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ABSTRACT

Since 1971, nearly four million adults have qualified for a high school equivalency credential based on General Educational Development (GED) test results. During Spring 1980 two major studies were undertaken by the GED Testing Service: (1) the U.S. High School Norming Study involving the administration of the GED Tests to a representative sample of U. S. high school graduating seniors and (2) the National Survey of GED Examinees (adults). Results of these two studies provided the data for this study, which comparerd the performance on the GED tests of graduating high school seniors and GED examinees. The percentiles and average standard scores for GED examinees show achievement levels only slightly below the levels for graduating high school seniors. Detailed analyses indic ted that graduating high school seniors outperformed GED examinees in 20 of the 22 test content areas in the GED battery. Statistically significant differences occurred in the areas of Capitalization and Punctuation, Usage, and Sentence Correction on the Writing Skills test, and Algebra on the Mathematics test. GED graduates outperformed graduating high school seniors in 18 of the 22 content areas in the GED battery. Statistically significant differences occurred in the areas of General Reading and Prose Literature on the Reading Skills test. However, the magnitude of the differences between graduating high school seniors and GED graduates was small. (Author/JAZ)

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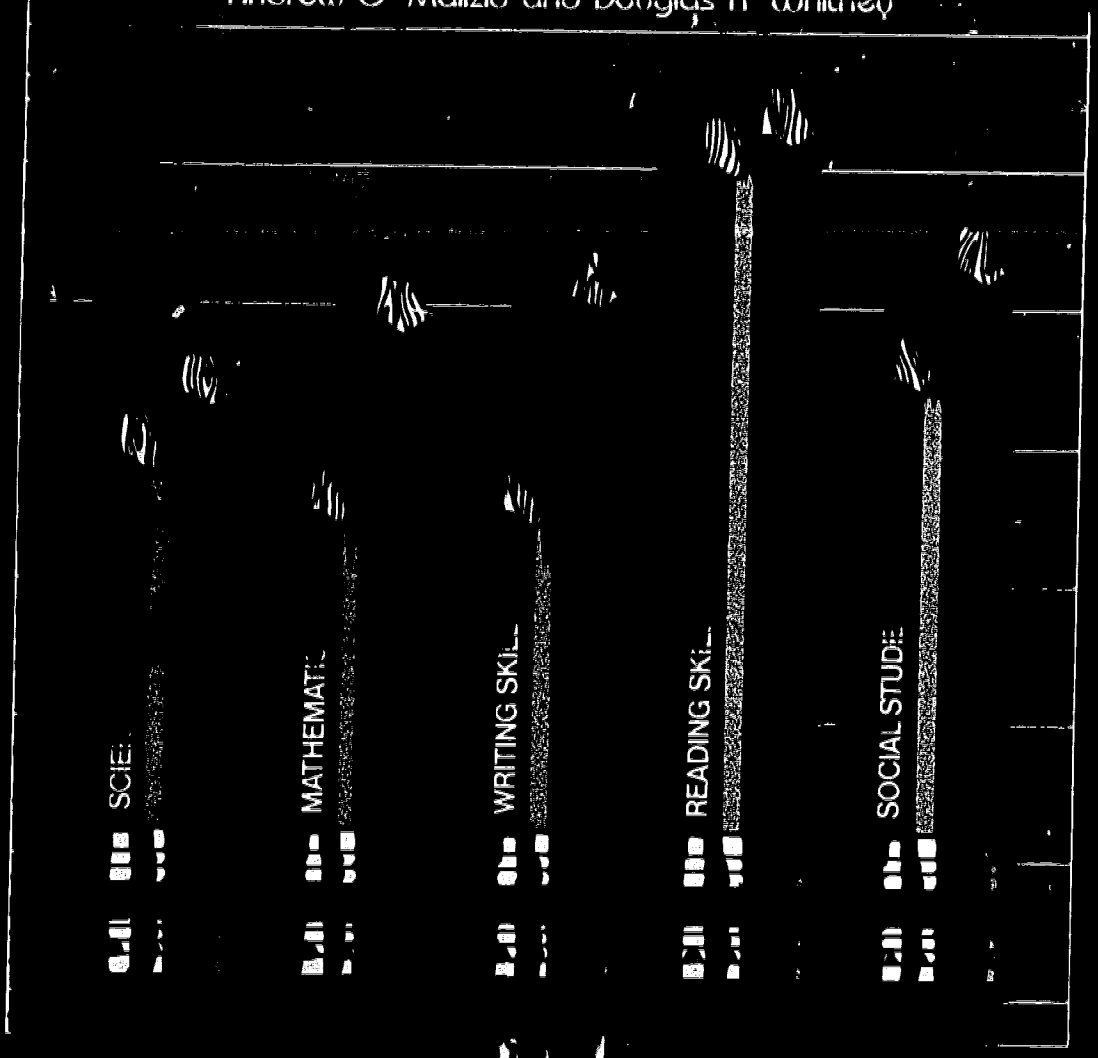
EXAMINEE AND HIGH SCHOOL SENIOR PERFORMANCE ON THE GED TESTS:

Andrew C. Malizio and Douglas R. Whitney



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The American Council on Education (ACE), founded in 1918 and composed of institutions of higher education and national and regional education associations, is the nation's major coordinating body for postsecondary education. Through voluntary and cooperative action, the Council provides comprehensive leadership for improving education standards, policies, procedures, and services.

The GED testing program began in 1942 with the development of a battery of tests for United States military personnel who had not completed their high school studies. Today, through the GED Testing Service of the American Council on Education, the test are administered in all fifty states, in many Canadian provinces, and in the U.S. commonwealths and territories. The GED testing program has offered millions of adults a "second chance" by enabling them to demonstrate that they have many of the skills they would have acquired had they been able to remain in high school.

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Abstract

Since 1971, nearly four million adults have qualified for a high school equivalency credential based on GED test results. During Spring 1980 two major studies were undertaken by the GED Testing Service: (1) a national norming study involving the administration of the GED Tests to a representative sample of U.S. high school graduating seniors and (2) a national survey of adult examinees. Results of these two studies provided the data for this study, which compared the performance on the GED tests of graduating high school seniors and GED examinees. The percentiles and average standard scores for GED examinees, the first such results published, show achievement levels only slightly below the levels for graduating high school seniors.

Detailed analyses indicated that graduating high school seniors outperformed GED examinees in 20 of the 22 test content areas in the GED battery. Statistically significant differences occurred in the areas of Capitalization and Punctuation, Usage, Sentence Correction on the Writing Skills test, and Algebra on the Mathematics test. Although this performance pattern was consistent, the magnitude of the differences was small.

GED graduates (examinees who earned standard scores of at least 35 on each GED Test and an average standard score of at least 45 on all five tests) outperformed graduating high school seniors in 18 of the 22 content areas in the GED battery. Statistically significant differences occurred in the areas of General Reading and Prose Literature on the Reading Skills test. However, although this performance pattern was consistent, the magnitude of the differences between graduating high school seniors and GED graduates was small.

During the past four decades, the Tests of General Educational Development (GED Tests) have provided millions of adults who were unable to complete their formal high school studies with the opportunities to (1) qualify for jobs, (2) secure job promotions, (3) undertake postsecondary education and training, and (4) achieve a variety of personal goals, including that of personal satisfaction. Currently, more than 800,000 candidates (including civilians and military personnel) take the GED Tests each year; of these, about 515,000 earn a high school equivalency credential (GEDTS, 1982). Through the GED Testing Service, tests are administered at more than 2,900 locations throughout the United States and Canada to persons who have not graduated from high school and who meet the eligibility requirements set by their state, territory, or province.

