Investigating the Concordance Relationship Between the HSA Cut Scores and the PARCC Cut Scores Using the 2016 PARCC Test Data

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By

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Executive Summary

The purpose of this study is to conduct a replication investigation using the same linking methods and the 2016 PARCC test data to obtain the PARCC equivalents of the HSA cut scores and the HSA equivalents of the PARCC cut scores. Comparisons between PARCC cutscores from the 2015 study and this study were also performed. Specifically, the HSA Algebra cut score were mapped onto the PARCC Algebra I scale and the HSA English cut score to the PARCC ELA10 scale and vice versa. The cut scores for passing HSA English and Algebra are 396 and 412 respectively. The cut scores for being in performance level 3 and higher are 725 for both PARCC ELA10 and Algebra I. This replication study followed the same methods used by the MARC team in the 2015 study. Namely, the following two options were explored again to create the concordance tables.

1. Option I: Using PSAT as an external common test to link HSA and PARCC tests via two-step linking. As item level response data were not available, the equipercentile linking method was used to set up the linkage using a single group design. The exploration was conducted using the first-time test takers' scores.

2. Option II: Using the propensity score matching method to come up with matched equivalent groups so that the equivalent group linking method can be used to map the HSA cut scores onto the PARCC scales directly. The equipercentile linking method was used to set up the linkage using the first-time test takers' scores.

Major Findings

The detailed data cleaning, preparation, and analyses are documented in this report. The following summarizes the major findings based on this current exploration using the 2016 test data.

1. Using PSAT as an external common test to link HSA and PARCC tests via two-step linking produced PARCC equivalent cut scores of 715 and 716 for PARCC ELA10 and Algebra I respectively. Overall, the PARCC equivalent cut scores for both Algebra I and ELA10 tests yielded passing rates falling within the ranges of the HSA historical yearly and May passing rates. Compared with the propensity

score matching method, the PSAT linking method produced lower PARCC equivalent cut scores that lead to higher passing rates for both Algebra I and ELA 10 tests.

2. Using the propensity score matching method under different matching conditions produced PARCC equivalent cut scores of 716, and 717 for PARCC ELA10 depending on the matching conditions and 726, 727, 735, and 736 for Algebra I depending on the matching conditions. Further when combining Design II and III matched samples, the cut scores were 729, 730, 734, and 735 depending on the matching conditions. The passing rates for PARCC ELA 10 fall within the ranges of the yearly and May passing rates. However, the passing rates for PARCC ALG I fall outside the ranges of both the yearly and May passing rates. Compared with the PSAT linking method, the propensity score method produced higher PARCC equivalent cut scores that lead to lower passing rates for both Algebra I and ELA 10 tests.

3. Compared with results from the previous study using the 2015 PARCC test data, the equivalent cut scores for the 2016 PARCC test increased by an average of eight scale score points. For the PARCC ELA 10 test, the equivalent PARCC cut score increased from 707 to 715-717. For the PARCC ALG I test, the equivalent PARCC cut score increased from 720 to around 730. This may be because the average score for the 2016 PARCC test increased compared to the 2015 PARCC test when students became more familiar with the PARCC tests.

4. 95% confidence intervals and one standard deviation above and below the PARCC equivalents of the HSA cut scores were constructed. For ELA10, the 95% confidence interval around the mapped PARCC equivalent score of the HSA cut score using the mean, the minimum, and the maximum conditional standard error of measurement (CSEM) contained the PARCC cut score of 725 which divides performance level 2 from 3. For Algebra I, all intervals contained the PARCC cut score of 725. The patterns were consistent across most propensity score linking methods.

5. The HSA equivalents of the PARCC cut score of 725 that divides performance levels 2 from 3 are summarized. In general, the HSA equivalents of the PARCC cut scores, 725 for both ELA10 and Algebra were higher than the original HSA cut scores using the PSAT linking method. For the propensity score matching method, the PARCC cut score of 725 for ELA 10 was higher than the original HSA cut score but was lower than the original HSA cut score for ALG I test.

6. This replication study provides additional empirical evidence about the PARCC equivalents of the HSA cut scores and the HSA equivalents of the PARCC cut score of 725 between performance level 2 and 3 for ELA10 and Algebra I. In general, students performed better in 2016 than in 2015. Thus, the mapped PARCC equivalent scores for HSA cut scores were all higher than those obtained

using the 2015 data. The final adoption of cut scores obtained in this study depends on considerations from psychometric, policy, and practical perspectives.

Option I

Using PSAT as an External Linking Test

Data Cleaning and Preparation

The three datasets used in this exploration are from the PARCC, PSAT, and HSA tests. Data cleaning was conducted prior to data analysis for English and Algebra tests respectively. For all dataset, students with missing IDs or scale scores for study were exlucded from analysis. In the HSA layout table, 05 stands for Algebra test. The team used Test Format by Content information in the dataset as supplemental information to find the code for English test (Code 06 for HSA English). For each HSA dataset, the first timer test scores were selected and used in the analyses when multiple attempts were found. Further, only the regular students were selected for the linking study.

For the PARCC test, the dataset was separated into English and Math test and the first time test scores for each unique student ID were extracted using testing year information. For duplicated cases (the same test year and administration but with different scores), first entry record was used.

The contents areas of the PARCC, PSAT, and HSA tests are summarized in Table 1.1. The subjects used in this study are the PARCC Algebra I, PARCC ELA10, PSAT Math, PSAT EBRW, HSA English, and HSA Algebra. The PARCC test data are from the 2016 administrations. The HSA test data are from the administrations during 2008 to 2015. The PSAT test data are from the administrations during 2008 to 2016. The HSA test was administrated five times a year, and the PSAT test was administrated once a year. The 2008 to 2015 PSAT test data contain three subjects: Verbal, Writing, and Math. However, the 2016 PSAT test data only contains EBRW and Math score. The EBRW is the combined score for Verbal and Writing. Besides, the scale changed from 40-160 to 160-760 for both EBRW and Math tests in 2016. To make the results comparable, Verbal and Writing scores were added and the conversion table from College Board (https://collegereadiness.collegeboard.org/pdf/2015-psat-nmsqt-concordance-tables.pdf) was used to convert 2008-2015 PSAT scale scores into the 2016 scale for both PSAT EBRW and Math. Then the converted 2008-2015 PSAT test scores were merged with the 2016 PSAT dataset and the new PSAT dataset was separated into EBRW and Math test and the first time test scores for each unique student ID were extracted using testing year information. For duplicated cases (the same test year and administration but with different scores), only the first entry record was retained.

