests candidates—adults who took one or more GED Tests in the U.S. in 2002-2004, and (c) GED Tests passers—i.e., candidates who passed the GED Tests in the U.S. in 2002-2004. These samples are described in detail below.

*Graduating high school seniors.* The sample of seniors used in this study included graduating high school seniors who were assigned to take newly developed, full-length GED Test(s) in the 2001 U.S. standardization/norming study and the 2002 and 2003 equating studies; the studies included only seniors who were expected to graduate in their senior year. The sample for the 2001 standardization/norming study was obtained through a two-stage stratified random sampling process. The two stages consisted of sampling schools and then students within schools. This procedure ensured that the makeup of the norm group sufficiently represented graduating high school seniors in the U.S. The 2001 sample included 359 schools and over 10,000 graduating high school seniors. Because the standards of performance required to pass the GED Tests must remain consistent over time, new test forms were administered in equating studies in order to statistically link the performance on new GED Tests forms to the performance of the original norm group. Each equating study used a stratified random sample to represent graduating high school seniors across the nation. The 2002 equating study included 148 schools and over 4,700

graduating high school seniors, and the 2003 equating study included 157 schools and over 5,100 graduating high school seniors.

Test results were excluded from the analyses if the senior test record indicated the senior (a) participated in the study but was administered a test other than a newly developed, full-length GED Test (e.g., a half-length GED Test or anchor form), (b) did not attempt their assigned test(s) (i.e., responded to less than one third of the items), or (c) obtained a raw score of zero on a test. The numbers of graduating high school seniors included in the analyses and who tested in the 2001-2003 studies are located in Table 1. In contrast to the GED Tests passer group described next, all seniors included in the analyses had the opportunity to take their assigned GED Test(s) only once.

*GED® Tests candidates and GED® Tests passers.* Two subgroups of GED Tests examinees, candidates and passers, were included in the analyses. GED Tests candidates are those examinees who took one or more GED Tests in the U.S. in 2002-2004 (first-time test scores were used). The GED Tests candidate group included test records from the first time a candidate took any of the five GED Tests in the U.S. in 2002-2004 regardless of whether or not the candidate completed all five tests in the battery; if they had completed all five tests in the battery, they may have either passed or failed the battery. The GED Tests passer group included only candidates who completed and passed all five tests in the battery in the U.S. in 2002-2004; it included test records from the time a candidate scored best on each of the five GED Tests. It follows that some test records in the GED Tests candidate group were also in the GED Tests passer group. GED Tests passers represented 64 to 71 percent of the GED Tests candidate group, depending on test (see Table 1). In contrast to the graduating high school senior group described

previously, GED Tests passers may have tested multiple times on a test(s) in order to pass the test battery.

Test results were excluded from the analyses if the GED Tests examinee test record indicated (a) a testing accommodation was used, (b) the examinee completed a non-English version of the U.S. Demographics survey, (c) the examinee indicated that their information could be not be used for research, (d) item-level data and verifiable raw scores<sup>2</sup> were not available, or (e) a standard score associated with the test was outside the valid range of 200 to 800; however, standard scores of 0 for the Language Arts, Writing Test were included in the analyses and represent cases where an examinee scored too low on the essay to produce a standard score. The numbers of GED Tests candidates and GED Tests passers included in the analyses that tested in 2002-2004 and met the above criteria are located in Table 1.

TABLE 1  
Number of Graduating High School Seniors, GED Tests Candidates, and GED Tests passers

GED Test	Seniors	GED Tests candidates	GED Tests passers
	N	N	N (%)
Language Arts, Writing	4,385	1,260,837	823,628 (65%)
Social Studies	3,910	1,285,131	823,628 (64%)
Science	2,636	1,275,890	823,628 (65%)
Language Arts, Reading	4,343	1,294,953	823,628 (64%)
Mathematics	4,153	1,153,278	823,628 (71%)

### *Demographics*

A demographic survey was administered to the graduating high school seniors and GED Tests examinees. Information on the seniors', GED Tests candidates', and GED Tests passers' gender and race/ethnicity is presented in Table 2.

<sup>2</sup> It is estimated that the data available for GED Tests examinees represented approximately 92-93% of the population data; the states that were affected by the selection criteria and therefore may be underrepresented in the analyses include Connecticut, Florida (Mathematics Test only), Indiana, Ohio, Vermont, California, New Jersey, Arizona, and Illinois.

The demographic survey also collected self-reported information on the number of years of high school study in five subject areas (English literature, English composition, social studies, science, and mathematics) and the typical grades received in those areas. The percentage of seniors who did not report their years of high school study or typical grades received ranged from 7 to 12 percent for seniors, 30 to 43 percent for GED Tests candidates, and 26 to 42 percent for GED Tests passers. The average of the reported number of years of high school study across the 5 subject areas was higher for seniors vs. both GED Tests candidates and passers (3 years vs. 2 years). The most frequently reported number of years of study in each subject area was also higher for seniors vs. GED Tests candidates (4 years for seniors, except for science, where it was 3 years, vs. 2 years for candidates, except for English literature where it was 1 year). GED Tests passers' most frequently reported years of study were the same as those reported by GED Tests candidates, with the exception of English literature: 3 years vs. the candidates' 2 years. The most frequently reported typical grade received in each of the five subject areas was "B" for seniors and "C" for GED Tests candidates and GED Tests passers. In summary, seniors were more likely to have completed more years of high school and earn higher grades in courses than GED Tests candidates or GED Tests passers. These results were within expectations given that the highest grade completed was 11th or less for over 90 percent of GED Tests candidates (GED Testing Service, 2002a, 2003, 2004) and that several studies have reported GED Tests candidates often drop out of high school because of academic difficulties (George, Schaefer, & Rao, 2003; George-Ezzelle, Zhang, & Douglas, 2006; Song & George-Ezzelle, 2006).