The purpose of the analyses reported here was to: (1) report the standard score and percentile rank distributions for a nationally representative sample of recent GED examinees and (2) compare and contrast the performance of *graduating high school seniors*, *GED examinees*, and *GED graduates*[1] on each of the 22 content areas in the GED Tests. Adult education administrators, teachers, and publishers should find this information useful in planning and developing instructional programs for GED examinees.[2]

[1] *Graduating high school seniors* refer to soon-to-be graduated high school students. Throughout the remainder of this paper, graduating high school seniors will be called *graduating seniors*. *GED examinees* are persons who take the GED Tests to qualify for a high school equivalency credential. *GED graduates* are examinees who earn standard scores of at least 35 on each test, and an average standard score of at least 45 on the GED battery (all five tests). This is the most widely used minimum score requirement in the United States.

[2] The data presented in this research report are based on *spring 1980 samples* of graduating seniors and GED examinees. Inferences are based on the assumption that the overall characteristics of more recent samples would be consistent with the 1980 samples. To the extent that these assumptions are inaccurate (e.g., changes in overall ability levels of graduating high school senior or examinees, or changes in motivation/preparation of high school seniors or GED examinees), conclusions may differ from those presented here.

Description of the GED Tests

The content of the GED Tests is intended to represent a sample of the expected outcomes of four years of high school instruction. Resulting from high school curriculum reviews, recommendations detailing the content areas to be covered and the relative emphasis within each subject area for the current GED Tests were determined. The current tests were developed by the Educational Testing Service. The GED Test battery contains a total of 290 items in five subject area tests: Writing Skills (80 items), Social Studies (60 items), Science (60 items), Reading Skills (40 items), and Mathematics (50 items). The tests contain questions requiring use of concepts, general knowledge, and thinking skills. There are few questions about isolated details, definitions, or specific facts. The GED Tests measure, among other things, the ability to use information rather than to remember details. For each item, examinees are asked to select the best answer from among five alternatives. The items cover a wide range of subjects and vary in difficulty from easy to difficult. A brief description of the content areas within each test is presented below. The approximate number of items appearing on each test form is in parentheses. Patience and Whitney (1982) present a more detailed description of the content of the GED Tests in *What Do the GED Tests Measure?*

Writing Skills

The Writing Skills test questions are intended to measure a person's ability to use standard written English clearly and effectively. Examinees must identify errors in spelling, capitalization, punctuation, and grammar; recognize preferred ways of writing sentences; and analyze the organization and logic of sentences within a passage. Content areas on the Writing Skills test are as follows: Spelling (10 items), Capitalization and Punctuation (10 items), Usage (24 items), Logic and Organization (12

items), and Sentence Correction (24 items). The Sentence Correction items include both Diction/Style and Sentence Structure content.

Social Studies

The Social Studies test[3] questions require examinees to understand basic social studies principles and ideas and explain meanings, draw conclusions, and to identify causes and effects. Test items are selected from the following areas: U.S. History (15 items), Economics (12 items), Geography (9 items), Political Science (12 items), and Behavioral Science (12 items).

Science

The Science test contains reading passages and individual questions that test the understanding of basic scientific principles and ideas. Most Science test questions ask examinees to use the information given to analyze and solve problems, explain results, or interpret information. The Science test contains two major types of items. One, composes about one-third of the test, includes single multiple-choice items based solely on material presented in the item stem. To answer these questions correctly, an examinee must understand and be able to apply broad fundamental scientific principles. The second type of item, composes approximately two-thirds of the test, consists of written passages or other stimuli (e.g., graphs, charts) accompanied by related multiple-choice questions. These items are designed to measure reading comprehension in the sciences and also to show how well the examinee can understand, analyze, and use the information presented in the passage. Test items are selected from the following content areas: Biology (30 items), Earth Science (12 items), Chemistry (9 items), Physics (9 items).

Reading Skills

The Reading Skills test items are based on a written passage or stimulus from newspapers, magazines, prose, literature, poetry, and drama. The questions require an examinee to demonstrate an understanding of what is read, interpret the meaning of the passages, and draw conclusions implied but not stated directly by the author. Items are selected from the following content areas: Practical Reading (6 items), General Reading (12 items), Prose Literature (12 items), Poetry (5 items), and Drama (5 items).

Mathematics

Most Mathematics test items involve some computation based on real-life situations or ask examinees to interpret graphs, charts, tables, or diagrams. Items for the Mathematics test [illegible] lowing content areas: Arithmet[illegible] (10 items), and Algebra (12 ite[illegible]

Reportin[illegible] GE[illegible] [illegible]esults

Scores on [illegible] GED Test[illegible] alw[illegible]ys reported as standard scores [illegible]nile ranks[illegible]. The standard score and percentile s[illegible] [illegible]n[illegible]e achievement of U.S. high schoo[illegible] gi[illegible]du[illegible] se[illegible] in such a way that half of the gradua[illegible] h[illegible]ol s[illegible]niors earn standard scores above 50 a[illegible] n sc[illegible]es at or below 50; standard scores less tha[illegible] [illegible]reater than 70 are earned by only about 2% of th[illegible] [illegible]g high school seniors (GEDTS, 1981). Most [illegible]tates also[illegible] se the average (or total) standard score earned [illegible] the [illegible]ve tests in determining eligibility for high school equivalency credentials. 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 examinee to that demonstrated by recent high school graduates.

The first GED standard score scales were based on a sample of U.S. high school seniors tested in 1943. In order to interpret examinee performance on the test battery relative to the performance of *contemporary* high school graduates, the relationship between the number of items correctly answered on each test and the standard score and percentile rank scales was completely redeveloped in norming studies conducted in 1955, 1967, 1977, and 1980. The scores reported to examinees are based on the results from the last previous study. Thus, the standard score scales for all English language GED Tests taken after January 1, 1982 are based on the achievement levels of 1980 U.S. graduating high school seniors.

Each st[illegible], province, or territory sets its own minimum scores for awarding a high school equivalency credential. The ACE Commission on Educational Credit and Credentials, the policy-making body for the GED Testing Service, has recommended that state minimum score requirements be established *not lower* than standard scores of at least 40 on each test *or* an average standard score of at least 45 across all five GED Tests. This recommendation reflects a reasoned judgement by the Commission that score requirements should be neither so high as to represent levels of achievement far above that demonstrated by recent high school graduates (as being arbitrarily unfair to adult examinees) nor so low as to threaten the credibility of the high school equivalency credential. Most current minimum state and province requirements for a high school equivalency credential are set so that GED examinees must earn scores that surpass 30% of today's graduating seniors. For purposes of occupation and college admission, credentials based on GED Tests are considered by many educational institutions and employers to be equivalent to a regular high school diploma received at the end of formal study.

[3] Canadian editions use slightly different specifications representative of social studies curriculum in Canada. Canadian history replaces U.S. history and the proportional weights given to Economics and Geography are reversed in the Canadian editions.

Method

Sample Descriptions

The 1980 U.S. High School Norming Study. The process of selecting schools and students involved careful definition of a sampling plan to ensure that the makeup of the norm group would sufficiently represent all graduating high school students. Approximately 304 U.S. high schools participated in the norming project conducted by the Educational Testing Service. The study used a stratified random sample of approximately 3,600 graduating high school seniors. A more detailed description of the sampling process is presented by Spille (1981).

As part of the 1980 norming study, a questionnaire elicting background information was administered to approximately 3,600 graduating seniors. Information gathered included: number of years of English, Social Studies, Science, and Mathematics; specific courses taken in Social Studies, Science, and Mathematics during four years of high school; and self-reported high school grades.