Table 1.1
Subjects in Each Test

Test	Subjects
PARCC	Algebra I, Algebra II, ELA10
PSAT	Math, EBRW
HSA	English, Biology, Government, Algebra/Data Analysis

Table 1.2 provides the summary statistics for the HSA Algebra and English tests after data cleaning. For both the HSA Algebra and English tests, the minimum score is 240 and the maximum score is 650. The average test score for Algebra is 424.5 while that for Engish is 409.2. Please note that these two tests are not on the same scale though the minimum and the maximum test scores for both tests are the same. In other words, scores for these two tests are not comparable. The standard deviation of Algebra test scores is also higher than that of English test scores.

Table 1.2
Summary Statistics for the HSA Test

Test	N	Mean	SD	Min	Max
English	445,776	409.2	33.90	240	650
Algebra	490,636	424.5	41.78	240	650

Table 1.3 provides the summary results for the PARCC Algebra I and ELA10 tests using the first-time test takers' scores. The total number of PARCC Algebra I test takers is 67,022 while that for the PARCC ELA10 test is 63,005. The standard deviation of the PARCC Algebra I test scores is lower than that of the PARCC ELA10 test scores.

Table 1.3
Summary Statistics for the PARCC Test

Test	N	Mean	SD	Min	Max
ELA10	63,005	741.4	48.01	650	850
ALG I	67,022	736.0	35.46	650	850

Table 1.4 provides the summary results for the PSAT test scores. All students are required to take both the PSAT EBRW and Math tests at the same time; therefore, the sample size for the Math and Verbal test is the same. The standard deviations of both tests are similar.

Table 1.4
Summary Statistics for the PSAT Test

	N	Mean	SD	Min	Max
EBRW	561,091	447.3	103.82	160	760
Math	561,091	450.3	106.61	160	760

In order to use the PSAT test as an external linking test, the HSA test was merged with the PSAT test and the PSAT test was merged with the PARCC test using the state issued student ID. Specifically, the PSAT EBRW test was merged with the HSA English test, the PSAT EBRW test was merged with the PARCC ELA10 test using the student ID. The PSAT Math test was merged with the HSA Algebra test, the PSAT Math test was merged with the PARCC Algebra I test. In total, there are four merged datasets and the descriptive statistics for the PSAT test in each merged dataset are summarized in

Table1.5. Descriptive statistics for the HSA test and the PARCC test in the merged datasets are summarized in Table 1.6.

Table 1.5
Summary Statistics for the PSAT Scores after Merging with the HSA and PARCC Tests

Subject	Test	N	Mean	SD	Min	Max	Correlation
English	PSAT EBRW & HSA English	384,620	445.3	101.55	200	760	0.744
	PSAT EBRW & PARCC ELA10	50,075	446.8	99.40	160	760	0.725
Math	PSAT Math & HSA Algebra	392,837	439.4	102.67	160	760	0.708
	PSAT Math & PARCC ALG I	7,729	390.6	68.89	160	750	0.471

Table 1.6
Summary Statistics for the HSA and PARCC Scores after Merging with the PSAT Test

Subject	Test	N	Mean	SD	Min	Max
English	HSA	384,620	413.04	31.66	240	650
	PARCC	50,075	748.10	46.92	650	850
Math	HSA	392,837	429.02	38.10	240	650
	PARCC	7,729	724.10	29.49	650	850

Using the PSAT Test to Link the HSA and PARCC Tests

After data cleaning and matching samples, the equipercentile linking method was conducted based on the matched samples of HSA and PSAT first and then those of PSAT and PARCC for both Algebra and English tests. The Linking with Equivalent Group or the Single Group Design (LEGS) program developed by Kolen and Brennan was used to link the two matched samples. After specifying the input data format which is the scores and frequencies, subgroup information (no subgroup in this study), smoothing parameters and score truncation in the original scale scores, the LEGS program reported the results for the equipercentile linking based on the single group design for mapping HSA to PSAT, then PSAT to PARCC based on a two-step linking approach. In Appendix A, a screenshot capturing the input window for linking HSA and PSAT tests using the first-time test-takers' scores was shown. Following what has been completed in the study using the 2015 PARCC test data, two smoothing values were compared in post- linking: 0.3 and 1. The choice of using smoothing parameters is supported by simulation studies that show the smoothed results outperforming the non-smoothed results in reducing linking errors (Cui & Kolen, 2009; Hanson et al., 1994). The results using smoothing value of 1 were reported due to the fact that after rounding there was little difference

between the results based on the two smoothing parameters.

The concordance tables were generated using LEGS. The single group design was used in this part. The passing score for the HSA English is 396 and for the HSA Algebra is 412. As shown in Tables 1.7 to 1.10, the corresponding score for the PARCC ELA10 is 715 and for the PARCC Algebra I test is 716. The direct concordance tables between the HSA and PARCC tests are presented in Tables 1.11 and 1.12 for ELA and Algebra respectively. Impact data or the passing rate for different cut score are presented in the concluding part of this report.

In other words, the HSA English cut score of 396 was mapped to a PSAT score of 370. Then the PSAT score of 370 was mapped to a PARCC score of 715. Therefore, a PARCC equivalent score of the HSA English cut score of 396 is 715. Following the same logic, the cut score of 412 for the HSA algebra test was mapped to a PSAT score of 380. Then the PSAT score of 380 was mapped to a PARCC Algebra I score of 716. Therefore, a PARCC Algebra I equivalent score of the HSA Algebra cut score of 412 is 716.