TABLE 2  
 Percentage of High School Seniors, GED Tests Candidates, and GED Tests Passers by Gender and Race/Ethnicity

	Seniors (N = 12,623)	GED Tests candidates (N = 1,380,563)	GED Tests passers (N = 823,628)
Gender			
Male	44.9	55.5	57.7
Female	48.4	42.7	41.3
Missing	6.7	1.8	1.0
Race/Ethnicity			
Hispanic	10.0	15.9	14.1
White	64.5	51.3	58.3
African American	12.9	19.3	14.5
Asian	2.2	1.6	1.5
American Indian or Alaskan Native	0.9	2.4	2.2
Native Hawaiian or Pacific Islander	0.7	0.5	0.5
Other	1.9	--	--
Missing	6.9	9.0	9.0

## Results

### *Test Performance*

*Percentile ranks and standard scores.* Raw scores (number of items correctly answered) earned on the GED Tests were converted to standard scores. Each standard score has a percentile rank associated with it. The percentile rank of a standard score indicates the percentage of persons in a particular group scoring at or below that standard score. The standard score-to-percentile rank conversions reported to GED Tests examinees are based on the performance of graduating high school seniors in the 2001 standardization/norming study. However, the percentile ranks used in this report to compare the graduating high school senior performance to GED Tests candidate performance were based on actual GED Tests candidate performance in 2002-2004 and do not correspond to those reported to candidates.

Table 3 compares the percentile ranks based on graduating high school senior performance in 2001 (column two) to percentile ranks based on actual GED Tests candidate performance in 2002-2004. Based on Table 3, if a GED Tests candidate earned a standard score of 450 on the Language Arts, Writing Test, the percentile rank reported would be 31, indicating that about 31 percent of the U.S. high school norm group earned standard scores at or below 450 (see first two columns). However, a standard score of 450 on the Language Arts, Writing Test had a corresponding percentile rank of 44 within the GED Tests candidate sample, indicating that about 44 percent of GED Tests candidates earned standard scores at or below 450 (see third column). Table 3 also presents the mean and median GED Test and battery average standard scores. On average graduating high school seniors performed better than GED Tests candidates on the Language Arts, Writing and Mathematics Tests.

Table 3  
 Comparison of Percentile Ranks\* (PR) Based on GED Tests Candidate Performance and  
 Graduating High School (HS) Senior Performance

Standard score	HS PR	GED Tests candidates					
		Language Arts, Writing**	Social Studies	Science	Language Arts, Reading	Mathematics	Battery average
800	99	99+	99+	99+	99+	99+	99+
750	99	99	98	98	95	99	99+
700	98	98	97	97	91	98	99
650	93	96	93	92	84	96	97
600	84	93	87	85	74	93	89
550	69	83	72	70	61	89	75
500	50	67	48	43	46	70	51
450	31	44	24	22	21	46	23
410	18	20	11	10	9	26	8
350	7	6	2	1	1	7	1
300	2	6	1	1	1	2	1
250	1	6	1	1	1	1	1
200	1	6	1	1	1	1	1
Mean	500	459	514	519	539	467	509
SD	100	133	87	86	107	87	73
Median	500	460	510	520	520	460	500

\* Percentile ranks for individual GED Tests were calculated using the GED Tests candidate sample and percentile ranks for the battery average were calculated using GED Tests candidates who completed the battery (first-time test scores were used).

\*\* Percentile ranks for the Language Arts, Writing Test included standard scores of 0; this represents the case where an examinee scored too low on the essay to produce a standard score.

Table 4 compares standard scores that corresponded to selected percentile ranks for graduating high school seniors and GED Tests candidates. For example, in row 6 of Table 4, the standard scores that corresponded to a percentile rank of 75 for GED Tests candidates are Language Arts, Writing: 530, Social Studies: 570, Science: 560, Language Arts, Reading: 610, and Mathematics: 510. In comparison, the standard score corresponding to a percentile rank of 75 for graduating seniors is 550 for each test (for the U.S. editions of the GED Tests, the score scales were derived so that a standard score of 550 has the same percentile rank on each test). Graduating high school seniors' higher standard scores associated with a percentile rank of 75 for the Language Arts, Writing

and Mathematics Tests indicated that higher performance was exhibited by seniors than candidates on those tests.

Table 4  
 GED Tests Standard Scores\* Corresponding to Selected Percentile Ranks (PR) for Graduating High School (HS) Senior Norm Group and GED Tests Candidates

PR	HS Battery average estimate	GED Tests candidates					Battery average
		Language Arts, Writing**	Social Studies	Science	Language Arts, Reading	Mathematics	
99	700	710	800	760	800	740	700
95	640	620	660	670	750	630	640
90	610	580	620	630	700	570	610
85	580	560	600	600	660	540	590
80	570	540	580	580	620	530	570
75	550	530	570	560	610	510	560
67	530	500	540	550	570	500	540
60	520	490	530	540	550	480	520
50	500	460	510	520	520	460	500
40	450	450	490	500	490	440	490

\* Standard scores for individual GED Tests were calculated using the GED Tests candidate sample and standard scores for the battery average were calculated using GED Tests candidates who completed the battery (first-time test scores were used).

\*\* Percentile ranks for the Language Arts, Writing Test included standard scores of 0; this represents the case where an examinee scored too low on the essay to produce a standard score.

A closer inspection of Tables 3 and 4 reveals that those GED Tests candidates who completed the test battery – regardless of whether they passed – performed better than graduating high school seniors on the test battery as a whole. This was evidenced in the second and last columns of Table 3 that indicate 75 percent of GED Tests candidates vs. 69 percent of seniors earned an average score of 550 or lower on the test battery. Similarly, only 8 percent of GED Tests candidates vs. 18 percent of seniors earned a battery average score of 410 or lower. One of the largest differences in score distributions was in the Language Arts, Reading Test where candidates earned higher scores than seniors. Based on the comparison of high school senior and candidate percentile ranks in Table 3, a greater percentage of GED Tests candidates earned Language Arts, Reading

Test scores equal to or less than a standard score than did graduating high school seniors. On the other hand, in the Mathematics Test, seniors generally earned higher scores than candidates. There was a greater percentage of GED Tests candidates that earned Mathematics Test scores equal to or higher than 410 than did graduating high school seniors.

