Concordance of ACT Aspire and PreACT/ACT Test Scores

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Introduction

Concordance is used to align scores from two different tests that measure similar constructs; however, it does not result in score interchangeability and does not optimize prediction accuracy. Rather, concordance can be used to set comparable cut scores on two tests or to compare the performance of candidates who took different tests. In this paper, we document the data and methods used to generate concordance tables linking ACT® Aspire® scores to PreACT® or ACT® scores. We provide recommendations for how the concordances should be used.

The ACT Aspire Summative Assessments measure student progress in English, math, reading, science, ELA (overall performance in English, reading, and writing), and STEM (overall performance in math and science; ACT, 2019a). The tests are grade-level specific for grades 3 through early high school (grade 9 and 10). Other than writing, the tests are vertically-scaled and scale scores are reported on a scale from 400 to a maximum score that varies across subjects and grades (e.g., 429 for reading grade 3 to 460 for math early high school). ACT Aspire Summative Assessments include multiple-choice, technology-enhanced, and constructed-response item types, as well as a writing task (if the writing test is taken).

The ACT test measures student achievement in English, math, reading, science, and writing (ACT, 2019b). The tests are oriented towards the general content areas of college and high school instructional programs. The tests are intended for students in grade 11 and 12, though students in earlier grades also take the ACT for placement and talent identification purposes. Scale scores are reported on a 1–36 scale for all subjects except writing. The ACT test uses multiple-choice items and a writing task (if the writing test is taken). The PreACT test is designed to be similar to the ACT test but is targeted to the general population of 10th-grade students (ACT, 2019c). The PreACT test does not include a writing test. Scores are reported on a 1–35 scale that is approximately on the same ACT score scale.

The philosophical basis of the ACT Aspire, PreACT, and ACT tests are similar, and the design of all three tests is informed by the ACT National Curriculum Survey (ACT, 2016). All three tests report Composite (average of the English, math, reading, and science scores) and STEM scores (average of the math and science scores). ACT Aspire and the ACT test also report ELA scores (average of the English, reading, and writing scores).

The tests also share reporting categories, which are used to group the items and tasks from the different domains represented on each test.

Sample and Data

Concordances generally require large samples of examinees who took the tests being linked. A single-group design is used when each examinee took both of the tests being linked. A two-group design is used when each examinee took one of the tests being linked and when the two groups are approximately equivalent (e.g., when examinees are randomly assigned to a test). This study used a single-group design with students who took ACT Aspire and the PreACT or ACT not more than two instructional months apart. Study inclusion criteria required that examinees must have:

- taken one or more ACT Aspire tests in grade 8, 9, or 10.
- taken one or more PreACT or ACT tests within two instructional months[1] of an ACT Aspire test in the same subject. By requiring that students took the tests in close time proximity, we are more confident that the concordance will result in score comparisons that are not confounded by instructional time between tests. Common scenarios in which students take multiple tests in close proximity include:
    - taking the ACT test in 9th or 10th grade for admissions into a concurrent enrollment program or for early practice, and also taking ACT Aspire as part of a regular state or district testing program; and
    - taking ACT Aspire in the spring, and then taking the PreACT test early the next fall, with both tests being taken as part of a regular district testing program.
- attended a high school in the United States at the time of the PreACT or ACT test.

ACT Aspire assessments taken from spring 2014 through spring 2019, ACT assessments taken from spring 2014 through summer 2019, and PreACT assessments taken from fall 2016 through fall 2019 were available for matching. The resulting samples of matched data are summarized in Table 1. For all subjects except ELA, over 70,000 matches were made, approximately 73% of which were Aspire/ACT matches and 27% of which were Aspire/PreACT matches. Because PreACT does not have a writing test and therefore does not report an ELA score, all matches for ELA were for Aspire/ACT. The ELA sample size (n=9,905) was much smaller than the sample sizes for the other subjects because relatively few students took the ACT test with writing.

Test score means and standard deviations and correlations between test scores are shown in Table 1. Students who take the ACT test in grades 8–10 tend to be higher-achievers relative to the general student population, and thus their test scores are subject to restriction of range. In addition to the simple correlation, we present correlations corrected for restriction of range and measurement error.[2] Along with test content considerations (e.g., test blueprints and performance level descriptors), the corrected correlations can help inform the extent that the tests measure similar constructs. The corrected correlations ranged from 0.85 to 0.95. On average, the corrected correlation was 0.92, suggesting that the tests measure similar constructs.