Table 1.7

Concordance Table for HSA English Test and PSAT EBRW Test

HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT
240	200	292	210	344	270	396	370	448	590	500	720	552	740	604	750
241	200	293	210	345	270	397	370	449	590	501	720	553	740	605	750
242	200	294	210	346	270	398	370	450	600	502	730	554	740	606	750
243	200	295	210	347	270	399	380	451	600	503	730	555	740	607	750
244	200	296	210	348	280	400	380	452	610	504	730	556	740	608	750
245	200	297	210	349	280	401	380	453	610	505	730	557	740	609	750
246	200	298	210	350	280	402	390	454	620	506	730	558	740	610	750
247	200	299	210	351	280	403	390	455	620	507	730	559	740	611	750
248	200	300	210	352	290	404	390	456	630	508	730	560	740	612	750
249	200	301	210	353	290	405	400	457	630	509	730	561	740	613	750
250	200	302	210	354	290	406	400	458	640	510	730	562	740	614	760
251	200	303	210	355	290	407	400	459	640	511	730	563	740	615	760
252	200	304	210	356	290	408	410	460	640	512	730	564	740	616	760
253	200	305	210	357	300	409	410	461	650	513	730	565	740	617	760
254	200	306	210	358	300	410	410	462	650	514	730	566	740	618	760
255	200	307	210	359	300	411	420	463	650	515	730	567	740	619	760
256	200	308	210	360	300	412	420	464	660	516	730	568	740	620	760
257	200	309	210	361	300	413	420	465	660	517	730	569	740	621	760
258	200	310	210	362	310	414	430	466	670	518	730	570	740	622	760
259	200	311	210	363	310	415	430	467	670	519	730	571	740	623	760
260	200	312	210	364	310	416	440	468	670	520	730	572	740	624	760
261	200	313	210	365	310	417	440	469	680	521	730	573	740	625	760
262	200	314	220	366	310	418	440	470	680	522	730	574	740	626	760
263	200	315	220	367	310	419	450	471	680	523	730	575	740	627	760
264	200	316	220	368	310	420	450	472	680	524	730	576	750	628	760
265	200	317	220	369	320	421	450	473	690	525	730	577	750	629	760
266	200	318	220	370	320	422	460	474	690	526	730	578	750	630	760
267	200	319	220	371	320	423	460	475	690	527	730	579	750	631	760
268	200	320	220	372	320	424	470	476	700	528	730	580	750	632	760
269	200	321	220	373	320	425	480	477	700	529	730	581	750	633	760
270	200	322	220	374	320	426	480	478	700	530	730	582	750	634	760
271	200	323	220	375	330	427	490	479	700	531	730	583	750	635	760
272	200	324	230	376	330	428	490	480	710	532	730	584	750	636	760
273	200	325	230	377	330	429	490	481	710	533	730	585	750	637	760
274	200	326	230	378	330	430	500	482	710	534	730	586	750	638	760
275	200	327	230	379	330	431	500	483	710	535	730	587	750	639	760
276	200	328	230	380	330	432	510	484	710	536	730	588	750	640	760
277	200	329	230	381	340	433	510	485	710	537	730	589	750	641	760
278	200	330	230	382	340	434	520	486	720	538	730	590	750	642	760
279	200	331	230	383	340	435	520	487	720	539	740	591	750	643	760
280	200	332	240	384	340	436	530	488	720	540	740	592	750	644	760
281	200	333	240	385	340	437	540	489	720	541	740	593	750	645	760
282	200	334	240	386	350	438	540	490	720	542	740	594	750	646	760
283	200	335	240	387	350	439	540	491	720	543	740	595	750	647	760
284	200	336	250	388	350	440	550	492	720	544	740	596	750	648	760
285	210	337	250	389	350	441	550	493	720	545	740	597	750	649	760
286	210	338	250	390	360	442	560	494	720	546	740	598	750	650	760
287	210	339	250	391	360	443	560	495	720	547	740	599	750		
288	210	340	260	392	360	444	570	496	720	548	740	600	750		
289	210	341	260	393	360	445	570	497	720	549	740	601	750		
290	210	342	260	394	360	446	580	498	720	550	740	602	750		
291	210	343	270	395	370	447	580	499	720	551	740	603	750		

Table 1.8

Concordance Table for PSAT EBRW Test and PARCC ELA10 Test

PSAT	PARCC	Proficiency Level	PSAT	PARCC	Proficiency Level
160	650	1	470	764	4
170	650	1	480	767	4
180	650	1	490	771	4
190	650	1	500	775	4
200	650	1	510	779	4
210	650	1	520	783	4
220	650	1	530	786	4
230	650	1	540	791	4
240	650	1	550	795	4
250	650	1	560	799	4
260	650	1	570	803	5
270	651	1	580	807	5
280	653	1	590	811	5
290	656	1	600	815	5
300	660	1	610	819	5
310	666	1	620	823	5
320	673	1	630	828	5
330	681	1	640	832	5
340	691	1	650	837	5
350	699	1	660	842	5
360	708	2	670	847	5
370	715	2	680	849	5
380	722	2	690	850	5
390	728	3	700	850	5
400	733	3	710	850	5
410	738	3	720	850	5
420	743	3	730	850	5
430	747	3	740	850	5
440	752	4	750	850	5
450	756	4	760	850	5
460	760	4			