Slightly more than 97% of the graduating seniors reported three years or more of English; while about 80% reported four years or more. Percentages of seniors who reported taking various social studies courses during high school were as follows: American History (90%), World History (55%), Political Science (42%), Behavioral Science (35%), Economics (28%), Civics (21%), and Geography (19%). Specific science courses taken by seniors were reported as: Biology (81%), Physical Science (45%), Chemistry (36%), General Science (35%), and Physics (17%). Specific mathematics courses taken by seniors were reported as: Algebra (76%), Geometry (54%), Advanced Algebra (35%), General Mathematics (32%), Trigonometry (21%), Business Math (20%), and Calculus (7%).

About 33% of the graduating high school seniors reported grades of "mostly A," or "half A and half B", 46% reported grades of "mostly B" or "half B and half C", 19% reported grades of "mostly C" or "half C and half D", while approximately 1% reported grades "mostly D or below." As expected, because the independent studies claimed to sample similar populations, the percentages reported above were nearly identical to those reported by the National Center for Education Statistics in *High School and Beyond* (Peng, Fetters, & Kolstad, 1981).

The 1980 National Survey of GED Examinees. The 1980 national survey of GED examinees marked the first time that detailed demographic and test performance data on GED examinees were gathered. Examinees tested at approximately 250 Official GED Testing Centers (10% stratified random sample of centers) participated in the national survey of GED examinees. Approximately 13,000 examinees completed a questionnaire eliciting background information on age, highest grade completed, reasons for taking the GED Tests, test preparation activities, reading habits, and self-reported grades. A full description of the sampling procedures and survey data is presented by Malizio and Whitney (1981). Briefly, the survey data revealed the following: more than half the examinees were 21 years old or younger; about 70% of the examinees who took the GED Tests completed the 10th grade or higher; nearly 39% of the examinees took the GED Tests chiefly for job-related reasons, while another 30% took the tests for reasons related to furthering their education; approximately 80% of the examinees prepared in some manner to take the GED Tests; about 90% of the examinees reported reading books, magazines, or newspapers at least once per week. Further, about 11% of the GED examinees reported grades of "mostly A" or "half A and half B", 41% "mostly B" or "half B and half C", 42% "mostly C" or "half C and half D", and 7% "mostly D and below."

A comparison of survey results clearly showed that the 1980 graduating seniors reported higher grades in school than those reported by 1980 GED examinees, whose median grade completed was 10. Information on specific subjects studied while in school was not collected in the national survey of GED examinees.

Calculation of Standard Scores and Percentile Ranks

Examinee raw scores (number of items correctly answered) on the GED Tests are converted and reported as standard scores and percentile ranks. The standard scores and percentile ranks reported to GED examinees are based on the performance of graduating seniors in the 1980 norming study. The *percentile ranks* used in comparing the graduating senior performance to GED examinee performance in this report were based on actual examinee performance.

All raw-to-standard score conversions used in this study were based on the 1980 high school norming study. However, the percentiles for GED examinees were calculated separately and *do not correspond to those currently reported to examinees.* For example, if a GED examinee earned a standard score of 45 on the Writing Skills test, the percentile rank reported would be 31, indicating that about 31% of the U.S. high school norm group earned standard scores at or below 45. A standard score of 45 on the Writing Skills test would have a corresponding percentile rank of 52 in the GED examinee sample, indicating that 52% of the GED examinee sample earned standard scores on the Writing Skills test at or below 45.

Calculation of Content Area Mean Percent Correct Values

All discussions and inferences presented in the detailed comparisons of the GED Test content area performance of graduating high school seniors and GED examinees are based on the mean percent correct scores (i.e., mean item difficulties or mean p-values) for content areas contained on the GED Tests obtained by the norming and national examinee samples. The mean content area p-values, standard deviations, and standard errors of the mean p-values were obtained separately for graduating seniors and GED examinees as follows:

1) Item p-values (percent correct) were calculated for each of 290 items on nine forms of the GED Tests separately for seniors and examinees. This resulted in 2610 item p-values for each group—a total of 5220 p-values.

2) The mean of all items that compose a given content area was computed by summing the p-values across all forms separately by group. For example, p-values for Writing Skills test items 1-10 (spelling) across all forms were summed. This summed value was then divided by the total number of items contained in a given content area (e.g., 90) to obtain the mean p-value for spelling items. Identical procedures were followed for each content area.

3) Standard deviations of the mean p-value for each content area were calculated separately by group. Standard errors of each mean p-value were calculated by dividing the standard deviations by the square root of the number of items in each respective content area. These standard errors were then used in calculating 99% confidence intervals for each mean p-value. If the mean p-value confidence intervals between two content area groups overlap, the performance differences between the groups were not *statistically* significant.

TABLE 1. Comparison of 1980 GED Examinee Performance[1] to High Sch Senior Performance (Based on High School Norms Effective January 1, 19

Standard Scores	HS PR[2]	GED Examinees						
		Writing Skills PR	Social Studies PR	Science PR	Reading Skills PR	Math PR	Battery Avg PR	
80	99	99	99	99	99	99	99	
75	99	99	99	99	99	99	99	
70	98	99	99	99	99	99	99	
65	93	99	98	99	96	99	99	
60	84	96	93	94	89	97	97	
55	69	89	81	82	74	92	89	
50	50	75	66	61	57	73	68	
45	31	52	42	37	38	50	43	
40	16	23	20	17	15	25	18	
35	7	9	7	7	6	8	6	
30	2	3	3	3	3	3	2	
25	1	2	2	2	2	2	1	
20	1	1	1	2	2	1	1	
Mean	50	45.53	47.40	47.87	49.05	45.70	47.02	
SD	10	8.19	8.87	8.70	9.64	8.0	7.56	
Median	50	45	47	48	48	46	47	

[1] GED examinee sample based on a 10% sample of centers. National survey conducted during Ap and May 1980. Sample sizes for each test are approximately 13,000. About 11,000 examin completed the entire battery.

[2] Percentile Ranks (PR) for graduating high school seniors are based on single test performance. T percentile rank of a standard score indicates the percent of persons scoring at or below that st dard score. Thus, because 16% of the high school norm group obtained standard scores at or bel 40, while about 23% of GED examiness obtained standard scores on the Writing Skills test at below 40, it should be concluded that GED examinees do not earn scores as high as those earned graduating high school seniors.

[3] Based on a sample of 686 graduating high school seniors participating in the 1980 norming stu who completed all five tests of the anchor form.

TABLE 2. Standard Scores Corresponding to Selected Percentile Ranks

Percentile Rank	HS Seniors	GED Examinees					
		Writing Skills	Social Studies	Science	Reading Skills	Math	Batte Av
99	73	65	69	67	73	64	64
95	67	59	62	61	65	58	60
90	63	56	59	58	61	56	57
75	57	51	53	53	56	51	52
50	50	45	47	48	48	46	47
25	43	41	42	43	43	41	42
10	37	36	37	37	39	36	38
5	27	32	34	33	34	33	35
1	20	20	20	20	20	20	28

Results

Percentile Ranks for Graduating High School Seniors and GED Examinees

The percentile rank of a standard score indicates the percent of persons in a particular sample scoring at or below that standard score (see Table 1). Table 2 illustrates standard scores corresponding to selected percentile ranks.[4] For example, (see row 4) the standard scores corresponding to a percentile rank of 75 for GED examinees (as a group) are Writing Skills (51), Social Studies (53), Science (53), Reading Skills (56), and Mathematics (51). The standard score corresponding to a percentile rank of 75 for graduating seniors is 57 on each test (The score scales are derived so that a standard score of 57 has the same meaning on each test).

A closer inspection of the percentile ranks presented in Table 1 reveals that the percentile ranks for graduating high school seniors and for GED examinees are simil for standard scores below 40, but major differences occ above 45. Although this pattern is similar on all five GE Tests, this point is most clearly illustrated in Figure 1 b the Writing Skills test standard score distribution. Abo 77% of the GED examinees and 84% of the graduatir seniors had standard scores above 40 on the Writir Skills test. However, 48% of the GED examinees (con pared to 69% of the graduating seniors) had standar scores above 45.