Table 1. Summary Statistics

Subject	Sample	N	ACT Aspire		ACT/PreACT		r	r_c
			Mean	SD	Mean	SD		
English	PreACT	18,677	431.0	10.0	17.7	5.8	0.81	0.94
	ACT	51,680	438.9	8.2	21.9	5.6	0.79	0.95
	Combined	70,357	436.8	9.4	20.8	6.0	0.82	0.95
Math	PreACT	19,040	428.4	9.0	19.1	4.7	0.80	0.92
	ACT	51,984	433.0	7.7	21.3	4.6	0.79	0.94
	Combined	71,024	431.8	8.4	20.7	4.7	0.80	0.93
Reading	PreACT	19,030	424.2	7.8	20.3	6.5	0.72	0.87
	ACT	51,798	428.9	6.1	22.4	5.7	0.62	0.85
	Combined	70,828	427.6	6.9	21.8	6.0	0.66	0.85
Science	PreACT	19,273	428.1	9.2	19.2	5.3	0.75	0.89
	ACT	51,658	433.5	7.4	21.9	4.5	0.69	0.89
	Combined	70,931	432.1	8.3	21.2	4.9	0.73	0.89
ELA	ACT	9,905	434.3	5.3	22.0	4.8	0.79	0.95
STEM	PreACT	19,160	428.5	8.6	19.4	4.7	0.84	0.92
	ACT	51,481	433.5	7.1	21.8	4.2	0.81	0.93
	Combined	70,641	432.2	7.8	21.2	4.5	0.83	0.93
Composite	PreACT	19,131	428.1	8.1	19.2	5.0	0.88	0.93
	ACT	51,047	433.7	6.4	22.0	4.5	0.84	0.93
	Combined	70,178	432.2	7.4	21.2	4.8	0.86	0.93

Note: SD = standard deviation, r = Pearson correlation, r_c = Pearson correlation corrected for restriction of range and measurement error

Other characteristics of the samples are presented in Table 2. The sample includes mostly 10th-grade students from the South and Midwest regions of the United States. The combined sample is predominantly White (77%) and female (55%), with some representation from other racial/ethnic and other student subgroups (students with disabilities, English language learners, and economically-disadvantaged students).[3] Relative to the Aspire/PreACT sample, the Aspire/ACT sample had higher mean achievement, more females, more students from the South region of the United States, and more 10th graders, among other differences (Table 2).

In 46% of all cases, the PreACT or ACT test was taken after the ACT Aspire test (by one or two instructional months), in 19% of cases the ACT Aspire test was taken before the PreACT or ACT test, and in 35% of cases the tests were taken during the same month. For Aspire/PreACT matches, the PreACT or ACT test was taken after the ACT Aspire test in 82% of cases, as compared to 33% for Aspire/ACT matches.

Table 2. Sample Characteristics

Characteristic	Sample		
	PreACT %	ACT %	Combined %
Gender			
Female	51.2	56.5	55.0
Male	48.8	43.6	45.0
Race/Ethnicity			
African American	7.3	7.8	7.7
Asian	2.7	3.5	3.2
Hispanic	11.6	4.4	6.3
Other race/ethnicity	3.6	3.8	3.7
White	68.9	79.9	77.0
Missing	5.9	0.6	2.1
Economically disadvantaged			
Yes	25.9	23.5	24.1
No/Missing	74.1	76.5	75.9
Disability status			
Yes	7.3	0.8	2.6
No/Missing	92.7	99.2	97.4
English language learner			
Yes	2.7	0.7	1.3
No/Missing	97.3	99.3	98.7
School affiliation			
Public	87.7	82.7	83.9
Non-public	12.2	16.9	15.8
Missing	0.1	0.4	0.3
Geographic region			
Midwest	83.5	16.3	34.1
Northeast	0.1	0.2	0.2
South	16.0	81.7	64.3
West	0.6	1.5	1.2
Missing	0.0	0.4	0.3
Grade level*			
8	10.6	1.9	4.3
9	37.8	12.2	19.2
10	51.6	85.9	76.6
Academic year*			
2013-2014	0.0	1.0	0.7
2014-2015	0.0	8.1	6.3
2015-2016	16.4	31.6	27.4
2016-2017	19.6	29.3	26.5
2017-2018	29.8	15.7	19.5
2018-2019	34.2	14.1	19.6

*At time of ACT Aspire test

Concordance Estimation

Concordances are a form of score linking for tests developed from similar but different test specifications. Concordances are often developed using equipercentile linking, which results in a symmetric linkage (not considering rounding) and preservation of the scales of both tests. We used equipercentile linking results without smoothing, adopting an analytic method described by Kolen (1984). For score points at the two extreme ends on the scale where there were very few students (i.e., less than 0.5%), linear interpolation was implemented to stabilize the linking.

Because the PreACT and ACT tests share a common scale, we expected the Aspire/PreACT and Aspire/ACT concordances to be similar. Three sets of concordances with ACT Aspire test scores were estimated, using: (a) PreACT test scores only, (b) ACT test scores only, and (c) PreACT and ACT test scores combined. For ELA, only the Aspire/ACT concordance was estimated. If the concordance results are consistent for PreACT and ACT, the concordances based on the combined data can be used.

Figures 1–7 show the three sets of un-rounded concordance results for each subject (ELA has only one concordance). The orange line shows the concordance using PreACT test scores only, the blue line shows the concordance using ACT test scores only, and the yellow line shows the combined results.

Generally, the PreACT and ACT concordances are in close agreement. On average, the concordant ACT Aspire score is 0.8 points higher for the ACT concordance relative to the PreACT concordance.[4] In Figures 1–7, the blue line (ACT) is above the orange line (PreACT) when the concordant ACT Aspire score is higher for the ACT concordance relative to the PreACT concordance. In 41% of cases, the ACT and PreACT results are within half a point of one another. In 59% of cases, the results are within one point of one another.

