

The 2020 PreACT 8/9 Norming Study

Han Yi Kim, PhD, and Jeff Allen, PhD

This document describes the development of the PreACT® 8/9 norms, to be used for reporting during the 2020–2021 and 2021–2022 academic years. Procedures for sample selection, weighting, estimation of weighted percentile ranks, interpolation and extrapolation of norms, and summary statistics are detailed in this document.

Samples

The norming sample is comprised of students who completed the PreACT 8/9 tests during the 2019–2020 school year and received Composite scale scores. The norms were created for each subject score (i.e., English, math, reading, and science); the science, technology, engineering, and math (STEM) score; and the Composite score.¹ Separate norms are estimated for fall and spring test administrations and for different grade levels. Students tested from August to January (i.e., August 2019–January 2020) were included in the fall norm samples, and those who tested from February to July (i.e., February 2020–July 2020) were included in the spring norm samples.

Table 1 presents sample sizes by grade level and season. As can be seen in the table, the sample sizes for the spring administration were relatively small because of schools closing in the spring of 2020 due to COVID-19. Hence, a statistical interpolation and extrapolation procedure was implemented to estimate the norms for the spring grade 8 and spring grade 9 samples. More details on the method are provided later in this paper.

Table 1. Number of Students by Grade Level and Season

Season	Grade Level	
	8	9
Fall	18,379	41,530
Spring	5,664	8,772

Weighting Methodology

One purpose of the PreACT 8/9 test is to simulate the ACT testing experience such that students can practice and prepare for the ACT test. Therefore, the samples used to develop the PreACT 8/9 norms should be representative of the population of ACT test-takers. A weighting procedure was used to make the PreACT 8/9 samples similar to the population of ACT test-takers who completed high school in 2019. The weighting variables included gender, race/ethnicity, school geographic region, and school category. School category is defined by public/nonpublic status and percentage of students eligible for free and reduced-price lunch (FRL).

For each combination of the weighting variables (e.g., grade 8 female African American students who attend nonpublic schools in the Midwest), the sample and population percentages were first calculated. Then, the weight for each combination was calculated as the population percentage (for the ACT-tested graduates of 2019) divided by the sample percentage (i.e., the PreACT 8/9 sample). In the cases where weights were very large (greater than 5.0) or very small (less than 0.2), they were truncated so that all weights were in the interval of [0.2, 5.0]. Within each combination, the final weight was applied to all students, and the weighting procedure was conducted separately for each of the four norm samples (fall grade 8, spring grade 8, fall grade 9, and spring grade 9). Tables 2 and 3 show the distributions of the ACT population and the weighted and unweighted PreACT 8/9 samples in terms of weighting variables. Note that the sum of the percentages given in the tables may not equal 100 due to rounding.

Table 2. Summary of the ACT Population and the Grade 8 PreACT 8/9 Samples

Weighting Variable	ACT Population (%)	PreACT 8/9			
		Fall		Spring	
		Unweighted (%)	Weighted (%)	Unweighted (%)	Weighted (%)
Gender					
Female	51.96	46.91	50.69	47.99	47.31
Male	46.48	48.55	47.30	49.61	50.98
Missing	1.56	4.54	2.01	2.40	1.71
Race/Ethnicity					
African American	12.38	12.05	12.07	27.70	19.51
Asian	4.68	4.63	3.71	1.54	2.11
Caucasian	51.54	45.38	52.51	23.41	41.21
Hispanic	16.44	18.16	16.37	31.29	22.19
Other	5.67	10.55	6.82	5.63	5.80
Unknown	9.29	9.24	8.52	10.43	9.17
Region					
Midwest	27.40	15.56	15.72	10.88	21.45
Northeast	7.03	0.13	0.89	52.70	30.59
South	47.28	67.57	66.82	29.27	43.29
West	18.25	16.74	16.57	7.15	4.68
Missing	0.04	0.00	0.00	0.00	0.00
School Category					
Nonpublic	12.27	6.69	14.44	9.25	24.19
Public					
0–10% FRL	6.13	1.52	3.32	0.00	0.00
10–20% FRL	11.73	1.82	6.79	6.69	5.03
20–40% FRL	24.61	3.31	18.19	0.21	2.40
40–60% FRL	21.75	4.51	21.61	0.64	8.83
60–80% FRL	11.45	6.06	9.82	4.18	13.74
> 80% FRL	8.45	11.59	7.75	3.28	3.52
FRL Unknown	2.42	64.50	18.09	75.74	42.30
Public Total	86.54	93.31	85.57	90.74	75.82
Missing	1.20	0.00	0.00	0.00	0.00