Although graduating seniors (as a group) earned high scores than GED examinees, the most important diffe ences are those affecting rates at which state credenti standards would be met. To examine these critical dec sions, additional analyses were conducted to estima the percentages of GED examinees and graduating senio

[4] As an illustration, the percentage of each group earning average standard scores above 40 (100 minus the percentile rank) was 86% (100-14; see Table 1 and column 9, row 9) for the norm group and 82% (100-18; see Table 1 column 8, row 9) for the GED examinees.

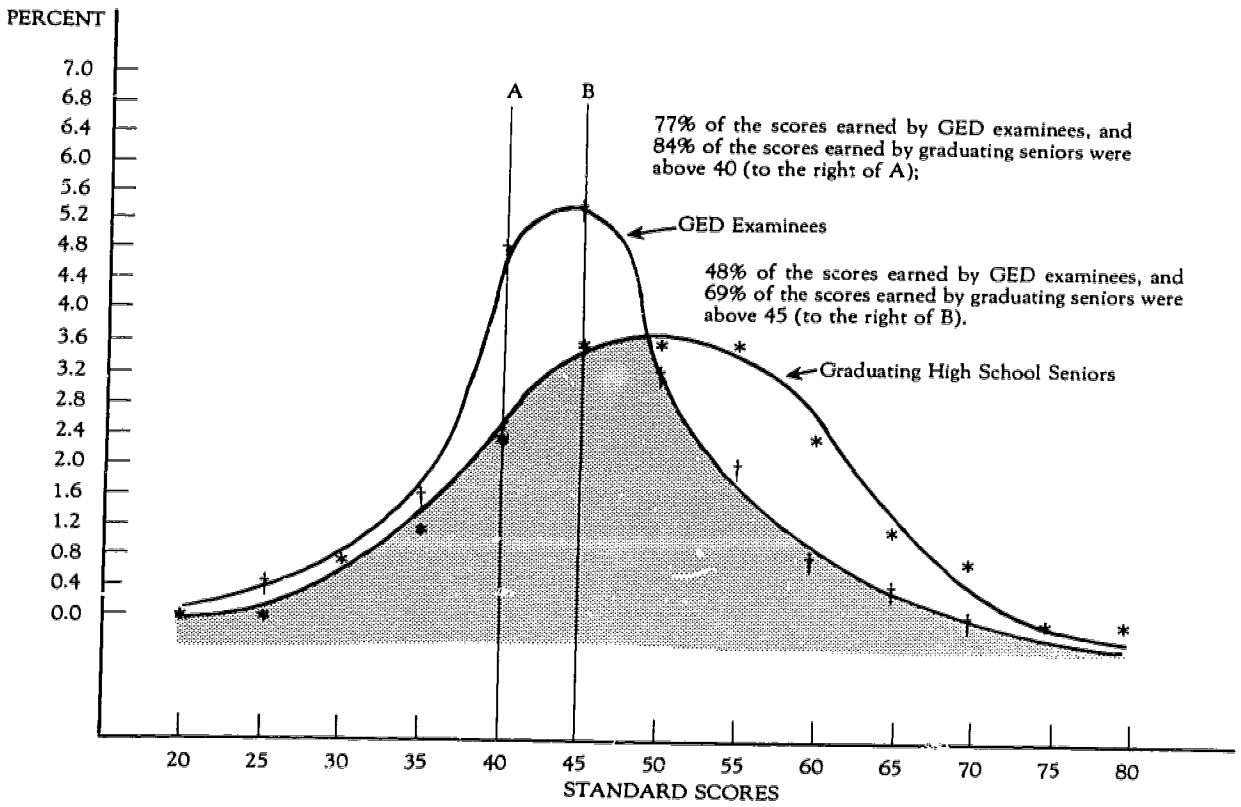


Figure 1. Plot of Smoothed Frequency Distributions for Writing Skills Tests

that met the current minimum score recommendation of the Commission on Educational Credit and Credentials, as well as various state requirements. Table 3 shows the estimated passing rates for GED examinees and high school seniors at selected minimum score requirements.

As shown in Table 3, graduating seniors and GED examinees show little difference in the percentages able to meet the recommended minimum score requirement. Similarly, only minor differences in the percentages able to meet the most widely used state minimum score requirement (Minimum 35 *and* Mean 45) were observed.

Content Area Group Performance

To further develop the differences between senior/examinee test performance analyses were conducted for each of the 22 content areas in the GED battery. The mean p-value represents the average percent correct on all items of a given content area. The number of items contained in each content area and the mean p-values are presented in Appendix 1.

When comparing group performances on the GED Tests, it is important to note that any given test represents a *sample* of possible items that may have been used to measure achievement in a particular content area and major subject area. In constructing the GED Tests, items are permitted to vary somewhat in difficulty from one content area to another. Therefore, when study results indicate that, for a sample of examinees, one set of items (e.g., biology items) is more difficult than another (e.g., earth science items) within a particular test, it *should not be concluded* that the group was "less prepared" in the former area. Another set of items may have produced different results. For this reason, percent correct values (i.e., p-values) can be used to compare the achievement of *two* groups, but not to compare the achievement levels of a single group on two content areas.

The *overall performances* of both groups only differed slightly (see Table 4). Graduating high school seniors correctly answered an average of six more Writing Skills items, four more Mathematics items, two more Social

TABLE 3. Estimated Percent of 1980 U.S. Graduating High School Seniors and GED Examinees Able to Meet Various Minimum Standard Score Requirements.

Requirements	HS Seniors	GED Examinees
[1]Minimum 40 or Mean 45	73	70
Minimum 40 or Mean 50	70	66
Mean 45	70	63
[2]Minimum 35 and Mean 45	69	62
Minimum 40	69	66
Minimum 40 and Mean 45	67	59
Minimum 45 or Mean 50	55	42

[1]Commission on Educational Credit and Credentials recommended minimum score requirement.

[2]Current minimum score requirement in most states. Refer to the 1981 Annual Statistical Report (GEDTS, 1982) for the current minimum score requirement in effect in specific states, territories, and provinces.

TABLE 4. Percent of Items Correctly Answered by Group[1]

GED Tests	Graduating Seniors[2]	GED Examinees[3]
Writing Skills	59	51
Social Studies	60	56
Science	55	53
Reading Skills	65	64
Mathematics	58	51

[1]A more detailed table is presented in Appendix 2.
[2]Soon-to-graduate U.S. high school seniors.
[3]Includes GED examinees who do not pass the GED battery.

Studies items, and one more Science item than did GED examinees. Both groups correctly answered approximately the same number of Reading Skills items.

In order to better understand the differences in overall performance, average percent-correct values for content areas within each of the GED Tests were examined. Graduating seniors earned higher scores than did GED examinees in all content areas *except* drama and prose literature. Although differences do exist and the pattern of performance is consistent (i.e., seniors perform better than GED examinees) the *magnitude* of the actual differences is *very small*. Further, the overall rank order (of the mean content area p-values) correlation coefficient was .83. This suggests that content areas that tended to be difficult for seniors also tended to be difficult for GED examinees; likewise, those areas that were less difficult for seniors (as a group) also tended to be less difficult for examinees. The most difficult content areas (i.e., types of items) for both groups were chemistry and algebra items. The least difficult types of items for both groups were practical reading, drama, and general reading items.

Writing Skills. In general, those Writing Skills content areas that were more difficult for seniors also tented to be more difficult for GED examinees (see Table 5).