The PreACT/ACT agreement varied across subject areas. Agreement was strongest in math, science, and STEM and was weakest in reading. For reading, the concordant ACT Aspire score is 1.9 points higher for the ACT concordance relative to the PreACT concordance, on average (Figure 3). It is possible that since concordances can be sample dependent, that these concordance differences are due to the differences in sample characteristics. It is also possible that the small differences in assessment timing (e.g., PreACT tests were more likely to be taken one or two instructional months after the ACT Aspire tests) influenced the results.

Because the concordance results are mostly similar for PreACT and ACT, we chose to use the concordances based on the combined PreACT/ACT data. By doing so, we capitalize on the larger sample size and ensure representation of PreACT and ACT examinees. Because the combined data is mostly based on ACT data (approximately 73%), the combined results are similar to the Aspire/ACT results. Therefore, one of the cautions of using the concordance is that it may be slightly less accurate for comparing PreACT and ACT Aspire scores.

Figure 1. Concordance from PreACT/ACT to ACT Aspire, English

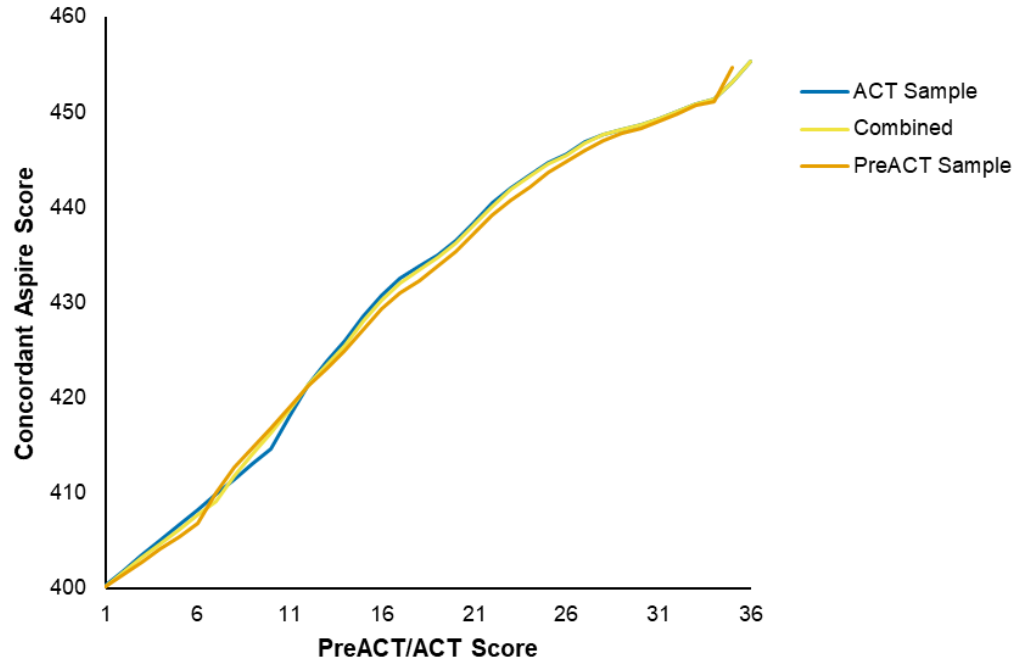


Figure 2. Concordance from PreACT/ACT to ACT Aspire, Math

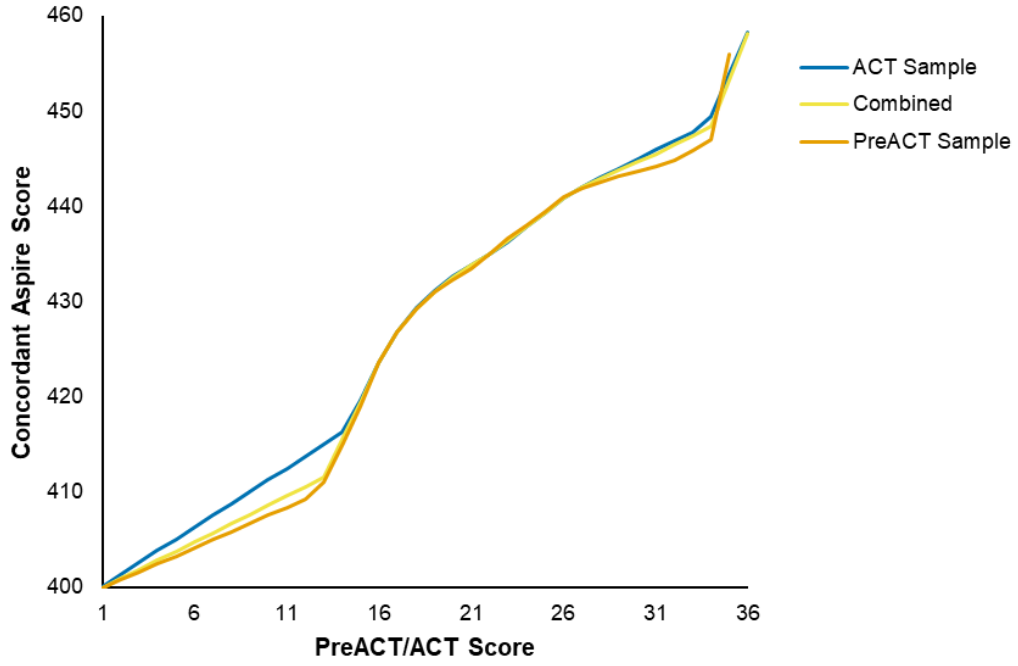


Figure 3. Concordance from PreACT/ACT to ACT Aspire, Reading

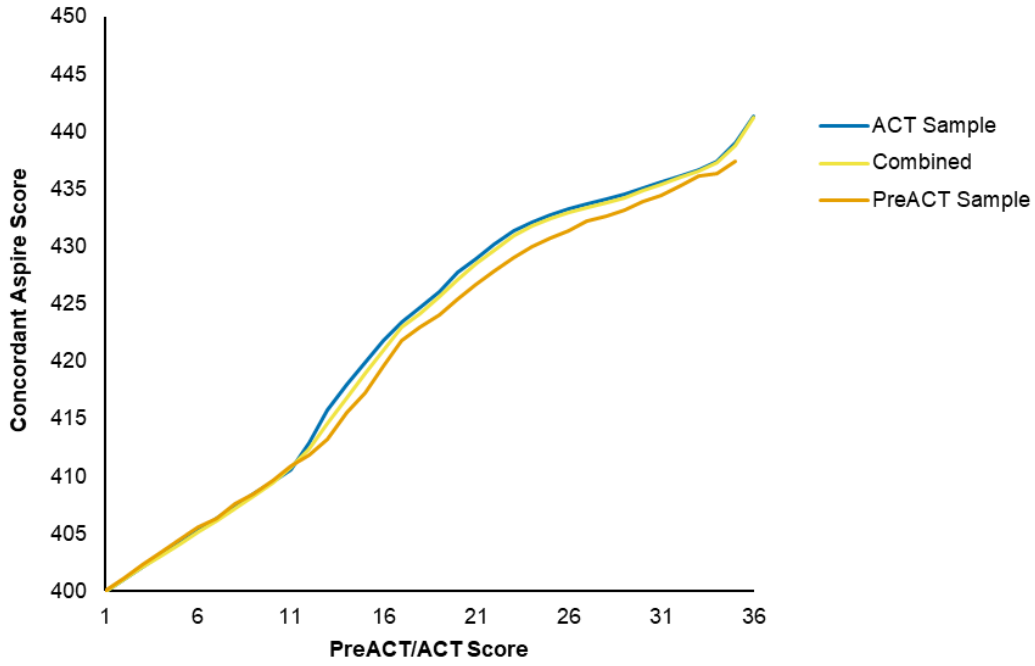


Figure 4. Concordance from PreACT/ACT to ACT Aspire, Science

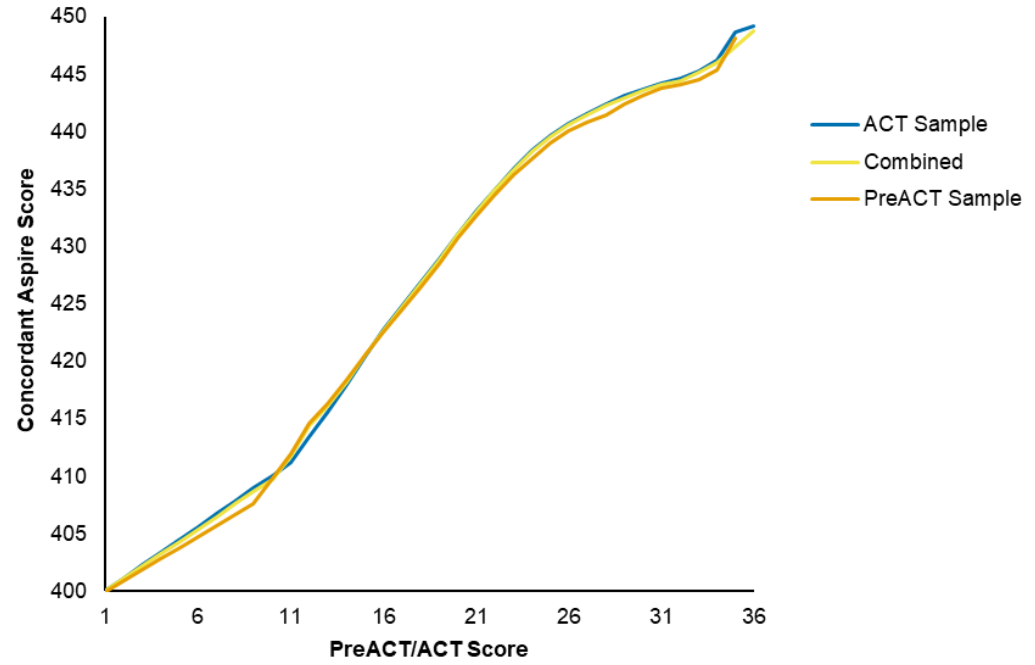


Figure 5. Concordance from ACT to ACT Aspire, ELA

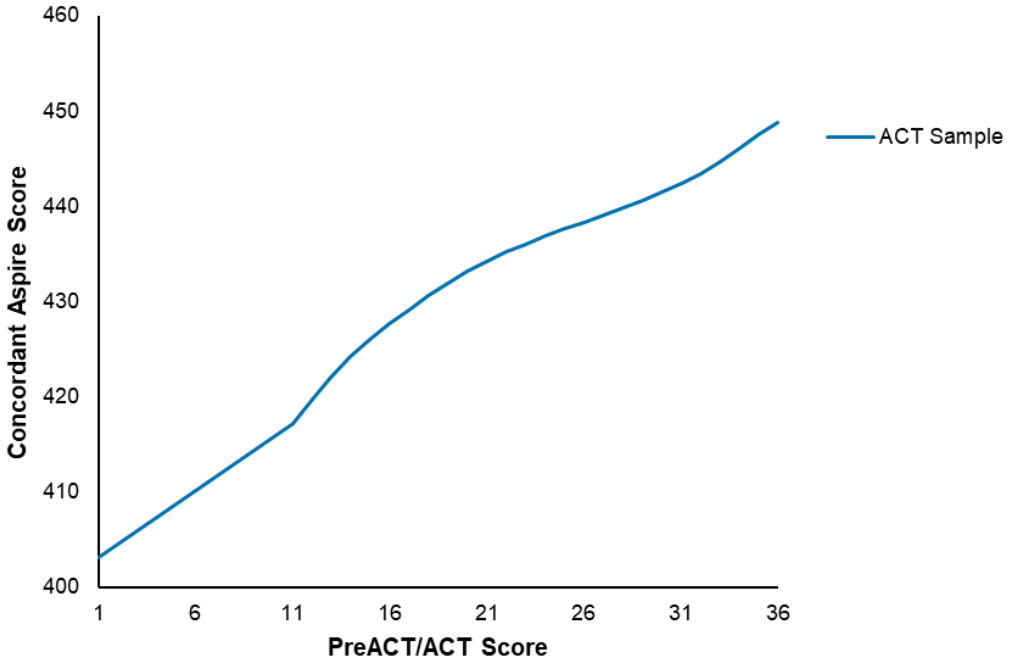


Figure 6. Concordance from PreACT/ACT to ACT Aspire, STEM

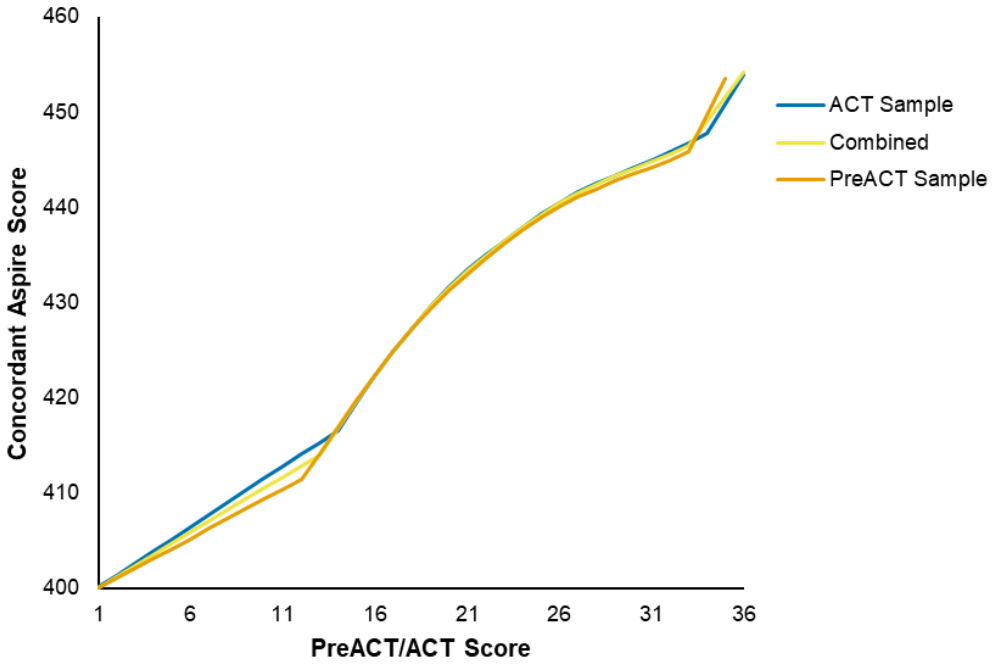


Figure 7. Concordance from PreACT/ACT to ACT Aspire, Composite

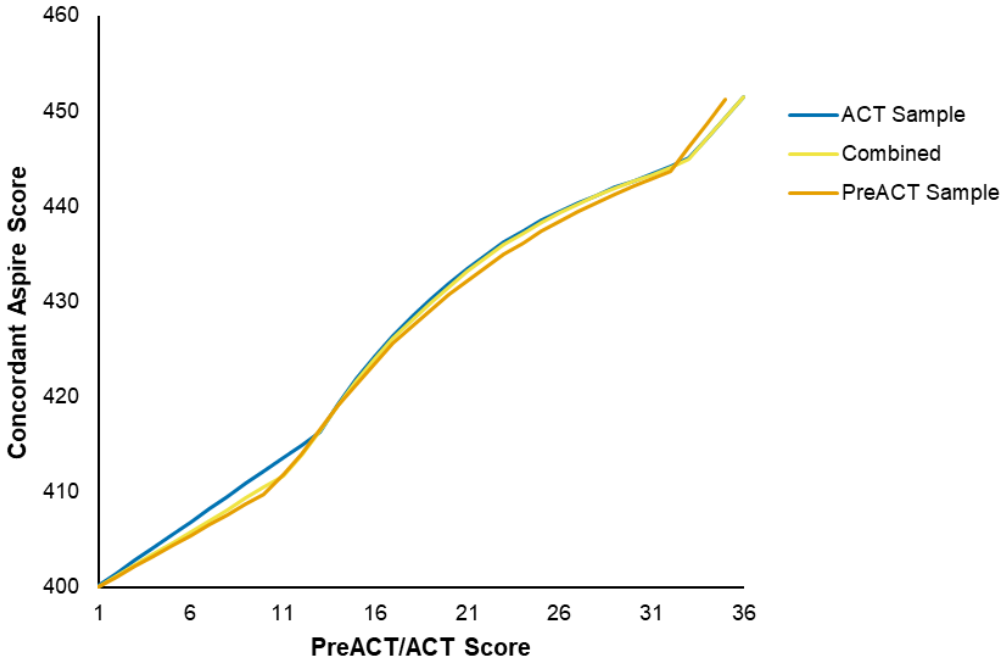


Table 3. PreACT/ACT to ACT Aspire Concordance

PreACT or ACT Score	Concordant ACT Aspire Score						
	English	Math	Reading	Science	ELA	STEM	Composite
1	400	400	400	400	403	400	400
2	402	401	401	401	405	401	401
3	403	402	402	402	406	402	402
4	405	403	403	403	407	404	404
5	406	404	404	404	409	405	405
6	408	405	405	405	410	406	406
7	409	406	406	406	412	407	407
8	412	407	407	408	413	408	408
9	414	408	408	409	414	409	409
10	416	409	409	410	416	411	411
11	419	410	411	412	417	412	412
12	421	411	412	414	420	413	414
