Research Notes

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Concordance Between SAT® I and ACT™ Scores for Individual Students

Over 85 percent of colleges and universities require admission tests of their applicants, and the majority of these institutions accept either SAT® I or ACT™ scores. Institutions consider scores on both tests to be useful indicators of college readiness and valid predictors of college success. However, there are often difficulties when admission officers, high school counselors, or others attempt to evaluate or compare scores from these different tests. How are the scores related? If a test taker scores in the 90th percentile on the ACT, can we assume that he or she would also score in the 90th percentile on the SAT I, and vice versa? How does an individual score of 32 on the ACT relate to performance on the SAT I? Could a college that has established admission criteria for scores on the ACT use comparability measures to set target scores for the SAT I?

This paper describes how results on distinct assessments, such as the ACT and SAT I, can be compared through statistical linking procedures.

WHAT ARE CONCORDANCE STUDIES?

Meaningfully relating scores on different tests, such as the ACT and the SAT I, is referred to as *concordance*. Concordance tables relate scores on test *Y* to scores on test *X*. Scores on nonparallel tests that are linked via concordance tables should be described as "comparable" rather than "equal" (Marco, Abdel-fattah & Baron, 1992).

Concordance tables do not equate scores on different tests. The SAT I and ACT are different tests that measure similar but distinct constructs. Table 1 contrasts the content within each section of the ACT and SAT I. As one might expect, scores on the SAT I and ACT are highly related; in the three most recent concordance studies, the correlations between individuals' SAT I and ACT scores range from .89 to .92. However, the SAT I is designed to focus on developed verbal and mathematical reasoning skills, while the ACT emphasizes achievement related to high school curricula. The SAT I consists of two scales—Verbal and Mathematical—while the ACT Assessment has four subscales—English, Mathematics, Reading, and Science Reasoning. An ACT Composite score is also reported. (An ACT Composite score is the sum of four individual components divided by four and rounded to the nearest whole number.)

KEYWORDS:

SAT I
ACT
Concordance

WHY USE CONCORDANCE TABLES?

Concordance tables have actually been used for decades for a variety of purposes. While imperfect, they are a useful tool for admission counselors who need assistance in comparing scores submitted on both tests. High school guidance counselors can use concordance tables for individual counseling purposes (e.g., to advise students concerning potential colleges and universities). College admission counselors can use a concordance table between scores on the SAT I or ACT to assist admission or selection decisions, scholarship determinations, or placement options. NCAA eligibility, often based on ACT scores, might be determined from an individual's SAT I score.

HOW CONCORDANCE TABLES ARE PRODUCED

Several basic steps precede the actual development of the concordance tables. Researchers who have completed previous concordance studies

TABLE 1*
CONTENT COMPARISON ACROSS ACT AND SAT I COMPONENT SCORES

SAT I Verbal	Critical Reasoning (36–44) questions	Analogies/Sentence Completions (34–42) questions				
SAT I Math	Arithmetic Reasoning (18–19) questions	Algebraic Reasoning (17) questions		Geometric Reasoning (16–17) questions		Miscellaneous Reasoning (7–9) questions
ACT Math	Pre-Algebra (14) questions	Elementary Algebra (10) questions	Intermediate Algebra (9) questions	Coordinate Geometry (9) questions	Plane Geometry (9) questions	Trigonometry (4) questions
ACT English	Usage/Mechanics (40) questions	Rhetorical Skills (35) questions				
ACT Reading	Prose Fiction (10) questions	Humanities (10) questions		Social Sciences (10) questions	Natural Sciences (10) questions	
ACT Science Reasoning				Research Summaries (18) questions	Conflicting Viewpoints (7) questions	Data Representation (15) questions

*Reprinted from Dorans, 1999.

have generally followed the same basic procedures: SAT I and ACT scores are obtained from participating universities, along with demographic information such as Social Security numbers that can be used to match individual scores. Statistical weighting may be used to correct time differences between the test administrations (i.e., so there are no mean differences in test scores due to time elapsed between administration of the first and second test), and statistical procedures may be used to "smooth" the data if scores are sparse in some parts of the score distribution, usually at the scale extremes. Finally, the statistical method of choice (either equipercentile or linear) is used to convert scores in both directions: SAT I to ACT, and ACT to SAT I. Then the final concordance tables are prepared (Marco, September 1995).