Table1.9

Concordance Table between the HSA Algebra Test and the PSAT Math Test

HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT	HSA	PSAT
240	160	292	190	344	220	396	350	448	490	500	700	552	740	604	750
241	180	293	190	345	220	397	350	449	490	501	700	553	740	605	750
242	180	294	190	346	220	398	350	450	490	502	710	554	740	606	760
243	180	295	190	347	220	399	350	451	500	503	710	555	740	607	760
244	180	296	190	348	220	400	360	452	500	504	710	556	740	608	760
245	180	297	190	349	220	401	360	453	510	505	710	557	740	609	760
246	180	298	190	350	220	402	360	454	510	506	720	558	740	610	760
247	180	299	190	351	230	403	360	455	510	507	720	559	740	611	760
248	180	300	190	352	230	404	360	456	510	508	720	560	740	612	760
249	180	301	190	353	230	405	360	457	520	509	720	561	750	613	760
250	180	302	190	354	230	406	360	458	520	510	730	562	750	614	760
251	180	303	200	355	230	407	360	459	520	511	730	563	750	615	760
252	180	304	200	356	240	408	370	460	530	512	730	564	750	616	760
253	180	305	200	357	240	409	370	461	530	513	730	565	750	617	760
254	180	306	200	358	250	410	370	462	540	514	730	566	750	618	760
255	180	307	200	359	250	411	370	463	540	515	730	567	750	619	760
256	180	308	200	360	250	412	380	464	550	516	730	568	750	620	760
257	180	309	200	361	250	413	380	465	550	517	740	569	750	621	760
258	180	310	200	362	250	414	380	466	560	518	740	570	750	622	760
259	180	311	200	363	250	415	390	467	560	519	740	571	750	623	760
260	180	312	200	364	260	416	390	468	570	520	740	572	750	624	760
261	180	313	200	365	260	417	390	469	570	521	740	573	750	625	760
262	180	314	200	366	260	418	390	470	570	522	740	574	750	626	760
263	180	315	200	367	260	419	400	471	570	523	740	575	750	627	760
264	180	316	200	368	260	420	400	472	580	524	740	576	750	628	760
265	180	317	200	369	270	421	400	473	580	525	740	577	750	629	760
266	180	318	200	370	270	422	400	474	590	526	740	578	750	630	760
267	180	319	200	371	280	423	410	475	590	527	740	579	750	631	760
268	180	320	200	372	280	424	410	476	590	528	740	580	750	632	760
269	180	321	200	373	280	425	410	477	600	529	740	581	750	633	760
270	180	322	200	374	290	426	410	478	600	530	740	582	750	634	760
271	180	323	200	375	290	427	420	479	610	531	740	583	750	635	760
272	180	324	200	376	300	428	420	480	610	532	740	584	750	636	760
273	180	325	200	377	300	429	420	481	620	533	740	585	750	637	760
274	180	326	200	378	300	430	430	482	620	534	740	586	750	638	760
275	190	327	200	379	310	431	430	483	630	535	740	587	750	639	760
276	190	328	200	380	310	432	430	484	630	536	740	588	750	640	760
277	190	329	200	381	310	433	430	485	630	537	740	589	750	641	760
278	190	330	200	382	310	434	440	486	640	538	740	590	750	642	760
279	190	331	200	383	320	435	440	487	640	539	740	591	750	643	760
280	190	332	200	384	330	436	440	488	650	540	740	592	750	644	760
281	190	333	200	385	330	437	450	489	650	541	740	593	750	645	760
282	190	334	200	386	330	438	450	490	660	542	740	594	750	646	760
283	190	335	210	387	340	439	450	491	660	543	740	595	750	647	760
284	190	336	210	388	340	440	460	492	660	544	740	596	750	648	760
285	190	337	210	389	340	441	460	493	670	545	740	597	750	649	760
286	190	338	210	390	340	442	460	494	670	546	740	598	750	650	760
287	190	339	210	391	340	443	470	495	670	547	740	599	750		
288	190	340	210	392	340	444	470	496	680	548	740	600	750		
289	190	341	210	393	350	445	480	497	690	549	740	601	750		
290	190	342	210	394	350	446	480	498	690	550	740	602	750		
291	190	343	210	395	350	447	480	499	700	551	740	603	750		

Table 1.10

Concordance Table for PSAT Math Test and PARCC Algebra I Test

PSAT	PARCC	Proficiency Level	PSAT	PARCC	Proficiency Level
160	650	1	470	760	4
170	650	1	480	765	4
180	650	1	490	770	4
190	650	1	500	775	4
200	654	1	510	777	4
210	664	1	520	780	4
220	666	1	530	784	4
230	667	1	540	788	4
240	668	1	550	791	4
250	671	1	560	795	4
260	675	1	570	798	4
270	678	1	580	800	5
280	679	1	590	803	5
290	681	1	600	806	5
300	684	1	610	809	5
310	687	1	620	812	5
320	690	1	630	815	5
330	694	1	640	818	5
340	698	1	650	820	5
350	702	2	660	823	5
360	709	2	670	826	5
370	713	2	680	829	5
380	716	2	690	832	5
390	722	2	700	835	5
400	728	3	710	838	5
410	733	3	720	840	5
420	740	3	730	843	5
430	743	3	740	846	5
440	747	3	750	849	5
450	753	4			
460	757	4			

Table 1.11

Concordance Table for PARCC ELA10 Test and HSA English Test

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	297	650	354	656	411	743	468	847	525	850	582	850	639	850
241	650	298	650	355	656	412	743	469	849	526	850	583	850	640	850
242	650	299	650	356	656	413	743	470	849	527	850	584	850	641	850
243	650	300	650	357	660	414	747	471	849	528	850	585	850	642	850
244	650	301	650	358	660	415	747	472	849	529	850	586	850	643	850
245	650	302	650	359	660	416	752	473	850	530	850	587	850	644	850
246	650	303	650	360	660	417	752	474	850	531	850	588	850	645	850
247	650	304	650	361	660	418	752	475	850	532	850	589	850	646	850
248	650	305	650	362	666	419	756	476	850	533	850	590	850	647	850
249	650	306	650	363	666	420	756	477	850	534	850	591	850	648	850
250	650	307	650	364	666	421	756	478	850	535	850	592	850	649	850
251	650	308	650	365	666	422	760	479	850	536	850	593	850	650	850
252	650	309	650	366	666	423	760	480	850	537	850	594	850		
253	650	310	650	367	666	424	764	481	850	538	850	595	850		
254	650	311	650	368	666	425	767	482	850	539	850	596	850		
255	650	312	650	369	673	426	767	483	850	540	850	597	850		
256	650	313	650	370	673	427	771	484	850	541	850	598	850		
257	650	314	650	371	673	428	771	485	850	542	850	599	850		
258	650	315	650	372	673	429	771	486	850	543	850	600	850		
259	650	316	650	373	673	430	775	487	850	544	850	601	850		
260	650	317	650	374	673	431	775	488	850	545	850	602	850		
261	650	318	650	375	681	432	779	489	850	546	850	603	850		
262	650	319	650	376	681	433	779	490	850	547	850	604	850		
263	650	320	650	377	681	434	783	491	850	548	850	605	850		
264	650	321	650	378	681	435	783	492	850	549	850	606	850		
265	650	322	650	379	681	436	786	493	850	550	850	607	850		
266	650	323	650	380	681	437	791	494	850	551	850	608	850		
267	650	324	650	381	691	438	791	495	850	552	850	609	850		
268	650	325	650	382	691	439	791	496	850	553	850	610	850		
269	650	326	650	383	691	440	795	497	850	554	850	611	850		
270	650	327	650	384	691	441	795	498	850	555	850	612	850		
271	650	328	650	385	691	442	799	499	850	556	850	613	850		
272	650	329	650	386	699	443	799	500	850	557	850	614	850		
273	650	330	650	387	699	444	803	501	850	558	850	615	850		
274	650	331	650	388	699	445	803	502	850	559	850	616	850		
275	650	332	650	389	699	446	807	503	850	560	850	617	850		
276	650	333	650	390	708	447	807	504	850	561	850	618	850		
277	650	334	650	391	708	448	811	505	850	562	850	619	850		
278	650	335	650	392	708	449	811	506	850	563	850	620	850		
279	650	336	650	393	708	450	815	507	850	564	850	621	850		
280	650	337	650	394	708	451	815	508	850	565	850	622	850		
281	650	338	650	395	715	452	819	509	850	566	850	623	850		
282	650	339	650	396	715	453	819	510	850	567	850	624	850		
283	650	340	650	397	715	454	823	511	850	568	850	625	850		
284	650	341	650	398	715	455	823	512	850	569	850	626	850		
285	650	342	650	399	722	456	828	513	850	570	850	627	850		
286	650	343	651	400	722	457	828	514	850	571	850	628	850		
287	650	344	651	401	722	458	832	515	850	572	850	629	850		
288	650	345	651	402	728	459	832	516	850	573	850	630	850		
289	650	346	651	403	728	460	832	517	850	574	850	631	850		
290	650	347	651	404	728	461	837	518	850	575	850	632	850		
291	650	348	653	405	733	462	837	519	850	576	850	633	850		
292	650	349	653	406	733	463	837	520	850	577	850	634	850		
293	650	350	653	407	733	464	842	521	850	578	850	635	850		
294	650	351	653	408	738	465	842	522	850	579	850	636	850		
295	650	352	656	409	738	466	847	523	850	580	850	637	850		
296	650	353	656	410	738	467	847	524	850	581	850	638	850		