*Item difficulties (p-values).* Mean item difficulties, or  $p$ -values, for each of the five GED Tests for graduating high school seniors, GED Tests candidates, and GED Tests passers are presented in Table 5. Mean  $p$ -values for each test represent the mean percent correct for the items found across the nine test forms administered to seniors and GED Tests examinees during the years incorporated into this study. For example, graduating high school seniors participating in studies during 2001-2003 correctly answered a mean of 68 percent of the 450 Language Arts, Writing Test items administered during those years. For the same set of Language Arts, Writing Test items administered to GED Tests examinees in 2002-2004, GED Tests candidates correctly answered a mean of 74 percent of the items, and GED Tests passers correctly answered a mean of 80 percent of the items. The most difficult GED Tests, those with the lowest mean  $p$ -values or percent correct for graduating high school seniors, were the Mathematics, Social Studies, and Science Tests. The most difficult tests for GED Tests candidates and passers were the Mathematics, Social Studies, and Language Arts, Writing Tests.

Table 5 also presents the standard deviation of the mean  $p$ -value for each test for each group. The standard deviation is a measure of the variability of the mean percent correct for the items across the nine test forms. For example, the mean  $p$ -value for the

Science Test was 65 and some individual item Test  $p$ -values were greater than 65 and some were lower. The standard deviation is a measure of the average distance of an individual item's  $p$ -value from the mean  $p$ -value. From Table 5's GED Tests passer column, it is shown that there was more variability in the Mathematics Test's individual item  $p$ -values than for any other test. This is an indication that, for this group on this test, the percent correct for individual items was more spread out around the mean percent correct than for the other four tests.

The standard error of each mean  $p$ -value was calculated by dividing the standard deviation by the square root of the number of items in each respective test. The standard error was then used in calculating 99 percent confidence intervals for the mean  $p$ -values. The values under the 99 percent confidence interval column indicate the range within the population mean value would be expected to be found 99 percent of the time. If two groups' confidence intervals for a test did not overlap, the performance difference between the groups was statistically significant at the .01 level. This indicates the observed difference in performance would not be expected to occur by chance more than one time in one hundred assuming the samples came from the same population. From this point forward, all performance differences refer to those at the .01 level of statistical significance.

In comparing groups' performance, GED Tests candidates correctly answered a statistically significant greater percentage of items than seniors (6 to 10 percent more) on the Language Arts, Writing; Social Studies; Science; and Language Arts, Reading Tests. Seniors correctly answered a statistically significant greater percentage (4 percent more) of Mathematics Test items than GED Tests candidates but a statistically significant

smaller percentage (5 percent less) of items than GED Tests passers. Across all tests, GED Tests passers correctly answered 6 to 9 percent more items than GED Tests candidates, and 5 to 16 percent more items than seniors.

### *Content and Cognitive Level Performance*

Content and cognitive level performance analyses were conducted to further explore the question of “How does the performance of adults who take the GED Tests and/or hold a GED Tests credential compare with the performance of graduating high school seniors?” Mean item difficulties, or  $p$ -values, in content and cognitive levels measured by the GED Tests, were calculated for graduating high school seniors, GED Tests candidates, and GED Tests passers. Mean  $p$ -values in content and cognitive levels represent the mean percent correct on the content or cognitive level items across the nine test forms administered to seniors and GED Tests examinees during the years incorporated into this study. The standard deviation and 99 percent confidence interval in each content and cognitive level were also obtained for each group. Results are presented in Tables 6 through 10. If two groups’ confidence intervals for a test did not overlap, the performance difference between the groups was statistically significant at the .01 level. This indicates the observed difference in performance would not be expected to occur by chance more than one time in one hundred, assuming the samples came from the same population. All performance differences refer to those at the .01 level of statistical significance.

When comparing performance on the GED Tests across groups, it is important to note that any given test represents a sample of possible test items that could have been

Table 5  
 GED Tests Mean *p*-values, 99% Confidence Intervals (CI), and Standard Deviations (*SD*) for Graduating High School (HS) Seniors, GED Tests Candidates, and GED Tests Passers

Forms	<i>k</i>	HS seniors			GED Tests candidates			GED Tests passers		
		Mean	99% CI	<i>SD</i>	Mean	99% CI	<i>SD</i>	Mean	99% CI	<i>SD</i>
Language Arts, Writing	450	68	66-69	12	74	73-76	15	80	79-82	14
Social Studies	450	64	62-65	14	72	70-74	14	78	77-80	13
Science	450	65	63-67	14	75	73-76	14	81	79-82	13
Language Arts, Reading	360	70	69-72	12	79	77-80	12	85	83-86	11
Mathematics	450	65	64-67	12	61	59-63	16	70	68-72	17

*k* = number of items.

Note: Nonoverlapping CIs indicate statistical significance at the .01 level.

used to measure achievement in that particular area. In constructing the GED Tests, items were permitted to vary somewhat in difficulty from one content and cognitive level to another. Therefore, when the study results indicate that for a single group of examinees, one set of items (e.g., reading nonfiction critical review items) is more difficult than another (e.g., reading poetry items), it should not be concluded that the group was less prepared in the former area. A different set of items measuring the content or cognitive level may have produced different results. For this reason, *p*-values (i.e., percent correct values) can be used to compare the performance of two or more groups, but cannot be used to compare the achievement levels of a single group across content or cognitive levels.

Based on the results in Tables 6 through 10, the most difficult content area items for graduating high school seniors on average, or those with the lowest mean *p*-values, were observed in the content areas of writing organization, world history, reading nonfiction critical reviews, and measurement/geometry. The most difficult content areas for GED Tests candidates and passers were all of the content areas in the Mathematics Test and, for seniors, included writing organization. On average, the easiest content area items for all groups were observed in the three reading content areas of poetry, workplace documents, and general nonfiction texts, and in the writing content area of usage.