There are two basic statistical methods that are used to produce concordance tables: equipercentile scaling and linear scaling.

Equipercentile Scaling. The equipercentile scaling method, which is most frequently used for selection situations (Sawyer, May 19, 1995), sets equal the scores on each test having the same percentile ranks in each sample. For example, the score at the 80th percentile on the SAT I score distribution would correspond to the score at the 80th percentile of the ACT Sum score distribution. (ACT Sum score is a combined total of scores on the four subtests.) If the SAT I score of 1200 is concordant with an ACT Sum score of 105, then equal numbers of students in the research sample scored below a 1200 on the SAT I and below a 105 on the ACT Sum. Therefore, equipercentile scaling is useful for determining or selecting the same proportion of students on each test, rather than for predicting actual scores on one test from scores on another (Sawyer, May 19, 1995). Concordance tables based on equipercentile scaling are appropriate for estimating cutoff scores that would result in comparable proportions of students being selected from the population (Houston & Sawyer, 1991). Most of the concordance studies cited in this report, including the tables and the most current study, used the equipercentile method.

Linear Scaling. When data are sparse, smoothing procedures may be used. Linear scaling is one such smoothing procedure. Here the only data used are the average score on each test and the standard deviation, a measure of score spread. The mean and standard deviation of scores on the test to be scaled are set equal to the mean and standard deviation of the other test. For example, the mean and standard deviation on the SAT I is set equal to the ACT mean and standard deviation via a linear equation.

PREVIOUS CONCORDANCE STUDIES

Table 2 summarizes relevant information from three concordance studies that were performed in the last seven years. In addition, the State of Florida and several colleges and universities use their own concordance tables developed on their applicants. Scanning the table serves to highlight some advantages of the most current study. First, the most recent study (Dorans, Lyu, Pommerich & Houston, 1997) was conducted on a much larger sample than previous studies: over 103,000 students as compared to 55,000 students in the next largest sample. In addition, the sample included two state systems in addition to 14 individual universities, while most previous studies included only university-level data. Dorans et al. (1997) examined the ACT Sum as well as the ACT Composite. The ACT Sum more closely approximates the SAT I score distribution. The ACT Sum has 141 possible scores, and the SAT I has 121 possible scores, while the ACT Composite has only 36 scores. Using the ACT Sum allows researchers to map SAT I score onto a unique ACT Sum score.

Concordances between the SAT I and ACT math scores were established by Dorans (1999) using the same data used by Dorans, et al. (1997). The highest correlations among individual subtests were found between the two math tests (r = .89), enough to develop separate concordance for these measures.

INSTRUCTIONS FOR USING THE ATTACHED CONCORDANCE TABLES

The most current concordance data, based on the 1996-97 scores for approximately 103,000 students, are presented in Tables 3 through 5. Tables 3 and 4 provide ACT to SAT I conversions, first using the ACT Composite scores (Table 3), then the ACT Sum scores (Table 4). Table 5 provides conversions for SAT I scores to either ACT Sum or ACT Composite scores. To use the tables, scan the left column for the test score for which you wish to obtain a concordant score, then move to the right column to get the concordant score. For example, using Table 3, an ACT Composite score of 25 has a concordant SAT I score of 1140. Using Table 5, an SAT I V+M score of 1140 corresponds to an ACT Sum score of 99 and an ACT Composite score of 25.