TABLE 5. Mean Percent Correct, and Standard Deviation on Writing Skills Content Areas for Graduating Seniors and GED Examinees.[1]

	Graduating Seniors		GED Examinees	
Content Area	Mean	SD	Mean	SD
Spelling	63	17	54	18
Capitalization & Punctuation	59	17	47	17
Usage	57	17	50	18
Sentence Correction	61	15	55	15
Logic & Organization	53	12	47	12

[1]A more detailed table and explanation are presented in Appendix 2.

Overall performance differences ranged from six to nine percent. The most difficult item type for both groups was Logic and Organization. The least difficult content areas for both groups were Spelling and Sentence Correction.

Estimated confidence intervals about the mean content area p-values (i.e., percent correct) for the two groups are shown in Table 6. If the confidence intervals overlap (e.g., Spelling,and Logic and Organization), the differences between the groups are not statistically significant ($p > .01$). For example, the confidence intervals for the Spelling content areas for graduating seniors and GED examinees were 58-68%, and 50-59%, respectively. Thus, the differences were not statistically significant. However, graduating seniors outperformed GED examinees in Capitalization and Punctuation, Usage, and Sentence Correction ($p > .01$). Statistically significant differences do *not* exist, despite apparent large differences in mean p-values, for most content areas. This results from a number of factors including within-group variability of ability[5], as well as the number of items contained within each content area. In addition, a *statistically significant* difference may actually represent only a 1-2 item difference on a given test. Results indicated that seniors correctly answered about 1-2 more items (within a Writing Skills content area) than did GED examinees.

TABLE 6. Mean Content Area Confidence Intervals[1] on Writing Skills Test

Area Content	Graduating Seniors	GED Examinees
Spelling	58-68	50-59
Capitl. & Punctuation	54-64	42-52
Usage	54-60	47-53
Sentence Correction	59-64	53-58
Logic & Organization	50-57	44-50

[1]These values represent estimated 99% confidence intervals and were calculated by multiplying the standard error of each mean p-value by 2.58. For example, on the Writing Skills test, graduating high school senior probably would answer correctly an average of 58-68% of the spelling items; GED examinees an average of 50-59%. If the intervals overlap, the differences are not statistically significant ($p > .01$).

Social Studies. In contrast to the similarity in overall performance on the other GED Tests, the least difficult type of social studies items for graduating high school seniors was the most difficult for GED examinees (see Table 7). As a group, seniors correctly answered approximately 61% of the U.S. History items. GED examinees correctly answered about 56% of the items.

Differences between senior and examinees in mean content area p-values for thee Social Studies test ranged from three to five percent, and were not statistically

TABLE 7. Mean Percent Correct, and Standard Deviations on Social Studies Content Areas for Graduating Seniors and GED Examinees[1]

	Graduating Seniors		GED Examinees	
Content Areas	Mean	SD	Mean	SD
Economics	60	15	57	18
Geography	59	15	56	17
Political Science	60	17	57	17
U.S. History	61	17	56	18
Behavioral Science	61	13	56	15

[1]A more detailed table and explanation are presented in Appendix 2.

[5]Other things equal, content areas showing the greatest variation in the item p-values (i.e., the largest standard deviation for p-values) require a larger difference in means to be statistically significant; areas with fewer items require a larger difference in means to achieve statistical significance.

significant (see Table 8). For example, the confidence intervals for the Behavioral Science items for graduating seniors and GED examinees were 57-64% and 52-60% respectively. Graduating seniors correctly answered approximately 1 more item (within a Social Studies content area) than did GED examinees.

TABLE 8. Mean Content Area Confidence Intervals[1] on Social Studies Test

Content Area	Graduating Seniors	GED Examinees
Economics	56-64	52-61
Geography	55-63	51-61
Political Science	56-64	53-61
U.S. History	57-65	52-60
Behavioral Science	57-64	52-60

[1]These values represent estimated 99% confidence intervals and were calculated by multiplying the standard error of each mean p-value by 2.58. For example, on a given Social Studies test, graduating high school seniors probably would answer correctly an average of 57-64% of the Behavioral Science items; GED examinees an average of 52-60%. If the intervals overlap, the differences are not statistically significant ($p < .01$).

Science. In general, content areas that were more difficult for seniors also tended to be more difficult for examinees. Overall performance differences ranged from one to three percent. Chemistry items were the most difficult for both high school seniors and GED examinees. The least difficult area for both groups was Biology (see Table 9).

TABLE 9. Mean Percent Correct, and Standard Deviations on Science Content Areas for Graduating Seniors and GED Examinees[1]

	Graduating Seniors		GED Examinees	
Content Area	Mean	SD	Mean	SD
Biology	58	17	56	20
Earth Science	56	15	55	19
Chemistry	46	15	43	19
Physics	54	14	51	18

[1]A more detailed table and explanation are presented in Appendix 2.

As shown in Table 10, performance differences between graduating seniors and GED examinees were not statistically significant. For example, the estimated confidence intervals for Earth Science items were 53-60% for graduating seniors and 50-60% for GED examinees. Graduating seniors and GED examinees correctly answered approximately the same number of items within a specific content area with the exception of Biology. On average, seniors correctly answered approximately 1 more item within the Biology content area.

TABLE 10. Mean Content Area Confidence Intervals[1] of Science Test

Content Area	Graduating Seniors	GED Examinees
Biology	56-61	53-59
Earth Science	53-60	50-60
Chemistry	41-50	38-48
Physics	50-58	46-56

[1]These values represent estimated 99% confidence intervals and were calculated by multiplying the standard error of each mean p-value by 2.58. For example, on the Science test, graduating high school seniors probably would answer correctly an average of 56-61% of the Biology items; GED examinees an average of 53-59%. If the intervals overlap, the differences are not statistically significant ($p < .01$).

Reading Skills. Content areas that were more difficult for seniors, also tended to be more difficult for GED examinees. Overall performance differences ranged from one to four percent. The most difficult item type for both groups was Poetry (see Table 11). The least difficult content area for both groups was Practical Reading.

TABLE 11. Mean Percent Correct, and Standard Deviations on Reading Conteant Areas for Graduating Seniors and GED Examinees.[1]

	Graduating Seniors		GED Examinees	
Content Area	Mean	SD	Mean	SD
Practical Reading	73	17	69	15
General Reading	65	14	64	17
Prose Literature	63	16	64	17
Poetry	60	15	58	15
Drama	66	15	67	14

[1]A more detailed table and explanation are presented in Appendix 2.

As shown in Table 12, differences between graduating seniors and GED examinees were not statistically significant. Both groups correctly answered approximately the same number of items within a specific Reading Skill content area.

TABLE 12. Mean Content Area Confidence Intervals[1] on Reading Skills Test

Content Area	Graduating Seniors	GED Examinees
Practical Reading	68-79	63-75
General Reading	62-69	60-68
Prose Literature	59-67	60-68
Poetry	55-66	51-64
Drama	60-71	60-73

[1]These values represent estimated 99% confidence intervals and were calculated by multiplying the standard error of each mean p-value by 2.58. For example, on the Reading Skills test, graduating high seniors probably would answer correctly an average of 68-79% of the Practical Reading items; GED examinees an average of 63-75%. If the intervals overlap, the differences are not statistically significant ($p < .01$).

Mathematics. Content areas that were more difficult for seniors, were also more difficult for GED examinees. The most difficult item type for both groups was Algebra (see Table 13). Overall performance differences ranged from 4-15 percent. The least difficult content area for both groups was Arithmetic.