13	423	412	415	416	422	414	416
14	426	416	417	418	424	417	419
15	428	419	419	421	426	420	422
16	430	424	421	423	428	422	424
17	432	427	423	425	429	425	426
18	433	429	424	427	431	427	428
19	435	431	426	429	432	430	430
20	436	433	427	431	433	432	432
21	438	434	428	433	434	433	433
22	440	435	430	435	435	435	435
23	442	436	431	437	436	436	436
24	443	438	432	438	437	438	437
25	445	439	432	440	438	439	438
26	445	441	433	441	438	440	439
27	447	442	433	441	439	442	440
28	448	443	434	442	440	442	441
29	448	444	434	443	441	443	442
30	449	445	435	444	441	444	443
31	449	445	435	444	442	445	443
32	450	447	436	444	443	446	444
33	451	447	437	445	445	447	445
34	451	448	437	446	446	449	447
35	453	453	439	447	447	452	449
36	456	460	442	449	449	455	452

Table 4. ACT Aspire to PreACT/ACT Concordance

ACT Aspire Score	Concordant PreACT or ACT Score						
	English	Math	Reading	Science	ELA	STEM	Composite
400	1	1	1	1		1	1
401	2	2	2	2		2	2
402	2	3	3	3		3	3
403	3	4	4	4	1	4	3
404	4	5	5	5	2	5	4
405	4	6	6	6	2	6	5
406	5	7	7	7	3	7	6
407	6	9	8	8	4	8	7
408	6	10	9	9	5	9	8
409	7	11	10	10	6	9	9
410	7	12	10	10	6	10	9
411	8	13	11	11	7	11	10
412	8	13	12	11	8	12	11
413	9	14	12	12	9	13	12
414	9	14	13	12	10	13	12