Table 1.12

Concordance Table for PARCC Algebra I Test and HSA Algebra Test

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	297	650	354	667	411	713	468	798	525	846	582	849	639	850
241	650	298	650	355	667	412	716	469	798	526	846	583	849	640	850
242	650	299	650	356	668	413	716	470	798	527	846	584	849	641	850
243	650	300	650	357	668	414	716	471	798	528	846	585	849	642	850
244	650	301	650	358	671	415	722	472	800	529	846	586	849	643	850
245	650	302	650	359	671	416	722	473	800	530	846	587	849	644	850
246	650	303	654	360	671	417	722	474	803	531	846	588	849	645	850
247	650	304	654	361	671	418	722	475	803	532	846	589	849	646	850
248	650	305	654	362	671	419	728	476	803	533	846	590	849	647	850
249	650	306	654	363	671	420	728	477	806	534	846	591	849	648	850
250	650	307	654	364	675	421	728	478	806	535	846	592	849	649	850
251	650	308	654	365	675	422	728	479	809	536	846	593	849	650	850
252	650	309	654	366	675	423	733	480	809	537	846	594	849		
253	650	310	654	367	675	424	733	481	812	538	846	595	849		
254	650	311	654	368	675	425	733	482	812	539	846	596	849		
255	650	312	654	369	678	426	733	483	815	540	846	597	849		
256	650	313	654	370	678	427	740	484	815	541	846	598	849		
257	650	314	654	371	679	428	740	485	815	542	846	599	849		
258	650	315	654	372	679	429	740	486	818	543	846	600	849		
259	650	316	654	373	679	430	743	487	818	544	846	601	849		
260	650	317	654	374	681	431	743	488	820	545	846	602	849		
261	650	318	654	375	681	432	743	489	820	546	846	603	849		
262	650	319	654	376	684	433	743	490	823	547	846	604	849		
263	650	320	654	377	684	434	747	491	823	548	846	605	849		
264	650	321	654	378	684	435	747	492	823	549	846	606	850		
265	650	322	654	379	687	436	747	493	826	550	846	607	850		
266	650	323	654	380	687	437	753	494	826	551	846	608	850		
267	650	324	654	381	687	438	753	495	826	552	846	609	850		
268	650	325	654	382	687	439	753	496	829	553	846	610	850		
269	650	326	654	383	690	440	757	497	832	554	846	611	850		
270	650	327	654	384	694	441	757	498	832	555	846	612	850		
271	650	328	654	385	694	442	757	499	835	556	846	613	850		
272	650	329	654	386	694	443	760	500	835	557	846	614	850		
273	650	330	654	387	698	444	760	501	835	558	846	615	850		
274	650	331	654	388	698	445	765	502	838	559	846	616	850		
275	650	332	654	389	698	446	765	503	838	560	846	617	850		
276	650	333	654	390	698	447	765	504	838	561	849	618	850		
277	650	334	654	391	698	448	770	505	838	562	849	619	850		
278	650	335	664	392	698	449	770	506	840	563	849	620	850		
279	650	336	664	393	702	450	770	507	840	564	849	621	850		
280	650	337	664	394	702	451	775	508	840	565	849	622	850		
281	650	338	664	395	702	452	775	509	840	566	849	623	850		
282	650	339	664	396	702	453	777	510	843	567	849	624	850		
283	650	340	664	397	702	454	777	511	843	568	849	625	850		
284	650	341	664	398	702	455	777	512	843	569	849	626	850		
285	650	342	664	399	702	456	777	513	843	570	849	627	850		
286	650	343	664	400	709	457	780	514	843	571	849	628	850		
287	650	344	666	401	709	458	780	515	843	572	849	629	850		
288	650	345	666	402	709	459	780	516	843	573	849	630	850		
289	650	346	666	403	709	460	784	517	846	574	849	631	850		
290	650	347	666	404	709	461	784	518	846	575	849	632	850		
291	650	348	666	405	709	462	788	519	846	576	849	633	850		
292	650	349	666	406	709	463	788	520	846	577	849	634	850		
293	650	350	666	407	709	464	791	521	846	578	849	635	850		
294	650	351	667	408	713	465	791	522	846	579	849	636	850		
295	650	352	667	409	713	466	795	523	846	580	849	637	850		
296	650	353	667	410	713	467	795	524	846	581	849	638	850		

Option II

Using Equivalent Groups Based on Propensity Score Matching to Link HSA and PARCC Tests

The three designs used in the previous study based on the 2015 PARCC test data were used to link the HSA and PARCC tests based on the equivalent groups from propensity score matching. Six covariates were used in matching including gender, race, limited English proficiency (LEP), FARMS, Title I, and MSA test scores in the same content area.

Design I (English)

Group 1: HSA 2014 Grade 10 English + MSA 2012 Grade 8 Reading

Group 2: PARCC 2016 Grade 10 Algebra I + MSA 2014 Grade 8 Reading

Design II (Algebra)

Group 1: HSA 2014 Grade 9 Algebra+ MSA 2012 Grade 7 Math

Group 2: PARCC 2016 Grade 9 Algebra I + MSA 2014 Grade 7 Math

Design III (Algebra)

Group 1: HSA 2014 Grade 8 Algebra + MSA 2012 Grade 6 Math

Group 2: PARCC 2016 Grade 8 Algebra I + MSA 2014 Grade 6 Math

Combined Design II & III (Algebra)

Group 1: HSA 2014 Grade 9 Algebra+ MSA 2012 Grade 7 Math + HSA 2014 Grade 8 Algebra + MSA 2012 Grade 6 Math

Group 2: PARCC 2016 Grade 9 Algebra I + MSA 2014 Grade 7 Math + PARCC 2016 Grade 8 Algebra I + MSA 2014 Grade 6 Math

Prior to data analysis, the HSA test scores were merged with the above matched MSA test scores using testing year, grade, and state issued ID information for the regular first-time test-takers for each of the above mentioned three designs. Further, the PARCC test scores were also merged with the MSA test scores based on the above matched test year, grade, and state issued ID information for each design.