Notes: FRL refers to free and reduced-price lunch.

Table 3. Summary of the ACT Population and the Grade 9 PreACT 8/9 Samples

Weighting Variable	ACT Population (%)	PreACT 8/9			
		Fall		Spring	
		Unweighted (%)	Weighted (%)	Unweighted (%)	Weighted (%)
Gender					
Female	51.96	47.66	50.34	46.67	51.58
Male	46.48	49.37	48.25	49.89	47.18
Missing	1.56	2.97	1.41	3.44	1.24
Race/Ethnicity					
African American	12.38	10.33	12.79	9.22	12.87
Asian	4.68	2.80	2.97	4.06	4.22
Caucasian	51.54	54.12	53.50	63.34	55.36
Hispanic	16.44	18.85	16.62	11.37	13.25
Other	5.67	7.81	6.26	5.91	6.16
Unknown	9.29	6.08	7.86	6.11	8.14
Region					
Midwest	27.40	81.25	38.89	43.92	33.82
Northeast	7.03	3.56	3.68	5.00	3.60
South	47.28	12.28	47.73	22.79	44.01
West	18.25	2.90	9.7	28.28	18.57
Missing	0.04	0.01	0.00	0.00	0.00
School Category					
Nonpublic	12.27	6.84	15.08	13.62	14.05
Public					
0–10% FRL	6.13	6.51	3.53	10.1	3.11
10–20% FRL	11.73	8.53	6.64	19.93	11.04
20–40% FRL	24.61	26.97	28.41	31.17	28.54
40–60% FRL	21.75	24.24	21.74	9.77	22.99
60–80% FRL	11.45	14.8	12.72	6.37	11.26
> 80% FRL	8.45	9.02	8.88	4.27	6.78
FRL Unknown	2.42	3.09	3.00	4.77	2.25
Public Total	86.54	93.16	84.92	86.38	85.97
Missing	1.20	0.01	0.00	0.00	0.00

Notes: FRL refers to free and reduced-price lunch.

Estimation of Weighted Percentile Ranks and Summary Statistics

The weighted PreACT 8/9 norm samples were then used to develop norms for each grade level and season combination. A five-degree polynomial log-linear smoothing was applied to the weighted empirical cumulative percentages.²

After examining the results from the weighted samples, it was determined that the estimated norms for the spring samples (i.e., spring grade 8 and spring grade 9) were not viable due to the small, atypical samples. , to estimate the norms for the two spring samples, the information from the fall norms were “borrowed” to perform a statistical interpolation (for spring grade 8) and extrapolation (for spring grade 9) procedure (Cui, 2020). The following steps were implemented.

- **Step 1:** A constant quantifying the difference between the percentile ranks for the two fall samples is computed at each scale score point. Then, the derived constant is divided by 2. Mathematically,

$$c_i = \frac{|CP_{8Fi} - CP_{9Fi}|}{2} \quad (i = 1, \dots, 30),$$

where c_i refers to the resulting constant at the i th scale score point, CP_{8Fi} refers to the unrounded cumulative percentage for the fall grade 8 sample at the i th scale score point, and CP_{9Fi} refers to the unrounded cumulative percentage for the fall grade 9 sample at the i th scale score point.