415	10	14	13	12	10	13	13
416	10	14	14	13	11	14	13
417	10	14	14	13	11	14	13
418	11	15	15	14	11	14	14
419	11	15	15	14	12	15	14
420	11	15	16	15	12	15	14
421	12	15	16	15	13	16	15
422	12	16	16	16	13	16	15
423	13	16	17	16	13	16	16
424	13	16	18	17	14	17	16
425	14	16	19	17	14	17	16
426	14	17	19	18	15	17	17
427	15	17	20	18	16	18	17
428	15	17	21	19	16	18	18
429	15	18	22	19	17	19	19
430	16	18	22	20	18	19	19
431	16	19	23	20	18	20	20
432	17	20	24	20	19	20	20
433	18	20	26	21	20	21	21
434	18	21	28	22	21	21	22
435	19	22	30	22	22	22	22
436	20	23	32	23	23	23	23
437	20	23	34	23	24	23	24
438	21	24	35	24	25	24	25
439	21	25	35	24	27	25	26
440	22	25	36	25	28	26	27

Table 4. ACT Aspire to PreACT/ACT Concordance (continued)

ACT Aspire Score	Concordant PreACT or ACT Score						
	English	Math	Reading	Science	ELA	STEM	Composite
441	22	26	36	26	29	26	28
442	23	27	36	28	31	27	29
443	24	28		29	31	29	30
444	25	29		31	32	30	32
445	25	30		33	33	31	33
446	26	32		34	34	32	33
447	27	32		35	35	33	34
448	29	34		35	35	34	34
449	30	34		36	36	34	35
450	32	34				35	35
451	33	35				35	36
452	35	35				35	36
453	35	35				36	
454	35	35				36	
455	35	35				36	
456	36	36					
457		36					
458		36					
459		36					
460		36					