The most difficult cognitive level items for seniors on average were those in the Social Studies and Science Tests measuring application, analysis, and evaluation, and those in the Mathematics Test measuring application, modeling, and problem solving. The most difficult cognitive level items for GED Tests candidates and passers were, as for seniors, those in the Mathematics Test. On average, the easiest cognitive level items

for all three groups were those measuring comprehension and application in the Language Arts, Reading Test.

In 9 of the 23 content areas and 12 of the 18 cognitive levels measured by the GED Tests, GED Tests candidates correctly answered on average a statistically significant greater percentage of items than graduating high school seniors. Seniors correctly answered a statistically significant greater percentage of items than GED Tests candidates only in the Mathematics Test's content area of algebra, functions, and patterns. GED Tests passers correctly answered on average a statistically significant greater percentage of items than seniors in all content and cognitive levels within each test except in the Mathematics Test where GED Tests passers outperformed seniors at a statistically significant level in only the content areas of number operations and number sense; data analysis, statistics, and probability; and the conceptual cognitive level.

*Language arts, writing.* The writing content areas that were on average the easiest and hardest for seniors were also the easiest and hardest for GED Tests candidates and GED Tests passers (see Table 6). For all groups, the most difficult content area was organization and the easiest was usage. On average, GED Tests candidates correctly answered 5 to 8 percent more content area items and 6 to 8 percent more cognitive level items than seniors. GED Tests passers correctly answered on average 10 to 15 percent more content area items and 11 to 15 percent more cognitive level items than seniors. Confidence intervals around the mean content and cognitive level  $p$ -values for the three groups are also presented in Table 6. The percentage of items correctly answered on average by GED Tests candidates was greater than the percentage of items correctly answered on average by the seniors except in the content area of organization and the

cognitive level of construction shift. Furthermore, GED Tests passers outperformed seniors in all content and cognitive levels and GED Tests candidates on the cognitive level items measuring correction.

*Social studies.* On average, the content areas of world history, national history and civics and government were the most difficult and economics and geography were the easiest for all groups. The cognitive levels of application were the hardest on average for all groups. GED Tests candidates correctly answered on average 5 to 10 percent more content area items and 7 to 10 percent more cognitive level items than seniors. GED Tests passers correctly answered on average 11 to 17 percent more content area items and 14 to 16 percent more cognitive level items than seniors. Confidence intervals around the mean social studies content and cognitive level  $p$ -values for the three groups are also presented in Table 7. The percentage of items correctly answered on average by GED Tests candidates was greater than the number of items correctly answered on average by the seniors except in the content areas of world history and geography and the cognitive level of application. Furthermore, GED Tests passers outperformed seniors in all content and cognitive levels and GED Tests candidates on the cognitive level items measuring analysis.

*Science.* For all groups, the most difficult content area on average was chemistry, and the easiest was life science. Items measuring the cognitive level of evaluation were on average the most difficult, and those measuring comprehension were the easiest. GED Tests candidates correctly answered on average 7 to 10 percent more content area items and 8 to 11 percent more cognitive level items than seniors. GED Tests passers correctly answered on average 13 to 17 percent more content area items and 14 to 17 percent more

cognitive level items than seniors. Confidence intervals around the mean science content and cognitive level  $p$ -values for the three groups are also presented in Table 8. The number of items correctly answered on average by GED Tests candidates was greater than the number of items correctly answered on average by the seniors except in the content areas of chemistry and the cognitive level of evaluation. GED Tests passers outperformed seniors in all content and cognitive levels and outperformed GED Tests candidates on items in the life science content area and the analysis cognitive level.

*Language arts, reading.* On average, the content areas of nonfiction critical review and drama were the most difficult for all groups. Reading poetry and workplace documents were the easiest content areas for all groups. Items measuring the cognitive levels of analysis and synthesis were on average the most difficult for all groups. GED Tests candidates correctly answered on average 6 to 15 percent more content area items and 7 to 9 percent more cognitive level items than seniors. GED Tests passers correctly answered on average 10 to 21 percent more content area items and 13 to 14 percent more cognitive level items than seniors. Confidence intervals around the mean reading content and cognitive level  $p$ -values for the three groups are also presented in Table 9. The number of items correctly answered on average by GED Tests candidates was greater than the number of items correctly answered on average by the seniors in all cognitive levels but only one content area: prose fiction. GED Tests passers outperformed seniors in all content and cognitive levels and GED Tests candidates on items in the prose fiction content area and the analysis and synthesis cognitive levels.

*Mathematics.* In general, and unlike on the other GED Tests, graduating high school seniors performed on average as well as or better than GED Tests candidates on the mathematics content and cognitive levels (see Table 10). On average, the content areas of measurement and geometry, and algebra, functions and patterns were the most difficult for both seniors and GED Tests candidates, and the content area of data analysis, statistics, and probability was the easiest for both groups. For both groups, items at the cognitive level of application, modeling, and problem solving were on average the most difficult and those items at the procedural cognitive level were on average the easiest. Seniors on average correctly answered up to 8 percent more content area items and 2 to 5 percent more cognitive level items than GED Tests candidates. However, there was only one area in which seniors outperformed GED Tests candidates at a statistically significant level: the content area of algebra, functions, and patterns. On the other hand, GED Tests passers outperformed seniors and GED Tests candidates in the content areas of number operations and number sense and data analysis, statistics, and probability as well as on items measuring the conceptual cognitive level.

Table 6  
 Language Arts, Writing Test: Mean  $p$  -values, 99% Confidence Intervals (CI), and Standard Deviations ( $SD$ ) for Graduating High School (HS) Seniors, GED Tests Candidates, and GED Tests Passers

Language Arts, Writing Areas	$k$	HS seniors			GED Tests candidates			GED Tests passers		
		Mean	99% CI	$SD$	Mean	99% CI	$SD$	Mean	99% CI	$SD$
Content Area										
Organization	53	55	51-59	11	63	58-68	14	70	65-75	15
Sentence structure	145	68	65-70	11	74	71-77	14	80	77-83	13
Usage	141	73	71-75	10	81	78-84	12	86	84-89	11
Mechanics	111	68	65-71	11	73	69-76	15	78	74-82	15
Cognitive Level										
Correction	203	67	65-69	12	74	71-76	15	79	77-82	14
Revision	156	70	67-72	11	76	73-79	14	81	78-84	14
Construction shift	91	66	63-70	12	74	70-78	15	81	77-84	14

$k$  = number of items, CI = confidence interval,  $SD$  = standard deviation

Note: Nonoverlapping CIs indicate statistical significance at the .01 level.