- **Step 2:** The unrounded cumulative percentage for the Spring Grade 8 sample is estimated by interpolation.

$$CP_{8Si} = CP_{9Fi} + c_i,$$

where CP_{8Si} refers to the unrounded cumulative percentage for the spring grade 8 sample at the i th scale score point.

- **Step 3:** The unrounded cumulative percentage for the spring grade 9 sample is estimated by extrapolation.

$$CP_{9Si} = CP_{9Fi} - c_i,$$

where CP_{9Si} refers to the unrounded cumulative percentage for the spring grade 9 sample at the i th scale score point.

- **Step 4:** The estimated unrounded cumulative percentage from Steps 2 and 3 are rounded to integer values.

Tables 4 through 9 present the rounded cumulative percentages (i.e., norms) for each norming sample, showing the percentage of students scored at or below each scale score point for English, math, reading, science, STEM, and Composite scales scores, respectively.

Table 4. 2020 PreACT 8/9 English Norms: Percentages of Students at or Below Each Scale Score

PreACT 8/9 Scale Score	Grade Level and Season			
	8		9	
	Fall (%)	Spring (%)	Fall (%)	Spring (%)
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	2	2	2	2
6	4	4	4	3
7	7	7	6	6
8	11	10	10	9
9	17	15	14	12
10	22	20	19	17
11	28	26	24	22
12	35	32	30	28
13	41	39	36	34
14	48	46	43	41
15	55	52	50	48
16	61	59	57	55
17	67	66	64	62
18	73	72	70	69
19	79	77	76	75
20	83	82	82	81
21	87	87	86	85
22	91	90	90	89
23	93	93	93	92
24	95	95	95	94
25	97	97	96	96
26	98	98	97	97
27	99	98	98	98
28	99	99	99	99
29	99	99	99	99
30	100	100	100	100

Table 5. 2020 PreACT 8/9 Math Norms: Percentages of Students at or Below Each Scale Score

PreACT 8/9 Scale Score	Grade Level and Season			
	8		9	
	Fall (%)	Spring (%)	Fall (%)	Spring (%)
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	1	1	1	1
6	1	1	1	1
7	1	1	1	1
8	1	1	1	1
9	1	1	1	1
10	1	1	1	1
11	4	4	3	3
12	9	8	7	6
13	18	16	14	13
14	30	27	25	22
15	43	40	36	33
16	55	52	48	44
17	65	62	58	55
18	73	70	66	63
19	78	76	73	70
20	82	80	77	75
21	85	83	81	79
22	88	86	84	83
23	90	88	87	86
24	92	91	90	89
25	94	93	93	92
26	96	95	95	95
27	97	97	97	97
28	99	99	99	99
29	99	99	99	99
30	100	100	100	100

Table 6. 2020 PreACT 8/9 Reading Norms: Percentages of Students at or Below Each Scale Score

PreACT 8/9 Scale Score	Grade Level and Season			
	8		9	
	Fall (%)	Spring (%)	Fall (%)	Spring (%)
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	2	2	1	1
6	3	3	2	2
7	5	4	4	3
8	7	7	6	5
9	11	10	9	8
10	15	13	12	10
11	19	18	16	14
12	25	22	20	18
13	30	28	25	22
14	36	33	30	27
15	42	38	35	32
16	47	44	40	37
17	52	49	46	42
18	57	54	51	48
19	62	59	56	53
20	66	63	61	58
21	70	68	65	63
22	74	72	70	68
23	78	77	75	73
24	82	81	79	78
25	86	85	83	82
26	89	88	87	87
27	93	92	91	91
28	96	95	95	94
29	98	98	98	97
30	100	100	100	100

Table 7. 2020 PreACT 8/9 Science Norms: Percentages of Students at or Below Each Scale Score