For Design I, after extracting first-time test takers' scores and removing students taking the Modified MSA tests, the matched sample size for HSA and MSA for Group 1 is 47,644. For Group 2, the matched sample size for PARCC and MSA is 51,690. For Design II, the matched sample size between HSA and MSA for Group 1 is 17,669; for Group 2, the matched sample size for PARCC and MSA is 26,688. For Design III, Group 1 matched sample size between HSA and MSA is 23,165 while the matched sample size

between PARCC and MSA for Group 2 is 16,766. Table 2.1 summarizes the matched sample sizes for each pair.

Table 2.1
Sample Sizes for Matched Cases in Each Group under Each Design

Design	Matched Pair	Sample Size
Design I	Group1 HSA English with MSA	47,644
	Group2 PARCC ELA10 with MSA	51,690
Design II	Group1 HSA Algebra with MSA	17,669
	Group2 PARCC ALG I with MSA	26,688
Design III	Group1 HSA Algebra with MSA	23,165
	Group2 PARCC ALG I with MSA	16,766

In the merged dataset, six covariates were utilized for propensity score matching. As stated above, the six covariates are Gender, Race, LEP, Farms, Title I and MSA scores in the same content area. Gender, Race, LEP, Farms and Title I are variables from the HSA test dataset in Group 1 and the PARCC test dataset in Group 2 in all three designs. For the Gender variable, males are coded as 1 and females are coded as 0. For the Race variable, White is coded as 1 and all others are coded as 0. LEP is coded as 1 for students with limited English proficiency and 0 for others. The Farms variable is coded as 1 for students who take free and reduced priced meals and 0 for students who do not. The Title I variable is coded as 1 for students who belong to this category and 0 for students who do not belong to this category. The MSA scale score was used as a covariate directly with no recoding needed. Students with missing data for the six covariates in the three designs were excluded from analysis because propensity matching does not allow missing data.

R studio was used for propensity score matching. The package "MatchIt" developed by Ho, Imai, K. and Imai, M. (2013) was used to match cases in the control group to those in the treatment group. Usually the group with a smaller sample size is treated as the treatment group, and this was done in matching HSA and PARCC tests. For better matching, this study explored four conditions for each design by using different caliper values and the use of replacement of cases in matching. Caliper, which is the maximum degree of difference to be considered as a match, was set at two levels: caliper of 0.1 and caliper of 0.25. Replacement was set at two levels: with and without replacement of cases. Replacement means that the cases in the control group can be used multiple times to match those in the treatment group.

To compare the similarity of the treated and control subjects in the matched sample, the standardized mean difference is commonly used as an indicator for what is called a balance check. It can be used to compare the mean of continuous and binary variables between the treatment and control groups. For a continuous covariate, the standardized mean difference is defined as

$$d = \frac{\bar{x}_{treatment} - \bar{x}_{control}}{\sqrt{\frac{s^2_{treatment} + s^2_{control}}{2}}}$$

where $\bar{x}_{treatment}$ and $\bar{x}_{control}$ denote the sample mean of the covariate in treated and control subjects, respectively, whereas $s^2_{treatment}$ and $s^2_{control}$ denote the sample variance of the covariate in the treated and control groups, respectively.

The standardized mean difference compares the difference in means in units of the pooled standard deviation. Furthermore, it is not influenced by sample size and allows for the comparison of the relative balance of variables measured in different units. Although there is no universally agreed upon criterion as to what threshold of the standardized difference can be used to indicate important imbalance, an absolute value of standardized mean difference that is less than 0.25 has been suggested to indicate a negligible difference in the mean of a covariate between the treatment group and control group (Stuart, 2010). The R package "MatchIt" outputs the standardized mean differences.

Table 2.2
Propensity Score Matching Results for Design I

Condition No.	1.1	1.2	1.3	1.4
K	1	1	1	1
Caliper	0.1	0.1	0.25	0.25
Replacement	NO	YES	NO	YES
Gender	0.0007	0.0106	0.0029	0.0084
Race	0.0014	0.0158	0.0040	0.0127
LEP	0.0058	0.0073	0.0039	0.0073
FARMS	0.0004	0.0279	0.0070	0.0206
Title1	0.0042	0.0077	0.0014	0.0112
MSA	0.0020	0.0022	0.0097	0.0052
HSA English (Treatment)	45,533	47,643	46,353	47,644
PARCC ELA10 (Control)	45,533	30,397	46,353	30,640

Table 2.3
Propensity Score Matching Results for Design II

Condition No.	2.1	2.2	2.3	2.4
K	1	1	1	1
Caliper	0.1	0.1	0.25	0.25
Replacement	NO	YES	NO	YES
Gender	0.0083	0.0006	0.0079	0.0179
Race	0.0015	0.0052	0.0037	0.0078
LEP	0.0245	0.0217	0.0145	0.0217
FARMS	0.0197	0.0211	0.0068	0.0200
Title1	0.0368	0.0511	0.0429	0.0575
MSA	0.0221	0.0295	0.0030	0.0197
HSA Algebra (Treatment)	17,655	17,668	17,663	17,669
PARCC ALG I (Control)	17,655	12,575	17,663	12,597

Table 2.4
Propensity Score Matching Results for Design III

Condition No.	3.1	3.2	3.3	3.4
K	1	1	1	1
Caliper	0.1	0.1	0.25	0.25
Replacement	NO	YES	NO	YES
Gender	0.0107	0.0130	0.0005	0.0074
Race	0.0049	0.0076	0.0004	0.0050
LEP	0.0057	0.0056	0.0019	0.0106
FARMS	0.0004	0.0041	0.0015	0.0126
Title1	0.0024	0.0042	0.0027	0.0003
MSA	0.0033	0.0009	0.0136	0.0213
PARCC ALG I (Treatment)	16,440	16,763	16,600	16,765
HSA Algebra (Control)	16,440	11,631	16,600	11,711