Table 7  
 Social Studies Test: Mean  $p$ -values, 99% Confidence Intervals (CI), and Standard Deviations ( $SD$ ) for Graduating High School (HS) Seniors, GED Tests Candidates, and GED Tests Passers

Social Studies Areas	$k$	HS seniors			GED Tests candidates			GED Tests passers		
		Mean	99% CI	$SD$	Mean	99% CI	$SD$	Mean	99% CI	$SD$
Content Area										
World history	65	60	56-65	14	70	65-75	15	77	72-81	14
National history	112	63	59-66	13	70	67-74	14	77	73-80	13
Geography	65	68	63-73	15	73	68-77	14	79	74-83	13
Civics & government	108	63	59-66	14	72	69-76	14	79	75-82	13
Economics	100	66	62-69	14	75	71-78	14	81	78-84	13
Cognitive Level										
Comprehension	97	65	61-69	15	74	70-78	15	80	76-84	14
Application	85	62	58-66	14	69	65-73	14	76	72-79	13
Analysis	175	64	61-66	14	72	69-75	15	79	76-81	14
Evaluation	93	63	60-67	13	73	70-76	11	79	76-82	11

$k$  = number of items, CI = confidence interval,  $SD$  = standard deviation

Note: Nonoverlapping CIs indicate statistical significance at the .01 level.

Table 8  
 Science Test: Mean  $p$ -values, 99% Confidence Intervals (CI), and Standard Deviations ( $SD$ ) for Graduating High School (HS) Seniors, GED Tests Candidates, and GED Tests Passers

Science Areas	$k$	HS seniors			GED Tests candidates			GED Tests passers		
		Mean	99% CI	$SD$	Mean	99% CI	$SD$	Mean	99% CI	$SD$
Content Area										
Life science	210	66	64-68	14	76	73-78	13	82	80-84	13
Physical science - chemistry	60	64	58-69	16	71	66-77	17	77	72-83	16
Physical science- physics	91	64	61-68	12	74	70-77	13	80	76-83	13
Earth & space science	89	64	60-67	13	74	71-78	13	81	77-84	12
Cognitive Level										
Comprehension	150	70	67-73	13	80	77-83	13	85	82-88	13
Application	114	63	60-66	12	71	67-74	14	77	74-81	13
Analysis	150	63	60-66	13	74	71-76	14	80	77-83	13
Evaluation	36	58	52-64	13	68	63-73	11	75	70-79	11

$k$  = number of items, CI = confidence interval,  $SD$  = standard deviation

Note: Nonoverlapping CIs indicate statistical significance at the .01 level.

Table 9  
 Language Arts, Reading Test: Mean  $p$ -values, 99% Confidence Intervals (CI), and Standard Deviations ( $SD$ ) for Graduating High School (HS) Seniors, GED Tests Candidates, and GED Tests Passers

Language Arts, Reading Areas	$k$	HS seniors			GED Tests candidates			GED Tests passers		
		Mean	99% CI	$SD$	Mean	99% CI	$SD$	Mean	99% CI	$SD$
Content Area										
Drama	52	66	62-71	11	74	70-78	11	81	77-85	10
Prose fiction	158	68	65-70	11	77	75-79	12	83	81-85	11
Poetry	52	78	74-82	10	84	80-87	9	88	85-93	8
General nonfiction	56	74	70-78	12	80	76-84	12	86	82-90	11
Nonfiction critical review	10	61	52-71	9	76	66-85	9	82	72-91	9
Workplace	32	75	70-81	12	85	80-90	10	90	86-94	9
Cognitive Level										
Comprehension	73	74	70-77	13	83	79-86	12	88	84-91	11
Application	53	72	68-76	11	81	77-85	11	86	82-90	10
Analysis	117	70	67-72	12	77	74-80	11	83	81-86	10
Synthesis	117	69	66-71	11	77	75-80	11	83	81-86	10

$k$  = number of items, CI = confidence interval,  $SD$  = standard deviation.

Note: Nonoverlapping CIs indicate statistical significance at the .01 level.

Table 10  
 Mathematics Test: Mean  $p$  -values, 99% Confidence Intervals (CI), and Standard Deviations ( $SD$ ) for Graduating High School (HS) Seniors, GED Tests Candidates, and GED Tests Passers

Mathematics Areas	$k$	HS seniors			GED Tests candidates			GED Tests passers		
		Mean	99% CI	$SD$	Mean	99% CI	$SD$	Mean	99% CI	$SD$
Content Area										
Number operations and number sense	126	66	63-68	11	64	61-68	14	73	70-76	14
Measurement and geometry	86	61	57-64	12	54	49-58	17	61	56-66	18
Data analysis, statistics, and probability	122	67	64-70	14	67	64-71	15	76	72-80	15
Algebra, functions, and patterns	116	65	62-68	12	57	53-61	16	65	61-69	17
Cognitive Level										
Procedural	112	70	67-73	12	65	61-70	17	74	70-78	16
Conceptual	124	65	62-67	12	63	59-66	16	71	68-75	16
Application/modeling/ problem solving	214	63	61-65	12	58	55-61	16	66	63-69	17

$k$  = number of items, CI = confidence interval,  $SD$  = standard deviation  
 Note: Nonoverlapping CIs indicate statistical significance at the .01 level.