PreACT 8/9 Scale Score	Grade Level and Season			
	8		9	
	Fall (%)	Spring (%)	Fall (%)	Spring (%)
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	1	1	1	1
6	1	1	1	1
7	1	1	1	1
8	1	1	1	1
9	2	3	3	2
10	6	6	6	5
11	13	11	10	9
12	21	19	17	15
13	31	28	25	22
14	41	38	34	30
15	50	47	43	39
16	59	55	52	48
17	66	63	60	57
18	72	70	68	65
19	78	76	74	72
20	82	81	79	78
21	86	85	84	82
22	89	88	87	86
23	92	91	90	89
24	94	93	93	92
25	95	95	94	94
26	96	96	96	96
27	97	97	97	97
28	98	98	98	98
29	99	99	99	99
30	100	100	100	100

Table 8. 2020 PreACT 8/9 STEM Norms: Percentages of Students at or Below Each Scale Score

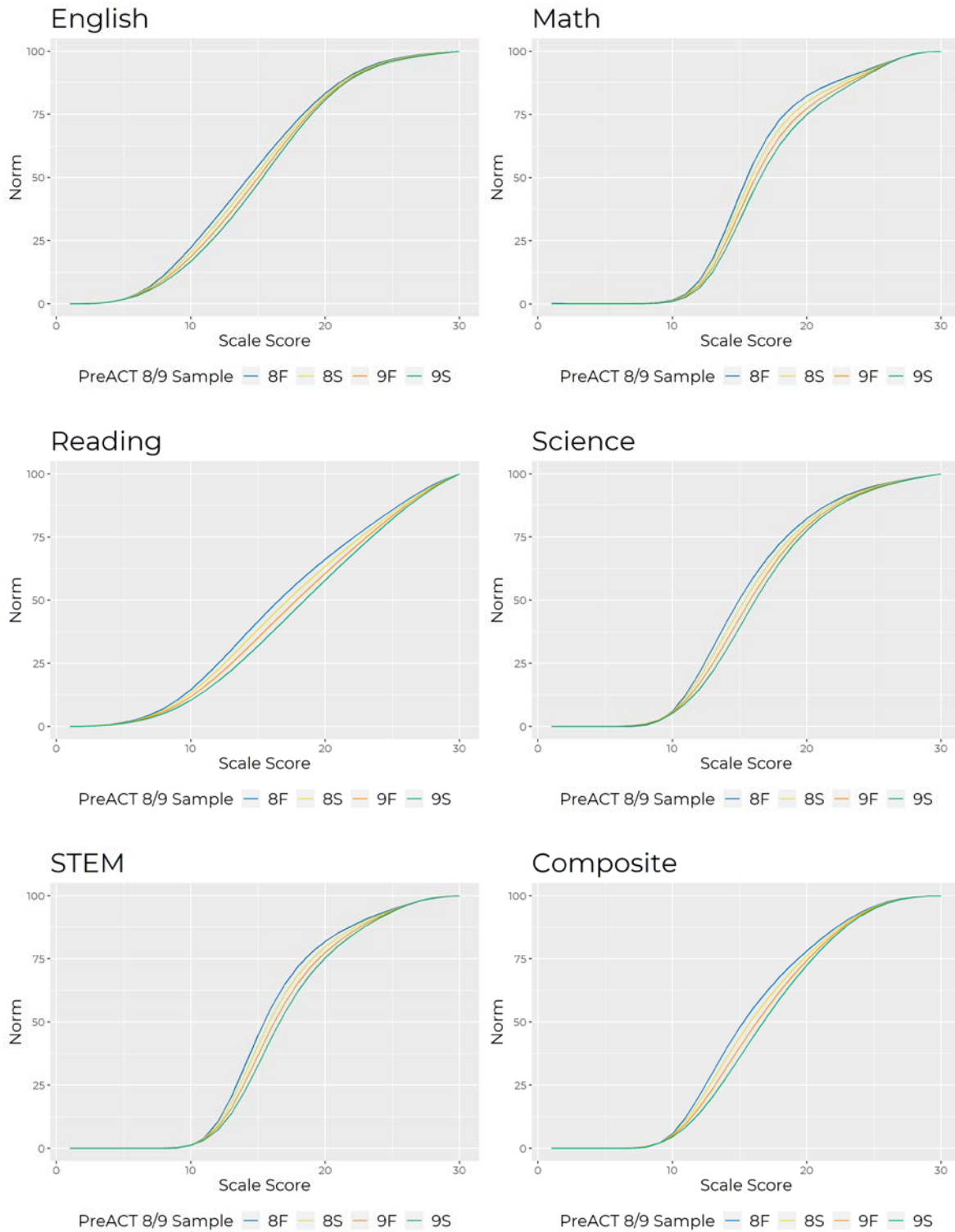
PreACT 8/9 Scale Score	Grade Level and Season			
	8		9	
	Fall (%)	Spring (%)	Fall (%)	Spring (%)
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	1	1	1	1
6	1	1	1	1
7	1	1	1	1
8	1	1	1	1
9	1	1	1	1
10	1	1	1	1
11	4	4	4	3
12	10	9	8	7
13	20	18	16	14
14	32	29	26	22
15	45	41	37	33
16	56	52	48	44
17	65	61	57	54
18	72	69	66	62
19	78	75	72	70
20	82	80	78	75
21	85	84	82	80
22	88	87	86	84
23	91	90	89	88
24	93	92	92	91
25	95	94	94	94
26	96	96	96	96
27	98	98	98	98
28	99	99	99	99
29	99	99	99	99
30	100	100	100	100