As shown in Table 14, *except for Algebra items*, differences between graduating seniors and GED examinees on Mathematics content area p-values were not statistically significant. Graduating seniors correctly answered

TABLE 13. Mean Percent Correct, and Standard Deviations on Mathematics Content Areas for Graduating Seniors and GED Examinees.[1]

Content Area	Graduating Seniors		GED Examinees	
	Mean	SD	Mean	SD
Arithmetic	63	20	59	23
Geometry	57	21	48	24
Algebra	49	19	34	18

[1]A more detailed table and explanation are presented in Appendix 2.

TABLE 14. Mean Content Area Confidence Intervals[1] on Mathematics Test

Content Area	Graduating Seniors	GED Examinees
Arithmetic	60-66	55-63
Geometry	51-63	42-55
Algebra	44-53	29-38

[1]These values represent estimated 99% confidence intervals and were calculated by multiplying the standard error of each mean p-value by 2.58. For example, on the Mathematics test, graduating high school seniors probably would answer correctly an average of 44-53% of the Algebra items; GED examiness an average of 29-38%. If the intervals overlap, the differences are not statistically significant ($p > .01$).

approximately one to four additional items (within a content area) than did GED examinees.

Graduating High School Seniors vs. GED Graduates

To this point, this paper has addressed the performance of GED examinees and graduating seniors sampled in the 1980 studies. A question frequently asked by adult educators, administrators, teachers, admissions officers, and employers is "How do GED 'graduates' compare with graduating high school seniors on the GED Tests?" To address this issue, analyses similar to those noted above were performed using only the item data from examinees who earned a minimum of 35 on each GED Test and an average of 45 across the GED battery. (This is the most widely used current minimum score requirement to earn the high school equivalency credential based on GED Test results.)

As shown in Table 15, these detailed analyses indicated that *GED graduates* (as a group) *outperformed graduating seniors* (based on mean content area p-values) in *18 of the 22* content areas contained in the GED battery. The content area p-values for graduating seniors, GED examinees, and GED graduates are shown in Figure 2. Estimated confidence intervals for each group are presented in Appendix 2. The most notable differences occurred on the Reading Skills test. Differences between GED graduates and graduating seniors were statistically significant in General Reading and Prose Literature. Estimated confidence intervals for the General Reading items for GED graduates and graduating seniors were 71-79% and 62-69%, respectively. Estimates for the Prose Literature items for GED graduates and graduating seniors were 70-79% and 62-69%, respectively.

TABLE 15. Mean Percent of Items Correctly Answered by Graduating High School Seniors and GED Graduates.[1]

Content Area	No. Items[2]	Graduating Seniors		GED Graduates	
		Mean	SD	Mean	SD
Writing Skills					
Spelling	90	63	17	61	18
Capitl. & Punctuation	90	59	17	53	19
Usage	216	57	17	58+	19
Sentence Correction	216	61	15	65+	16
Logic & Organization	108	53	12	56+	14
Social Studies					
Economics	105	60	15	66+	18
Geography	86	59	15	65+	18
Political Science	110	60	17	67+	18
U.S. History	134	61	17	65+	19
Behavioral Science	105	61	13	66+	16
Science					
Biology	262	58	17	65+	21
Earth Science	111	56	15	65+	21
Chemistry	85	46	15	50+	22
Physics	82	54	14	59+	20
Reading Skills					
Practical Reading	54	73	17	79+	16
General Reading	113	65	14	75+	16
Prose Literature	103	63	16	74+	17
Poetry	45	60	15	69+	17
Drama	45	66	15	76+	15
Mathematics					
Arithmetic	251	63	20	68+	24
Geometry	91	57	21	56	26
Algebra	108	49	19	39	21

[1]Percent correct values for GED examiness data based on item data from a 30% random sample of examinees participating in the 1980 National Survey. Percent correct values for GED graduates are based on a subset of the GED examinee sample (i.e., those examinees who earned a minimum of 35 on each test and an average 45 across all five GED Tests). Values followed by a plus sign (+) represent areas where GED graduates outperformed graduating seniors.

[2]Number of items on nine forms of the GED battery that were used in these analyses. All available forms that had data for both groups were included in the analyses.

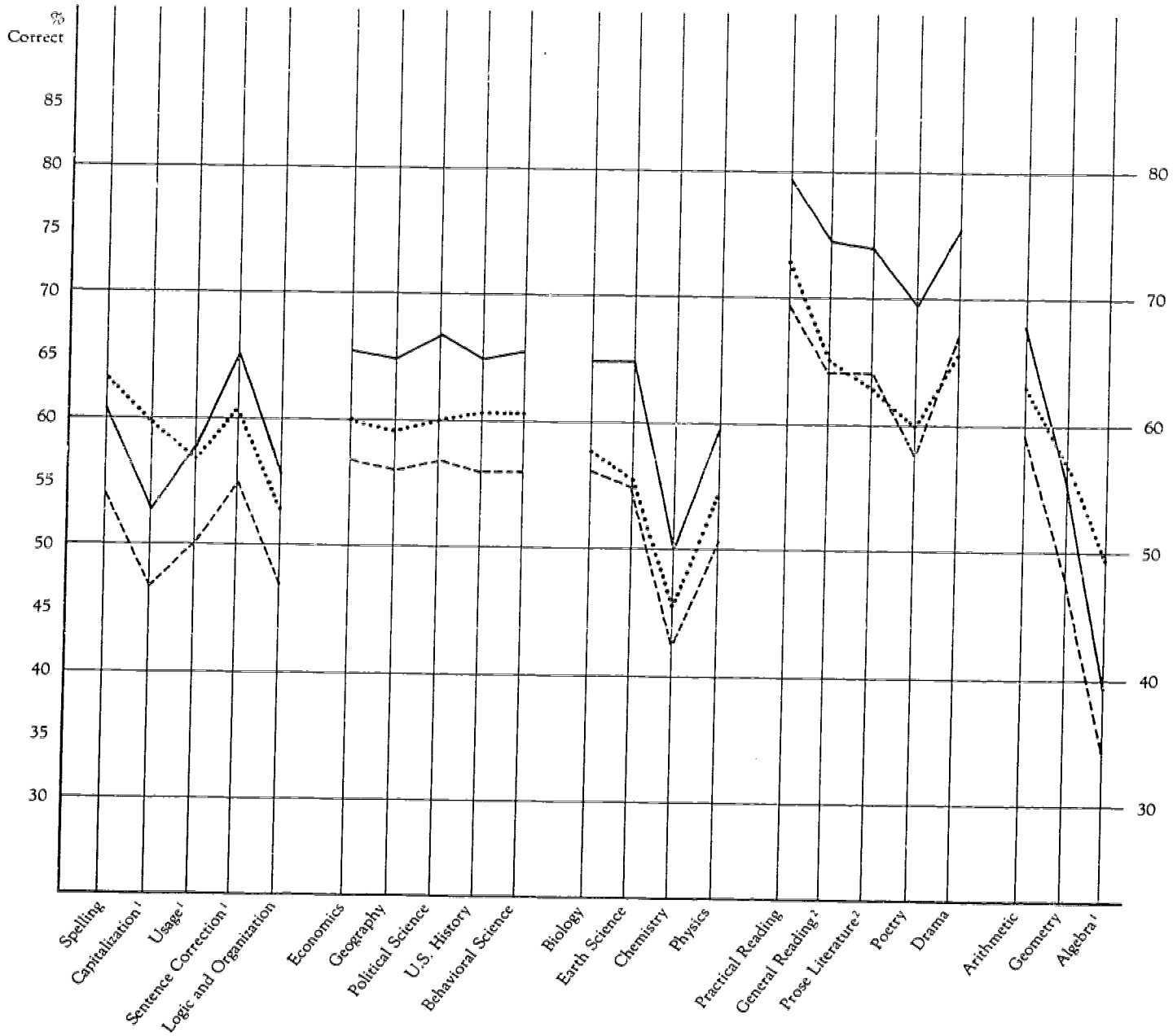
Discussion

The observed difference in overall performance indicated by the percentile ranks of each group was probably related to the GED examinee awareness of the current minimum standard score requirements in effect in most states. Unlike GED examinees who take the GED Tests with a specific objective (i.e., to earn scores high enough to qualify for a high school equivalency credential), graduating seniors participating in the norming study are unaware of the current minimum score requirements at the time of testing. Many GED examinees delay taking the tests until, through instruction or self study, they are reasonably confident of earning standard scores of at least 35-45. The availability of widely used predictive tests (e.g., Official GED Practice Tests (GEDTS, 1979)) may contribute to the relatively small numbers of GED examinees who earn standard scores below 35.