In Tables 2.2 to 2.4, the 12 conditions are labeled from 1.1 to 3.4 for convenience. The first number represents each of the three designs and the second number represents the matching condition based on the combination of different caliper values and matching with or without replacement. For example, Condition 3.1 represents one-to-one matching with a caliper value of 0.1 and no replacement. Each of these tables presents the absolute standardized mean difference values for each covariate. The bottom part in each of the three tables contains the number of matched cases in the treatment group and the control group. In this study, the group with fewer cases (the sample size is indicated in Table 2.1) was chosen as the treatment group and the other group was chosen as the control group in order to maximize the sample size of the matched cases in both the treatment and control groups. Therefore, in each design, either Group 1 or Group 2 was chosen as a treatment group based on the sample size of the matched cases in Table 2.1. The values of the absolute standardized mean differences in Tables 2.2 to 2.4 were checked. The results

indicated that for these three designs, the covariates were balanced after matching. The descriptive statistics for the HSA and PARCC test scores for the matched groups for each design and each matching condition are summarized in Tables 2.5 to 2.7.

Table 2.5
Descriptive Statistics for HSA and PARCC in the Matched Data in Design I (English)

Condition	Test Name	N	Mean	SD	Min	Max
1	HSA	45,533	412.19	29.04	240	650
	PARCC	45,533	750.23	44.95	650	850
2	HSA	47,643	413.39	29.25	240	650
	PARCC	30,397	749.45	45.56	650	850
3	HSA	46,353	412.74	29.23	240	650
	PARCC	46,353	750.85	45.31	650	850
4	HSA	47,644	413.40	29.25	240	650
	PARCC	30,640	749.86	45.68	650	850

Table 2.6
Descriptive Statistics for HSA and PARCC in the Matched Data in Design II (Algebra)

Condition	Test Name	N	Mean	SD	Min	Max
1	HSA	17,655	406.78	40.25	240	650
	PARCC	17,655	728.49	29.19	650	850
2	HSA	17,668	406.81	40.25	240	650
	PARCC	12,575	727.80	29.12	650	850
3	HSA	17,663	406.80	40.26	240	650
	PARCC	17,663	728.10	29.18	650	850
4	HSA	17,669	406.81	40.25	240	650
	PARCC	12,597	727.68	29.20	650	850

Table 2.7
Descriptive Statistics for HSA and PARCC in the Matched Data in Design III (Algebra)

Condition	Test Name	N	Mean	SD	Min	Max
1	HSA	16,440	427.80	34.20	240	650
	PARCC	16,440	755.60	30.70	650	850
2	HSA	11,631	428.05	34.20	240	650
	PARCC	16,763	755.07	30.85	650	850
3	HSA	16,600	428.07	33.79	240	650
	PARCC	16,600	755.32	30.80	650	850
4	HSA	11,711	428.34	34.08	240	650
	PARCC	16,765	755.07	30.85	650	850

After propensity score matching, the matched data were exported from all conditions in the three designs. LEGS program was again used for equipercentile linking

using the equivalent group design using frequency data. The propensity score matching with replacement weighs different cases differently. Weights for cases in the control group (with a larger sample size) may be a value larger or smaller than 1 while the weights for cases in the treatment group (with a smaller sample size) are still 1. Thus, in computing the frequency for the control group in the matched sample, weights assigned to each case were summed up and used as the frequency for each case. The sum of the weights is rounded up if larger than 0.5.

In total, there are 16 concordance tables created based on propensity score matching. The PARCC equivalents of the HSA cut scores for each matching condition are summarized in Table 2.8. The 16 HSA and PARCC concordance tables are presented in Tables 2.9 to 2.24.

Table 2.8
PARCC Equivalent Scores of the HSA Cut Scores Using Propensity Score Matching

Sub-Condition	1	2	3	4
Caliper	0.1	0.1	0.25	0.25
Replacement	NO	YES	NO	YES
Design I (ELA10)	717	716	717	717
Design II (ALG I)	726	727	726	726
Design III (ALG I)	736	735	735	735
Combined Design II & III (ALG I)	730	735	729	734

In general, the pattern in the mapped PARCC cut scores using the 2016 PARCC test data was consistent with that observed using the 2015 PARCC test data. For ELA 10, the differences in the mapped cut scores from the four explored methods with different calipers and with/without replacement did not differ too much, with the largest difference of 1. For Algebra I, the mapped cut scores based on grade 9 student responses were lower than those based on grade 8 student responses. This is consistent with the expectations. Students who took ALG I at grade 8 often have higher competence than those who took AGL I at grade 9. As the equipercentile linking method essentially link the two groups based on the same percentile rank, the scores corresponding to the same percentile rank would be higher for groups with higher competence than for groups with lower competence. Thus, the mapped scores based on the test performance of grade 8 students are expected to be higher than those of grade 9 students. With combined grades 8 and 9 student response data, the mapped cut scores were between those based on grade 8 and grade 9 student data. From a representativeness perspective, the mapped cut scores from the combined sample should be considered more important than those from individual grade samples.