Table 9. 2020 PreACT 8/9 Composite Norms: Percentages of Students at or Below Each Scale Score

PreACT 8/9 Scale Score	Grade Level and Season			
	8		9	
	Fall (%)	Spring (%)	Fall (%)	Spring (%)
1	1	1	1	1
2	1	1	1	1
3	1	1	1	1
4	1	1	1	1
5	1	1	1	1
6	1	1	1	1
7	1	1	1	1
8	1	1	1	1
9	2	2	2	2
10	6	5	5	5
11	12	11	10	8
12	21	18	16	14
13	30	27	24	21
14	39	36	32	28
15	48	44	40	36
16	55	52	48	44
17	62	59	55	52
18	68	65	62	59
19	73	71	69	66
20	78	76	74	73
21	83	81	80	78
22	87	86	85	84
23	90	90	89	88
24	93	93	92	92
25	96	96	95	95
26	98	97	97	97
27	99	99	99	99
28	99	99	99	99
29	99	99	99	99
30	100	100	100	100

Figure 1 shows the comparison of norms across grade levels and seasons. For each scale score point, the cumulative percentage decreases with additional time (grade level and season), reflecting increases in academic achievement from fall grade 8 to spring grade 9.

Figure 1. 2020 PreACT 8/9 Norms (Cumulative Percentages) Across Grades and Seasons



The weighted mean and standard deviation (SD) for each subject, grade level, and season are shown in Table 10. The scale score statistics were calculated based on the estimated norms for each PreACT 8/9 norm sample.

Table 10. 2020 PreACT Norms: Scale Score Means and Standard Deviations

Grade	Season	Statistic	English	Math	Reading	Science	STEM	Composite
8	Fall	Mean	15.1	17.0	17.5	16.3	16.6	16.9
		SD	5.4	4.2	6.4	4.6	4.6	4.2
	Spring	Mean	15.3	17.3	18.0	16.6	16.9	17.2
		SD	5.4	4.3	6.4	4.6	4.6	4.2
9	Fall	Mean	15.6	17.6	18.4	16.9	17.3	17.5
		SD	5.3	4.3	6.4	4.6	4.6	4.2
	Spring	Mean	15.9	17.9	18.9	17.2	17.6	17.8
		SD	5.3	4.3	6.3	4.6	4.6	4.2

To facilitate score interpretation and use, PreACT 8/9 scores are classified into one of three readiness levels:

1. **On Target:** Students scoring in this range are predicted to meet or exceed the ACT College Readiness Benchmark in 11th or 12th grade. The PreACT 8/9 Readiness Benchmark is the score associated with a 50% chance of meeting the ACT College Readiness Benchmark in 11th or 12th grade and is the minimum score of the On Target range.
2. **On the Cusp:** Students scoring in this range have less than a 50% chance, but greater than a 25% chance, of meeting the ACT College Readiness Benchmark.
3. **In Need of Intervention:** Students scoring in this range have less than a 25% chance of meeting the ACT College Readiness Benchmark.