Clearly, there are some limitations to using these tables. For example, only 26 possible SAT I scores are included in Table 3; when Table 4 is used, 101 possible SAT I scores are given. Due to the different number of scale points for the SAT I and the ACT Composite and Sum, one-to-one

TABLE 2
CONCORDANCE STUDIES 1991-1997

Year	Method	No. of subjects	No. of universities participating	Average days between tests	SAT-ACT correlation	Scales included
1996-97	Equipercentile	103,525	14 + 2 states	15	.92	ACT Composite & Sum; SAT V+M
1995	Equipercentile & Regression	55,326	22	N/A	.90	ACT Composite & Sum; SAT V+M
1991	Equipercentile	40,051	14	11.2	.89	ACT Composite; SAT V+M

TABLE 3*
CONCORDANCE BETWEEN ACT COMPOSITE AND SAT I V + M SCORES

ACT Composite	SAT I V+M	ACT Composite	SAT I V+M
36	1600	23	1070
35	1580	22	1030
34	1520	21	990
33	1470	20	950
32	1420	19	910
31	1380	18	870
30	1340	17	830
29	1300	16	780
28	1260	15	740
27	1220	14	680
26	1180	13	620
25	1140	12	560
24	1110	11	500

Notes: This and Tables 4 and 5 were taken from an article published in 1997 in *College and University* entitled Concordance Between ACT Assessment and Recentered SAT I Sum Scores by Neil J. Dorans and C. Felicia Lyu of Educational Testing Service, and Mary Pommerich and Walter M. Houston of ACT. These tables are based on data from 103,525 students from 14 universities and two states who took the ACT and the SAT I between October 1994 and December 1996. These tables contain scores that were achieved by comparable proportions of students who took both tests within 217 days of each other. Because the ACT and the SAT I tests have different content, concordant scores should not be viewed as interchangeable measures of the same combination of skills and abilities. In addition, these differences in content mean that the concordances may vary from sample to sample.

*Reprinted from Dorans et al., 1997.

TABLE 4*
CONCORDANCE BETWEEN ACT SUM AND SAT I V+M SCORES

ACT Sum	SAT I V+M	ACT Sum	SAT I V+M	ACT Sum	SAT I V+M	ACT Sum	SAT I V+M	ACT Sum	SAT I V+M
144	1600	124	1390	104	1190	84	1000	64	790
143	1600	123	1380	103	1180	83	990	63	780
142	1600	122	1360	102	1170	82	980	62	770
141	1600	121	1350	101	1160	81	970	61	750
140	1590	120	1340	100	1150	80	960	60	740
139	1580	119	1330	99	1140	79	950	59	730
138	1560	118	1320	98	1130	78	940	58	710
137	1550	117	1310	97	1120	77	930	57	700
136	1530	116	1300	96	1110	76	920	56	690
135	1520	115	1290	95	1100	75	910	55	670
134	1510	114	1280	94	1090	74	900	54	660
133	1500	113	1270	93	1080	73	890	53	640
132	1480	112	1260	92	1070	72	880	52	630
131	1470	111	1250	91	1070	71	870	51	610
130	1460	110	1240	90	1060	70	860	50	590
129	1440	109	1230	89	1050	69	840	49	570
128	1430	108	1220	88	1040	68	830	48	560
127	1420	107	1210	87	1030	67	820	47	540
126	1410	106	1200	86	1020	66	810	46	520
125	1400	105	1200	85	1010	65	800	45	510
								44	500

*Reprinted from Dorans et al., 1997.

TABLE 5*
CONCORDANCE BETWEEN SAT I V+M AND ACT SUM SCORES (AND ACT COMPOSITE)

SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite	SAT I V+M	ACT Sum	ACT Composite
1600	141-144	35-36	1380	123	31	1160	101	25	940	78	20	720	58	15
1590	140	35	1370	123	31	1150	100	25	930	77	19	710	58	15
1580	139	35	1360	122	31	1140	99	25	920	76	19	700	57	14
1570	138	35	1350	121	30	1130	98	25	910	75	19	690	56	14
1560	138	35	1340	120	30	1120	97	24	900	74	19	680	56	14
1550	137	34	1330	119	30	1110	96	24	890	73	18	670	55	14
1540	137	34	1320	118	30	1100	95	24	880	72	18	660	54	14
1530	136	34	1310	117	29	1090	94	24	870	71	18	650	53	13
1520	135	34	1300	116	29	1080	93	23	860	70	18	640	53	13
1510	134	34	1290	115	29	1070	91	23	850	69	17	630	52	13
1500	133	33	1280	114	29	1060	90	23	840	69	17	620	52	13
1490	132	33	1270	113	28	1050	89	22	830	68	17	610	51	13
1480	132	33	1260	112	28	1040	88	22	820	67	17	600	50	13
1470	131	33	1250	111	28	1030	87	22	810	66	17	590	50	13
1460	130	33	1240	110	28	1020	86	22	800	65	16	580	49	12
1450	129	32	1230	109	27	1010	85	21	790	64	16	570	49	12
1440	129	32	1220	108	27	1000	84	21	780	63	16	560	48	12
1430	128	32	1210	107	27	990	83	21	770	62	16	550	47	12
1420	127	32	1200	105	26	980	82	21	760	62	16	540	47	12
1410	126	32	1190	104	26	970	81	20	750	61	15	530	46	12
1400	125	31	1180	103	26	960	80	20	740	60	15	520	46	12
1390	124	31	1170	102	26	950	79	20	730	59	15	510	45	11
												500	44	11

*Reprinted from Dorans et al., 1997.

TABLE 6*
CONCORDANCE BETWEEN ACT MATHEMATICS AND SAT I MATH SCORES

ACT Math	SAT I Math	ACT Math	SAT I Math
36	800	23	540
35	790	22	520
34	780	21	500
33	740	20	480
32	720	19	460
31	700	18	440
30	680	17	420
29	650	16	390
28	640	15	360
27	620	14	330
26	600	13	290
25	580	12	250
24	560	11	220

*Reprinted from Dorans, 1999.

TABLE 7*
CONCORDANCE BETWEEN SAT I MATH AND ACT MATHEMATICS SCORES

SAT I Math	ACT Math	SAT I Math	ACT Math
800	36	500	21
790	35	490	20
780	34	480	20
770	34	470	19
760	33	460	19
750	33	450	18
740	33	440	18
730	32	430	18
720	32	420	17
710	31	410	17
700	31	400	17
690	31	390	16
680	30	380	16
670	30	370	15
660	29	360	15
650	29	350	15
640	28	340	14
630	28	330	14
620	27	320	14
610	27	310	14
600	26	300	13
590	26	290	13
580	25	280	13
570	25	270	13
560	24	260	12
550	23	250	12
540	23	240	12
530	22	230	11
520	22	220	11
510	21		

*Reprinted from Dorans, 1999.

mapping between scores is never possible, and rounding errors occur occasionally. Users should interpret and use the concordance data appropriately, with knowledge of their limitations.

Tables 6 and 7 provide concordances between SAT I Math and ACT Math scores and can be used much the same way as the above tables.

WHAT ARE THE LIMITATIONS OF SAT I/ACT CONCORDANCE TABLES?

SAT I/ACT concordance tables have general limitations:

1. The concordance tables provide a *comparable* score on the other test, but the scores cannot be assumed to be interchangeable or equivalent (Linn, 1993).
2. The statistical relationship between such nonparallel tests (i.e., concordance) is weaker than that between parallel forms of the same test (e.g., different forms of the SAT I) (Houston & Sawyer, 1991). Due to the different content covered in the two tests, students with the same SAT I score are likely to achieve different ACT scores. If a student took the test better suited to his or her skills, concordance tables might overestimate the potential score on the other test, and if he or she actually took the test less suited to his or her skills, the concordance table might *under*estimate the potential score on the other test.
3. SAT I and ACT score scales are different. The

score range for the SAT I V+M Sum includes 121 possible scores (400–1600 in 10 point increments). The range for the ACT Composite includes 36 possible scores (1–36), and the ACT Sum (the sum of the four ACT subscales) includes 141 possible scores (4–144). Therefore, more than one possible SAT I score will correspond to each given ACT Composite score. ACT Composite to SAT I conversions allow one-to-one mapping of scores, but SAT I to ACT Composite conversions inherently have many-to-one possible score matches.