## Discussion

The results in this report have shown that candidates who passed the GED Tests met and, in many test areas, exceeded performance standards exceeding that of the lower 40 percent of graduating high school seniors. The observed difference in overall performance indicated by the percentile ranks of graduating high school seniors and GED Tests candidates could have been related to several factors. First, GED Tests candidates likely had a heightened awareness of the current minimum standard score requirements and were oriented toward achieving that standard. Unlike candidates who take the GED Tests with the specific objective of earning scores high enough to qualify for a state's high school credential or diploma, graduating high school seniors who participated in the GED Tests studies were unaware of any minimum score requirements at the time they tested. Second, many GED Tests candidates may have pursued instruction or self-study and delayed taking the tests until they were reasonably confident of earning standard scores of 410 on each test and a battery average of 450. Third, the availability of, and for several states, the mandatory passing of, predictive tests (e.g., Official GED® Practice Tests developed by GEDTS) may have contributed to the relatively small number of GED Tests candidates who earned standard scores below 410. Fourth, the group of GED Tests passers used in this study may have tested multiple times, and/or received remedial instruction to achieve higher passing scores but the group of graduating high school seniors took the test(s) only once.

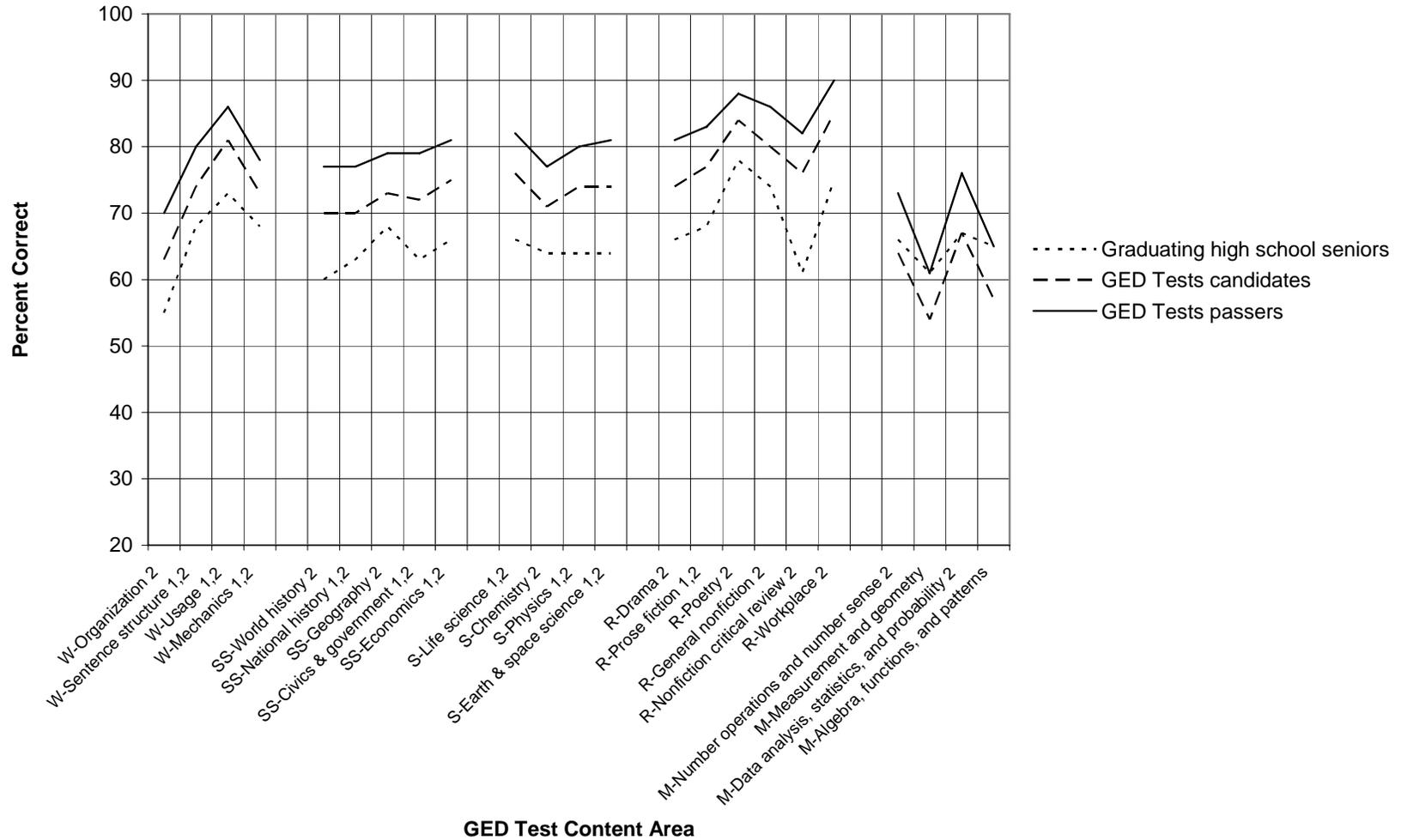
Figures 1 and 2 graphically display the performance via mean  $p$ -values, or percent correct, in content and cognitive levels, respectively, for graduating high school seniors, GED Tests candidates, and GED Tests passers. As noted previously, GED Tests passers

outperformed seniors at a statistically significant level ( $p < .01$ ) in every content and cognitive level in every test except the Mathematics Test. In the Mathematics Test, GED Tests passers outperformed seniors only in the content areas of number operations and number sense and data analysis, statistics, and probability and on items measuring the conceptual cognitive level. Furthermore, candidates outperformed seniors in 9 of the 23 content areas (mainly in writing, social studies, and science) and 12 of the 18 cognitive levels (in every test except the Mathematics Test), and seniors outperformed candidates only in the content area of algebra, functions, and patterns.

If the primary purpose of this report had been to provide a study guide for adult basic educators to apply to their current teaching strategy in order to increase the number of GED Tests examinees passing the GED Tests, an examination of the performance of candidates who scored near the passing scores and below would have been more appropriate. However, based on the overall performance of GED Tests candidates and GED Tests passers, it appears that the two groups differentiated themselves from one another in the following content and cognitive levels: (a) number operations and number sense; (b) data analysis, statistics, and probability; (c) reading prose fiction; (d) life science; (e) conceptual cognitive level within mathematics; (f) application/modeling/problem solving cognitive level within mathematics; (g) analysis (in social studies, science, and reading), (h) synthesis (reading) and (i) correction (writing). Statistically significant higher scores in each of these areas were observed for those candidates who completed and passed the test battery within the study timeframe vs. all candidates' first time scores. Additional or more effective instruction in preparing candidates in these areas may result in better test performance.