Concordance Table Uses

The combined concordance results are presented in Table 3 (PreACT/ACT to ACT Aspire) and Table 4 (ACT Aspire to PreACT/ACT), with the results rounded to the nearest integer. The concordances can be used to:

- **Set comparable cut scores**. For example, suppose that a district has an existing cut score for entrance into a concurrent enrollment math course, and the cut score is based on the ACT or PreACT math test. Table 3 can be used to find the ACT Aspire math score that is comparable to the existing cut score. Then, the district may elect to allow students to use the ACT Aspire math test to qualify for the concurrent enrollment course.
- **Understand the readiness of students who took different tests**. For example, suppose that a district administers the PreACT test to all 10th-grade students. New students entering the district in 11th grade did not take the PreACT test but did take ACT Aspire in 10th grade. Table 4 can be used to find the PreACT test scores that are comparable to the ACT Aspire scores. The district can use the concordant PreACT test scores to understand the readiness levels of the new students.
- **Align scores for research purposes.** Research studies may utilize ACT Aspire, PreACT, and ACT scores. The concordances can be used to align the scores to a common scale and thus enabling data analyses that incorporate students regardless of which tests they took.

To illustrate the first use ("setting comparable cut scores"), we used the PreACT/ACT-to-Aspire concordances (Table 3) to find the ACT Aspire scores that are comparable to the ACT College Readiness Benchmarks (Allen & Radunzel, 2017)—the minimum scores that have been identified as being associated with at least a 50% chance of earning a B or higher grade in a corresponding first-year subject-relevant college course(s) (see orange-shaded portion of Table 5). For example, the ACT Aspire math score comparable to the ACT College Readiness Benchmark is 435. Therefore, students who earn an ACT Aspire math score of 435 or higher are performing at a level consistent with being college-ready, according to the ACT College Readiness Benchmark in math.

Table 5. Scores Comparable to Readiness Benchmarks

Subject	ACT College Readiness Benchmark		Grade 10 ACT Readiness Benchmark	
	Benchmark	Comparable ACT Aspire Score	Benchmark	Comparable PreACT/ACT Score
English	18	433	428	15
Math	22	435	432	20
Reading	22	430	428	21
Science	23	437	432	20
ELA	20	433	430	18
STEM	26	440	437	23

Similarly, going in the alternative direction, we used the Aspire-to-PreACT/ACT concordances (Table 4) to find the PreACT or ACT scores that are comparable to the ACT Readiness Benchmarks based on ACT Aspire for 10th grade (blue-shaded portion of Table 5). Note that the ACT Readiness Benchmarks are the ACT Aspire scores indicating that students are on target for college readiness. For example, the PreACT/ACT math score comparable to the grade 10 ACT Readiness Benchmark for math is 20. Therefore, students who earn a PreACT or ACT math score of 20 or higher in 10th grade are performing at a level consistent with being on target for college readiness, according to the ACT Aspire Readiness Benchmark in math. These examples illustrate how districts might use the concordance tables to set comparable cut scores for the scenario described earlier to determine readiness for a concurrent enrollment course in math when a district cut score has been empirically-derived for only one of the tests but there are some students with test scores available on the other assessment.

We note that the PreACT test reports benchmarks that are slightly different than the concordant values found in Table 5: For math and reading, the PreACT benchmarks are one point lower than the concordant values (19 for math and 20 for reading), and for science and STEM, the PreACT benchmarks are one point higher than the concordant values (21 for science and 24 for STEM). These results highlight that when possible, interpretations of readiness should be based on the benchmarks or cut scores set for the assessment that was taken, rather than those based on concordant scores.

Concordance Table Cautions

We briefly discuss cautions that users should be aware of when using the concordance tables:

- **Concordant scores are comparable but are not interchangeable.** Because the concordances are based on equipercentile linking, the concordance tables provide the scores that are comparable in terms of score rank within a common group of students. But because ACT Aspire assessments are built to different specifications than ACT or PreACT assessments, the concordant scores are not interchangeable. The tests measure academic achievement in somewhat different ways and have different lengths and reliabilities. For certain uses of test scores, the concordances should not be used. For example, for high-stakes purposes such as college admissions, the ACT test should be used because it has higher reliability, stronger predictive validity, and stronger alignment to the knowledge and skills taught through high school and important for first-year college coursework.

- **Concordances are sample dependent**. The concordances in this study were estimated using students who took ACT Aspire and either the PreACT or ACT test while in grade 8, 9, or 10. Concordances are sample dependent, meaning that the results could be somewhat different if a different group of students had been studied. We found that the Aspire/ACT and Aspire/PreACT concordances had some differences, and this could be due to differences in the samples. The concordances presented in this paper are most applicable to students in grade 9 or 10 with above-average academic achievement.