4. Another limitation observed across most concordance studies to date is that students in the concordance samples on average score higher than the average scores obtained in the general SAT I and ACT candidate populations (Dorans et al., 1997). Students who take both tests, on average, are not representative of the general test-taking population. In addition, the sample data for all concordance studies are limited to students who self-select to take both tests and who applied to colleges and universities participating in each study. Since concordance results vary with the composition of the concordance sample, the results of a concordance do not generalize directly to other groups.
5. At score locations where the data are sparse (i.e., usually at the score extremes), the percentile ranks for a given sample may differ considerably from other samples (Marco, Abdel-fattah & Baron, 1992). Smoothing procedures might be needed.
6. If students take both the SAT I and the ACT, they tend to perform better on the second test that they take. Similarly, students generally increase their SAT I scores with repeated testing (Nathan & Camara, 1998). Both types of score increases may be attributed to increased personal growth and development between the testing dates, enhanced familiarity with the testing situation, or both. Score differences increase as the length of time between testing dates increases. Therefore, in a recent concordance study, students who took the two tests more than 217 days apart were eliminated from the sample (Dorans, Lyu, Pommerich & Houston, 1997). In that study, students took the SAT I before the ACT in a majority of cases, on an average of only about 13 days apart. Statistical adjustments can also be used to correct for the time difference between test dates.
7. Concordance between subscale scores of the ACT and SAT I are not appropriate with the exception of the math sections of each test (Dorans, 1999). Correlations for separate subtests range between .63 and .83, generally too low for comparability of scores. Yet, these correlations can provide solid predictions of performance across most subtests.

PRODUCING LOCAL CONCORDANCE TABLES

Colleges and universities with sufficient numbers of students submitting SAT I and ACT scores may be best served by developing their own concordance tables. The quality of local tables would depend upon factors such as the size of the test-taking sample, the quality and comparability of score distributions, the time lapse between the SAT I and ACT score administrations, and the statistical methods used to correct the data and produce the concordance tables (Marco & Abdel-fattah, 1991). Concordant SAT I and ACT scores do vary from university to university (Marco, September 1995). Local concordances are particularly useful when an institution's applicants differ from the sample of students employed in a national concordance. Admission or placement decisions may be flawed if one institution uses concordance data collected at another university, or even data pooled from multiple universities when their applicants differ in meaningful ways from students in the concordance samples based on other institutions (Houston & Sawyer, 1991).

If it is desirable and feasible for a given institution to develop its own tables, the following suggestions may help:

1. It is not possible to develop a concordance table that will apply to all populations, but tables are usually quite effective for a given, restricted population of test takers. Therefore, institutions that develop their

own concordance tables should ensure that the student sample used in the concordance does not differ significantly from the population on which the final tables will be used, either in academic ability, demographics, time lapse between test administrations, or other factors (Marco & Abdel-fattah, 1991).

2. Check the correlation between the two scores to be made concordant. If it does not exceed .87, scaling may not be a viable option for these scores (Dorans, 1999). If it equals or exceeds .87, proceed with steps 3 and 4.
3. The equipercentile method is suggested when there is sufficient data. Linear scaling can be used with smaller samples when scaling.
4. Smoothing or truncating data may be needed to statistically correct for limitations in the sample data, such as sparseness of scores at some parts of the score distribution (usually the scale extremes) and time differences between test administrations (Marco, Abdel-fattah & Baron, 1992).

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Data reported in this Research Note are based on research conducted by Dorans et al. (1997) and earlier concordance studies cited.

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