Performance differences between GED Tests candidates and graduating high school seniors were found to be generally opposite of performance differences reported in a similar study in 1982 by GED Testing Service. GED Test Battery pass rates from the current report were 77 percent for candidates vs. an expected 60 percent of seniors. Given the minimum score requirements used at the time of the 1982 report, GED Test Battery pass rates were estimated at 62 percent for candidates vs. 69 percent for seniors. The current study attempted to replicate the previous study as much as possible in terms of study design. The observed difference in performance may be due to differences in the educational and demographic background of candidates then and now. For example, of the examinees used in the 1982 report, 5 percent had completed 12th grade and at least 80 percent were employed at the time of testing (Malizio & Whitney, 1981). In contrast, 9 percent of the candidates in this study completed 12th grade or higher and 36 percent indicated they were employed at the time of testing. Furthermore, candidates in this study appeared to be more likely to be out of school fewer years and unemployed at time of testing compared to those in the 1980 study; 45 percent of candidates indicated they had been out of school less than 5 years and 30 percent indicated they were unemployed at the time of testing. Candidates today appear to have completed more years of high school, have been removed from the school setting for fewer years, and are less likely to be employed than candidates in 1980. The demographics of the GED Tests candidate population have changed, generating GED Tests credential holders that possess a higher level of academic knowledge and skills than ever before demonstrated.

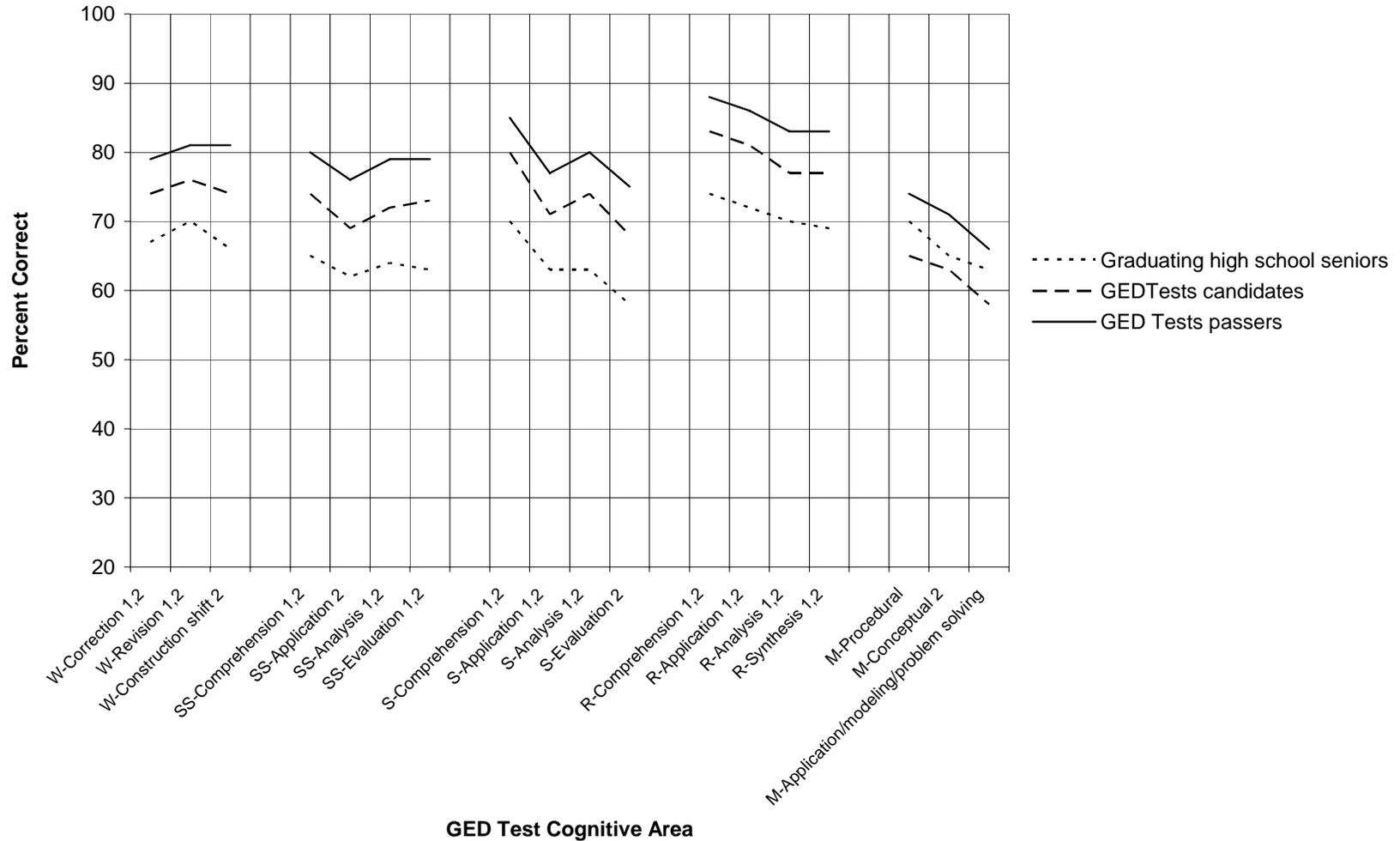
Figure 1. Percent Correct by Content Areas, by Group



<sup>1</sup> statistically significant difference between graduating high school seniors and GED Tests passers

<sup>2</sup> statistically significant difference between graduating high school seniors and GED Tests candidates

Figure 2. Percent Correct for Cognitive Areas, by Group



<sup>1</sup> statistically significant difference between graduating high school seniors and GED Tests passers

<sup>2</sup> statistically significant difference between graduating high school seniors and GED Tests candidates

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## Appendix

## Glossary

An *achievement test* is one designed to measure a student's grasp of some body of knowledge or his proficiency in certain skills. The GED Tests are intended to measure the major academic skills and knowledge associated with a high school program of study.