- **Concordant scores are different than predicted scores.** ACT Aspire and the PreACT test score reports provide students with predictions for scores that they will likely achieve in future years. ACT Aspire reports predicted PreACT and ACT scores, and PreACT reports predicted ACT scores. In all cases, the predictions assume that students will experience typical academic growth during the time between the tests, which is at least one year.

  It is important to keep in mind that concordant scores are different than predicted scores in three important respects.

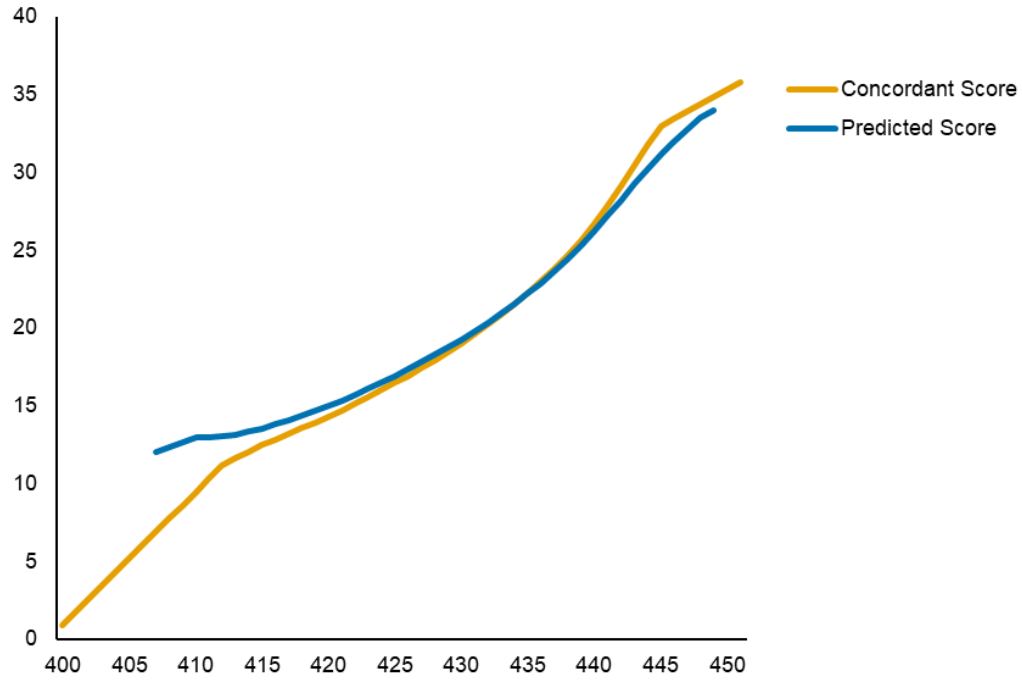
  - First, the concordant scores assume that the tests are taken at the same point in time, whereas predictions usually assume a significant period of time between tests.

  - Second, the concordance linkage is symmetric (not considering rounding), while predictive linkages are not. That is, “a score of *x* on ACT Aspire predicts a score of *y* on the ACT” does not imply that “a score of *y* on the ACT predicts a score of *x* on ACT Aspire.”

  - Third, because they are based on equipercentile linkage, the concordant scores do not optimize prediction accuracy. Figure 8 illustrates this point. It shows how predicted scores are different than concordant scores, even when the prediction is based on tests taken at the same time. The orange line shows the concordant scores–the PreACT or ACT Composite scores that are comparable (in terms of score rank) to each ACT Aspire Composite score. The blue line shows the PreACT/ACT Composite scores that students would be predicted to earn if they took the test at the same time they took the Aspire test. The predicted scores are calculated as the mean PreACT/ACT Composite score, conditional on ACT Aspire Composite score.

For much of the score distribution (e.g., ACT Aspire scores from 423 to 440), the lines are very similar. Therefore, the concordant scores can also be used as predicted scores for students scoring in the middle of the distribution. For students earning higher ACT Aspire scores (e.g., > 440), predicted PreACT/ACT scores are lower than the concordant scores. For students earning lower ACT Aspire scores (e.g., < 422), predicted PreACT/ACT scores tend to be higher than the concordant scores. This pattern holds for all subject areas. Predicted scores reflect "regression to the mean" whereas concordant scores do not. Therefore, the prediction accuracy of concordant scores is not as strong for students at the high and low ends of the score distribution.

Figure 8. Comparison of Concordant and Predicted Scores



Note: The predicted score is calculated as the mean PreACT/ACT score, conditional on ACT Aspire scores. Predicted scores are plotted for ACT Aspire Composite scores with n > 5.

Notes

1. We did not count the summer months (June, July, August) because students usually do not receive instruction during this time. For example, tests from April and September of the same year are two instructional months apart and could be included in the study.
2. To correct for restriction of range, we used the correction formula for Thorndike's Case 2 (Thorndike, 1949). To correct for measurement error, we used the standard formula for correction for attenuation (Spearman, 1904).
3. Student characteristics are based on data provided by schools and districts for ACT Aspire reporting. Disability status is based on whether the student has an Individualized Education Plan.
4. To assess agreement between the Aspire/PreACT and Aspire/ACT concordances, we weighted the data according to the distribution of PreACT/ACT scores in the combined sample. By doing so, we assess the practical implications of accuracy by giving more weight to regions of the score distributions where more students score.

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