ED 227 742 Examines high school senior performance on the GED test: A detailed analysis.

Malizio, Andrew G.; Whitney, Douglas R.

1 of 1 American Council on Education, Washington, DC. GED Testing Service. Jun 82 21p.



..... Graduating High School Seniors
- - - - - - - - - - - GED Examinees
———— GED "Graduates" (Min 35 and Avg. 45)

[1] Statistically significant difference between graduating seniors and GED examinees.
[2] Statistically significant difference between graduating seniors and GED "graduates."

Figure 2. Percent Correct Values for Content Areas, by Group.

Clearly, graduating seniors earned slightly higher scores than did GED *examinees* in every content area contained on the GED Tests except Drama and Prose Literature. Performance differences on Capitalization and Punctuation, Usage, Sentence Correction, and Algebra were statistically significant. Differences between the two groups showed that, in general, seniors correctly answered one to four additional items per test than did GED examinees. Both groups correctly answered approximately the same number of Reading Skills items. Perhaps, because of the goal orientation of GED examinees at the time they take the Tests, as well as other preparation and pretesting activities of examinees, the percentages of both groups able to meet the recommended minimum score requirements to earn the high school equivalency credential were essentially the same.

The purpose of this study was not to provide a formula for adult basic educators that, when applied to their current teaching strategy, would result in more GED examinees passing the GED Tests. However, based on the overall performance of graduating high school seniors and GED examinees, it would seem that the two groups differ most in terms of achievement in Capitalization and Punctuation, Usage, and Sentence Correction on the Writing Skills test, and in Algebra on the Mathematics test. Because graduating high school seniors earned higher scores in each of these four areas, additional or more effective instruction *may* result in better GED examinee performance. Other factors such as test anxiety may also influence test performance.

Although performance differences between GED examinees and graduating high school seniors were found, they were small. As shown in Figure 1, the score distributions of graduating high school seniors and GED examinees overlap substantially. Further, 30% of current graduating high school seniors could not meet state score requirements for the GED Tests. That is, examinees who pass the GED Tests, have demonstrated achievement levels that surpass about 30% of today's graduating high school seniors.

It should not be inferred that, on an individual basis, a given GED examinee is more or less prepared than a given graduating high school senior. Most GED examinees complete the 10th grade, have been out of school an average of 5-10 years, and are currently employed. Considering these factors, the similarity of test scores for the GED examinees and graduating seniors, is a notable commentary on examinee motivation and on the caliber of instruction offered in adult education programs.

The findings presented here substantiate the Office on Educational Credit and Credentials policy for awarding high school credentials based on the GED Tests. GED *graduates outperformed* the *graduating high school seniors* in *most areas on the battery*. In the four areas where graduating seniors outperformed GED graduates, the differences were not statistically significant. The authors believe that persons who meet the state/provincial established minimum score levels for the high school equivalency credential based on GED Test results should be considered high school graduates for the admissions, military, licensing, and employment purposes. Their test results reported here demonstrate this achievement equivalency.

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APPENDIX 1. Mean Percent of Items Correctly Answered by Graduating High School Seniors, GED Examinees, and GED Graduates.[1]

Content Area	No. Items[2]	Graduating Seniors Mean	Graduating Seniors SD	GED Examinees Mean	GED Examinees SD	GED Graduates Mean	GED Graduates SD
Writing Skills							
Spelling	90	63	17	54	18	61	18
Capitl. & Punctuation	90	59	17	47	17	53	19
Usage	216	57	17	50	18	58+	19
Sentence Correction	216	61	15	55	15	65+	16
Logic & Organization	108	53	12	47	12	56+	14
Social Studies							
Economics	105	60	15	57	18	66+	18
Geography	86	59	15	56	17	65+	18
Political Science	110	60	17	57	17	65+	18
U.S. History	134	61	17	56	18	65+	19
Behavioral Science	105	61	13	56	15	66+	16
Science							
Biology	262	58	17	56	20	65+	21
Earth Science	111	56	15	55	19	65+	21
Chemistry	85	46	15	43	19	50+	22
Physics	82	54	14	51	18	59+	20
Reading Skills							
Practical Reading	54	73	17	69	15	79+	16
General Reading	113	65	14	64	17	75+	16
Prose Literature	103	63	16	64	17	74+	17
Poetry	45	60	15	58	15	69+	17
Drama	45	66	15	67	14	76+	15
Mathematics							
Arithmetic	251	63	20	59	23	68+	24
Geometry	91	57	21	48	24	56	26
Algebra	108	49	19	34	18	39	21

[1] Percent correct values for GED examinee data based on item data from a 30% random sample of examinees participating in the 1980 National Survey. Percent correct values for GED graduates are based on a subset of the GED examinee sample (i.e., those examinees who earned a minimum of 35 on each test **and** an average 45 across all five GED Tests). Values followed by a plus sign (+) represent areas where GED graduates outperperformed graduating seniors.

[2] Number of items on nine forms of the GED battery that were used in these analyses. All available forms that had data for both groups were included in the analyses.

APPENDIX 2. Mean Content Area Confidence Intervals.[1]

Content Area	Graduating Seniors	GED Examinees	GED Graduates[2]
Writing Skills			
Spelling	58-68	50-59	57-66
Capitl. & Punctuation	54-64	42-52	48-58
Usage	54-60	47-53	54-61
Sentence Correction	59-64	53-58	62-68
Logic & Organization	50-57	44-50	52-59
Social Studies			
Economics	56-64	52-61	61-71
Geography	55-63	51-61	60-70
Political Science	56-64	53-61	62-71
U.S. History	57-65	52-60	61-70
Behavioral Science	57-64	52-60	62-70
Science			
Biology	56-61	53-59	61-68
Earth Science	53-60	50-60	60-70
Chemistry	41-50	38-48	44-57
Physics	50-58	46-56	53-65
Reading Skills			
Practical Reading	68-79	63-75	73-85
General Reading	62-69	60-68	71-79
Prose Literature	59-67	60-68	70-79
Poetry	55-66	51-64	63-76
Drama	60-71	60-73	71-82
Mathematics			
Arithmetic	60-66	55-63	64-72
Geometry	51-63	42-55	49-63
Algebra	44-53	29-38	34-44

[1] These values represent estimated 99% confidence intervals and were calculated by multiplying the standard error of each mean p-value by 2.58. For example, on a given Writing Skills test, graduating high school seniors probably would answer correctly an average of 58-68% of the spelling items; GED examinees an average of 50-59%; GED graduates, 57-66%.

[2] Based on GED examinees who earned standard scores of at least 35 on each GED Test and an average standard score of at least 45 on all five tests in the GED battery.

GLOSSARY*

1. An **achievement test** is one designed to measure a student's grasp of some body of knowledge or his proficiency in certain skill domains. The GED Tests are intended to measure achievement from a sample of expected outcomes of four years of high school instruction.