An *average*, used interchangeably with *mean*, is a number in the range of possible scores, though not always an actual score attained by an individual, who represents the most typical or representative value in a group of scores. It is calculated by adding all of scores and dividing the sum by the number of scores. On the GED Tests, the average standard score for graduating high school seniors is 500.

A *battery of tests* is a set of several tests intended to be administered to the same examinees. The tests in a battery are usually designed to yield comparable scores and are provided with norms on the same or comparable groups of persons. The GED Test Battery contains five subject area tests: Language Arts, Writing, Social Studies, Science, Language Arts, Reading, and Mathematics.

A *confidence interval* consists of two values on either side of a sample mean that has a specified high probability of covering the true population mean value. For example, for a 99 percent confidence interval, the probability that the two values actually include the true mean value is .99.

The *content validity* of GED Tests is determined by the extent to which the items in each content area sample the major academic skills and knowledge associated with a high school program of study and by the degree to which the items show evidence of measuring these outcomes.

*Equating* is a procedure whereby two parallel examinations are placed on a common scale of measurement. Typically, when parallel forms of an examination are constructed, despite the best efforts of test developers, the tests will vary to some extent in difficulty. Accordingly, without equating, two students of equal ability could receive different scores by taking different parallel examinations. The form of equating used in connection with the GED Tests is called equipercentile equating. This procedure involves the development of a function of equal percentile values based on the observed raw score distributions of parallel forms. These equating functions are then used to convert each parallel form to a given base/anchor form score scale. As the base/anchor form has already been normed and placed on a scale, equating allows all parallel forms to be placed on, and interpreted in terms of, this one single scale.

The *median* is a measure of the central tendency of the middlemost numerical value of a set of scores. It is calculated by adding finding the score below which 50 percent of all scores lie.

The *mean*, used interchangeably with *average*, is a number in the range of possible scores, though not always an actual score attained by an individual, who represents the most typical or representative value in a group of scores. It is calculated by adding all of scores and dividing the sum by the number of scores. On the GED Tests, the average standard score for graduating high school seniors is 500.

A *norm*, as the term is used in relation to test scores, is the average or typical test score (or other measure) for members of a specific group. Norms are often presented in tables giving the typical score values for a series of different homogeneous groups such as students in a given grade or students of a given age. English editions of the GED Tests are normed using a representative sample of graduating seniors in high schools throughout the United States.

A *normal distribution* is a mathematically defined frequency distribution. It is represented by a symmetrical, bell-shaped curve characterized by scores concentrated near the middle and tapering toward each extreme. The areas under the curve over various score intervals indicate what proportion of the total number of scores fall in that interval. The GED Tests standard scores for graduating high school seniors have an approximately normal distribution.

A *percentile rank* of a particular test score in a given distribution of scores is a number indicating the percentage of scores in the whole distribution which fall at or below the point at which the given score lies. Percentile ranks show relative standings among reported scores.

A *raw score* is the number first obtained in scoring the test, before any transformation to a standard score or other derived score. For the GED Tests, the raw score is the number of right answers. Equivalent raw score on two tests may not indicate equal performance due to differences in test difficulty. Equivalent converted scores or scaled scores on the GED Tests have been equated to be indicative of equal performance levels.

A *representative sample* is one chosen such a way as to make it more likely than a random sample to exhibit the same characteristics as the population. Representative samples are often stratified samples, with predetermined numbers of cases chosen randomly from different geographical areas, different age groups, or other subgroups which are thought to differ systematically with respect to the characteristic being measured. The samples of high school seniors used in norming the GED Tests are stratified by geographical region, by school type, and by district socioeconomic level.

A *statistically significant difference* is a large enough difference between two comparable statistics computed from separate samples to indicate that the probability of a difference as large as the observed difference would not be expected to occur by chance more than a specific number of times in one hundred. The statistical significance of a difference depends not only on the magnitude of the difference, but also upon the precision of the two measures used to obtain the difference. A difference has a statistical significance of  $p$  (probability)  $< .01$ , indicates the observed difference would not be expected to occur by chance more one time in one hundred.

The *standard deviation* is a measure of variability, dispersion, or spread of a set of scores around their mean value. Mathematically, the standard deviation is the square root of the mean of the square root of the mean of the squared deviation of the scores from the mean of the distribution of scores. The more closely the scores in a distribution cluster about the mean, the smaller the standard deviation. In a normal distribution, 68.26 percent of all the scores lie within plus and minus one standard deviation of the mean. The standard deviation of GED Tests standard scores for graduating high school seniors is 100 points.

A *standard error of measurement* is an estimate of the standard deviation of the errors of measurement associated with the test scores in a given set. The standard error of measurement is estimated by multiplying the standard deviation of the scores by the square root of minus the reliability coefficient. Approximately two-thirds of the errors of measurement in a given set of the test scores are likely to be less than three times the error of measurement. The standard errors of measurement based on raw scores for the GED Tests typically range from 2.1 to 2.5 for 40-item tests and 2.6 to 3.2 for 50-item tests.

A *standard score* is one derived from a raw score so that it can be expressed on a uniform standard scale without seriously altering its relationship to other scores in the distribution. A simple type of standard score is the z- score, which expresses each raw score as a positive or negative deviation from the mean of all raw scores on a scale in which the unit is one standard deviation. In another type of standard-score scale, the transformation is arranged to yield a normal distribution of standard scores. The use of standard scores simplifies comparisons and interpretations of scores. The standard scores for each GED Test are normalized scores with a mean of 500 and a standard deviation of 100. The relationship between raw scores (number of correct answers) and standard scores is based on the test results a stratified, random sample of graduating high school seniors.

The *variance* is a measure of the dispersion of scores about their mean. The variance is the mean of the squared deviations of the scores from their mean. Hence, it is equal to the square of the standard deviation.



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One Dupont Circle NW, Suite 250  
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