Table 11 provides the percentages of students in each PreACT 8/9 Readiness Level for each grade, season, and subject³ based on the estimated norms shown in Tables 4–9. The PreACT 8/9 Readiness Levels⁴ are used to monitor students' progress towards college readiness through their connection to the ACT College Readiness Benchmarks.

Table 11. 2020 PreACT 8/9 Norms: Percentages of Students for PreACT 8/9 Readiness Levels

Subject	PreACT 8/9 Readiness Level	Grade 8		Grade 9	
		Fall	Spring	Fall	Spring
English	In Need of Intervention	7	7	10	12
	On the Cusp	15	13	14	16
	On Target	78	80	76	72
Math	In Need of Intervention	9	16	25	33
	On the Cusp	21	24	23	22
	On Target	70	60	52	45
Reading	In Need of Intervention	19	22	25	27
	On the Cusp	17	16	15	15
	On Target	64	62	60	58
Science	In Need of Intervention	31	38	43	39
	On the Cusp	28	25	17	26
	On Target	41	37	40	35
STEM	In Need of Intervention	56	61	66	70
	On the Cusp	16	14	12	10
	On Target	28	25	22	20

Table 12. ACT College Readiness Benchmarks and the Scale Score Ranges for PreACT 8/9 Readiness Levels

Subject	ACT Benchmark	Grade Level and Season	PreACT 8/9 Readiness Level		
			In Need of Intervention	On the Cusp	On Target
English	18	8, Fall	1–7	8–10	11–30
		8, Spring	1–7	8–10	11–30
		9, Fall	1–8	9–11	12–30
		9, Spring	1–9	10–12	13–30
Math	22	8, Fall	1–12	13–14	15–30
		8, Spring	1–13	14–15	16–30
		9, Fall	1–14	15–16	17–30
		9, Spring	1–15	16–17	18–30
Reading	22	8, Fall	1–11	12–14	15–30
		8, Spring	1–12	13–15	16–30
		9, Fall	1–13	14–16	17–30
		9, Spring	1–14	15–17	18–30
Science	23	8, Fall	1–13	14–16	17–30
		8, Spring	1–14	15–17	18–30
		9, Fall	1–15	16–17	18–30
		9, Spring	1–15	16–18	19–30
STEM	26	8, Fall	1–16	17–18	19–30
		8, Spring	1–17	18–19	20–30
		9, Fall	1–18	19–20	21–30
		9, Spring	1–19	20–21	22–30

Notes

1. Unlike the ACT test, the PreACT 8/9 test does not include an English Language Arts (ELA) score because there is no separate writing test.
2. The five-degree polynomial log-linear smoothing was applied because it was the method used with the PreACT norming. Furthermore, it showed adequate fit with the empirical data with PreACT 8/9.
3. The PreACT 8/9 Readiness Levels are provided for English, math, reading, science, and STEM.
4. Additional information about the PreACT 8/9 Readiness Levels is included in the 2020 PreACT 8/9 Technical Bulletin: <https://success.act.org/s/article/PreACT-Technical-Manual>.

Reference

Cui, Z. (2020). Working with atypical samples. *Educational Measurement: Issues and Practice*, 39(3), 19–21.

About the Authors

Han Yi Kim, PhD is a Senior Psychometrician in Psychometric Research. Her research interests include test equating, scaling, and psychometric evaluation of educational assessments.

Jeff Allen, PhD is a Principal Research Scientist in Validity and Efficacy Research. He specializes in longitudinal research of educational outcomes, student growth models, and validation of college readiness measures.

Acknowledgements

The authors thank Yi-Fang Wu and Samuel Haring for their helpful feedback on earlier drafts of this brief.