2. An **average** is a number in the range of possible scores, though not always an actual score attained by an individual, which represents the most typical or representative value in a group of scores. "Average" is a generic term designating any measure of central tendency, such as the mean, median, or mode. In ordinary speech, the term "average" often means the same thing as the term "arithmetic mean." On the GED Tests, the average standard score for graduating high school seniors is 50.

3. 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 battery contains five subject area tests: Writing Skills (80 items), Social Studies (60 items), Science (60 items), Reading Skills (40 items), and Mathematics (50 items); a total of 290 items.

4. A **best answer item** is a multiple-choice test item in which the incorrect responses are not totally wrong. The examinee's task is to select the best response, even though it may not be the only plausible response. In a best answer item the difference between the correct answer and the incorrect alternatives is a difference in degree of correctness and/or completeness. Most items on the GED Tests are of this type.

5. **Comparable scores** are expressed on the same scale, and have the same mean and the same variability. If scores on several tests are truly comparable for a group of examinees, the distributions of their scores on each test would be identical, though the scores of any individual on the several tests might differ. Scores on the five tests in the GED battery are comparable for graduating high school seniors.

6. The **content validity** of the GED Tests is determined by the extent to which the items in each content area sample the expected outcomes of four years of high school instruction and by the degree to which the items faithfully tap these outcomes.

7. A **correlation coefficient** is a number, ranging from plus 1 to minus 1, that expresses the degree of relationship between two sets of scores or other measurements of each of the individuals in a group. *Positive correlations* indicate that as one set of scores *increase*, the other set of scores also tends to *increase*; similarly, as one set of scores *decreases* the other set of scores also tends to decrease. *Negative* correlations suggest that as one set of scores *increases*, the other set of scores tend to *decrease*; similarly, as one set of scores *decreases*, the other set tends to *increase*. The letter "r" is ordinarily used to represent the correlation coefficient. The most widely used coefficient of correlation is obtained from the Pearson product-moment formual, though a number of other formulas are also used.

8. A **critical score** separates those which are satisfactory in terms of some purpose or criterion from those which are unsatisfactory. A minimum passing score on a test is a critical score. For the GED Tests, the most widely used score requirement in the United States is a standard score of at least 35 on each subtest and an average standard score of at least 45 for the battery. In Canada, the most widely used score requirement is a standard score of at least 45 on each test. Participating states, provinces, and territories are free to choose unique minimum passing scores, so long as they are not lower than those scores established by the Commission on Educational Credit and Credentials.

9. A **derived score** is obtained by converting a score from one scale of measurement into another. Raw scores on a test, consisting of the number of correct responses, with or without correction for guessing, are frequently converted into such derived scores as percentile ranks, z-scores, or T-scores. Some derived scores are quantitatively proportional to the original scores; some are not. GED standard scores (T-scores) and percentile ranks are derived scales.

10. A **distribution of scores** is a tabulation or enumeration of the frequency of occurrence of each score in a given set of scores. A distribution of scores may be indicated graphically by a frequency polygon or by a histogram.

11. **Equating** is a procedure whereby two parallel examinations are placed on a common scale of measurement. Typically, when parellel 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 the two parallel forms. These equating functions are then used to convert each parallel form to a given base form score. As the base 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.

12. A **frequency distribution** consists of a sequence of score intervals opposite each of which is recorded the number of scores in the total group falling in that interval. The terms "frequency distribution" and "distribution of scores" are nearly synonymous.

13. The **mean** is a measure of the central tendency of the average numerical value of a set of scores. It is calculated by adding all of the scores and dividing the sum by the number of scores.

14. A **multiple-choice item** has two parts: the stem, consisting of a direct question or an incomplete statement, and two or more alternatives, consisting of answers to the question or completions of the statement. The examinee's task is to choose the correct, or the best (keyed), answer over the distracters.

15. 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.

*Adapted from Ebel, Robert L. *Measuring Educational Achievement*, pp. 444-469. Englewood Cliffs, NJ: Prentice-Hall, Inc. 1965.

16. 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. Tables have been prepared to show the height of the ordinate (vertical axis) at various points along the base line (score scale) and for showing areas under the curve in various intervals along the base line. The heights of the ordinates indicate the relative frequencies of each score in the distribution. The areas under the curve over various score intervals indicate what proportion of the total number of scores fall in that interval. The GED standard scores for graduating high school seniors have an approximately normal distribution.

17. An **objective test** is one which can be provided with a simple predetermined list of correct answers, so that subjective opinion or judgment in the scoring procedure is eliminated.

18. 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. Distribution of percentile (or centile) ranks is approximately rectangular, whereas most raw score distributions from which the percentile ranks are derived are approximately normal.

19. A **power test** is one on which the examinee's score depends chiefly on how much he is able to do, not how rapidly he is able to do it. Hence, in a power test there is either no time limit at all or a very generous time limit. The tasks in a power test are sometimes arranged in order of increasing difficulty, with the expectation that the examinee will stop when he reaches tasks of a level of difficulty beyond his capabilities. The GED Tests are intended to be power tests.

20. A **random sample** is a sample selected in such a way as to guarantee equal probability of selection to all possible samples of this size that could be formed from the members of the popoulation involved. It is also true that each element in the population has equal probability of being including in a random sample. If a random sample is sufficiently large and is truly random, a test given to the sample will produce the same score distribution as if the entire population were tested.

21. A **range of scores** is the smallest interval on the score scale which will include all of the measures in the distribution. It is sometimes defined, more simply but somewhat inaccurately, as the difference between the highest and the lowest scores in the distribution. The range of scores provides a simple measure of the variability of the scores of the distribution. GED standard scores can be 20-80, so they have a 61 point possible range.

22. 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 scores 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.

23. A **representative sample** is one chosen in 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 statified 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.

24. A **scale** is a sequence of numbers whose use is defined and limited so they will have special significance in indicating various degrees of some trait or characteristics. For example, the scores obtainable from any test constitute a scale. Scales are sometimes represented graphically by intervals and subdivisions of intervals along a line.

25. A **scoring formula** indicates how the raw score on the test is to be obtained from the number of correct, incorrect, or omitted responses. The simplest scoring formula (also the one used for the GED Tests) is "raw score equals number right." If scores corrected for guessing are desired, the number of wrong responses divided by one less than the number of answer options per item is frequently subtracted from the number of correct responses. Alternatively, the number of omitted items divided by the number of answer options per item can be added to the number of right responses.

26. 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 would not be expected to occur by change more than a specified number of times in one hundred. The statistical signficance 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.

27. 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 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 of the scores lie within plus and minus one standard deviation of the mean. The standard deviation of GED standard scores for graduating high school seniors is 10 points.

28. The **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 one minus the reliability coefficient. Approximately two-thirds of the errors of measurement in a given set of test scores will be less than the standard error of measurement. The largest error of measurement in a set of one hundred scores is likely to be less than three times the standard error of measurement. The standard error of measurement for the GED Tests typically range from 2.5 to 3.1 standard score points.

29. 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 distribu-

tion 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 50 and a standard deviation of 10. The relationship between raw scores (number of correct answers) and standard scores is based on the test results from specified samples of soon-to-graduate high school seniors.

30. A **standardized test** is one which has been constructed in accord with detailed specifications, one for which the items have been selected after tryout for appropriateness in difficulty and discriminating power, one which is accompanied by a manual giving definite directions for uniform administration and scoring, and one which is provided with relevant and dependable norms for score interpretation. Standardized tests are ordinarily constructed by test specialist, with the advice of competent teachers or experts.

31. A **T-score** is a normalized standard score on a scale such that the distribution of T-scores in the population from which they are derived has a mean of 50 and a standard deviation of 10. The original T-scores were devised by McCall and named in honor of Thorndike and Terman. GED standard scores are of this type.

32. 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.

GED Testing Service Research Studies #3

Andrew G. Malizio and Douglas R. Whitney

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