Table 2.9

Concordance Table for HSA English Test and PARCC ELA10 Test (Condition 1.1)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	650	344	656	396	717	448	815	500	850	552	850	604	850
241	650	293	650	345	656	397	719	449	818	501	850	553	850	605	850
242	650	294	650	346	657	398	721	450	820	502	850	554	850	606	850
243	650	295	650	347	658	399	723	451	822	503	850	555	850	607	850
244	650	296	650	348	659	400	725	452	824	504	850	556	850	608	850
245	650	297	650	349	659	401	726	453	827	505	850	557	850	609	850
246	650	298	650	350	659	402	728	454	829	506	850	558	850	610	850
247	650	299	650	351	660	403	730	455	831	507	850	559	850	611	850
248	650	300	650	352	661	404	732	456	833	508	850	560	850	612	850
249	650	301	650	353	662	405	734	457	835	509	850	561	850	613	850
250	650	302	650	354	663	406	736	458	837	510	850	562	850	614	850
251	650	303	650	355	663	407	737	459	839	511	850	563	850	615	850
252	650	304	650	356	664	408	739	460	841	512	850	564	850	616	850
253	650	305	650	357	664	409	741	461	843	513	850	565	850	617	850
254	650	306	650	358	665	410	743	462	845	514	850	566	850	618	850
255	650	307	650	359	666	411	745	463	847	515	850	567	850	619	850
256	650	308	650	360	667	412	747	464	849	516	850	568	850	620	850
257	650	309	650	361	668	413	749	465	849	517	850	569	850	621	850
258	650	310	650	362	669	414	751	466	850	518	850	570	850	622	850
259	650	311	650	363	670	415	752	467	850	519	850	571	850	623	850
260	650	312	650	364	670	416	754	468	850	520	850	572	850	624	850
261	650	313	650	365	671	417	756	469	850	521	850	573	850	625	850
262	650	314	650	366	672	418	758	470	850	522	850	574	850	626	850
263	650	315	650	367	673	419	760	471	850	523	850	575	850	627	850
264	650	316	650	368	674	420	762	472	850	524	850	576	850	628	850
265	650	317	650	369	675	421	764	473	850	525	850	577	850	629	850
266	650	318	650	370	676	422	766	474	850	526	850	578	850	630	850
267	650	319	650	371	677	423	767	475	850	527	850	579	850	631	850
268	650	320	650	372	678	424	769	476	850	528	850	580	850	632	850
269	650	321	650	373	679	425	771	477	850	529	850	581	850	633	850
270	650	322	650	374	680	426	773	478	850	530	850	582	850	634	850
271	650	323	650	375	682	427	775	479	850	531	850	583	850	635	850
272	650	324	650	376	683	428	777	480	850	532	850	584	850	636	850
273	650	325	650	377	684	429	779	481	850	533	850	585	850	637	850
274	650	326	650	378	686	430	781	482	850	534	850	586	850	638	850
275	650	327	650	379	687	431	783	483	850	535	850	587	850	639	850
276	650	328	650	380	689	432	785	484	850	536	850	588	850	640	850
277	650	329	650	381	690	433	786	485	850	537	850	589	850	641	850
278	650	330	650	382	692	434	788	486	850	538	850	590	850	642	850
279	650	331	650	383	693	435	790	487	850	539	850	591	850	643	850
280	650	332	650	384	695	436	792	488	850	540	850	592	850	644	850
281	650	333	651	385	697	437	794	489	850	541	850	593	850	645	850
282	650	334	651	386	699	438	796	490	850	542	850	594	850	646	850
283	650	335	652	387	700	439	798	491	850	543	850	595	850	647	850
284	650	336	652	388	702	440	800	492	850	544	850	596	850	648	850
285	650	337	653	389	704	441	802	493	850	545	850	597	850	649	850
286	650	338	653	390	706	442	803	494	850	546	850	598	850	650	850
287	650	339	653	391	708	443	805	495	850	547	850	599	850		
288	650	340	654	392	710	444	807	496	850	548	850	600	850		
289	650	341	654	393	711	445	809	497	850	549	850	601	850		
290	650	342	654	394	713	446	811	498	850	550	850	602	850		
291	650	343	655	395	715	447	813	499	850	551	850	603	850		

Table 2.10

Concordance Table for HSA English Test and PARCC ELA10 Test (Condition 1.2)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	650	344	655	396	716	448	816	500	850	552	850	604	850
241	650	293	650	345	656	397	718	449	818	501	850	553	850	605	850
242	650	294	650	346	656	398	720	450	820	502	850	554	850	606	850
243	650	295	650	347	657	399	722	451	822	503	850	555	850	607	850
244	650	296	650	348	658	400	724	452	825	504	850	556	850	608	850
245	650	297	650	349	659	401	726	453	827	505	850	557	850	609	850
246	650	298	650	350	659	402	728	454	829	506	850	558	850	610	850
247	650	299	650	351	660	403	730	455	831	507	850	559	850	611	850
248	650	300	650	352	660	404	732	456	833	508	850	560	850	612	850
249	650	301	650	353	661	405	733	457	835	509	850	561	850	613	850
250	650	302	650	354	662	406	735	458	837	510	850	562	850	614	850
251	650	303	650	355	663	407	737	459	839	511	850	563	850	615	850
252	650	304	650	356	664	408	739	460	841	512	850	564	850	616	850
253	650	305	650	357	664	409	741	461	843	513	850	565	850	617	850
254	650	306	650	358	665	410	743	462	845	514	850	566	850	618	850
255	650	307	650	359	666	411	744	463	847	515	850	567	850	619	850
256	650	308	650	360	667	412	746	464	849	516	850	568	850	620	850
257	650	309	650	361	668	413	748	465	850	517	850	569	850	621	850
258	650	310	650	362	669	414	750	466	850	518	850	570	850	622	850
259	650	311	650	363	669	415	752	467	850	519	850	571	850	623	850
260	650	312	650	364	670	416	754	468	850	520	850	572	850	624	850
261	650	313	650	365	671	417	756	469	850	521	850	573	850	625	850
262	650	314	650	366	672	418	758	470	850	522	850	574	850	626	850
263	650	315	650	367	673	419	760	471	850	523	850	575	850	627	850
264	650	316	650	368	674	420	761	472	850	524	850	576	850	628	850
265	650	317	650	369	675	421	763	473	850	525	850	577	850	629	850
266	650	318	650	370	676	422	765	474	850	526	850	578	850	630	850
267	650	319	650	371	677	423	767	475	850	527	850	579	850	631	850
268	650	320	650	372	678	424	769	476	850	528	850	580	850	632	850
269	650	321	650	373	679	425	771	477	850	529	850	581	850	633	850
270	650	322	650	374	680	426	772	478	850	530	850	582	850	634	850
271	650	323	650	375	682	427	774	479	850	531	850	583	850	635	850
272	650	324	650	376	683	428	776	480	850	532	850	584	850	636	850
273	650	325	650	377	684	429	778	481	850	533	850	585	850	637	850
274	650	326	650	378	685	430	780	482	850	534	850	586	850	638	850
275	650	327	650	379	687	431	782	483	850	535	850	587	850	639	850
276	650	328	650	380	688	432	784	484	850	536	850	588	850	640	850
277	650	329	650	381	690	433	786	485	850	537	850	589	850	641	850
278	650	330	650	382	691	434	788	486	850	538	850	590	850	642	850
279	650	331	650	383	693	435	790	487	850	539	850	591	850	643	850
280	650	332	650	384	695	436	792	488	850	540	850	592	850	644	850
281	650	333	650	385	696	437	794	489	850	541	850	593	850	645	850
282	650	334	650	386	698	438	796	490	850	542	850	594	850	646	850
283	650	335	650	387	700	439	798	491	850	543	850	595	850	647	850
284	650	336	651	388	702	440	800	492	850	544	850	596	850	648	850
285	650	337	651	389	704	441	802	493	850	545	850	597	850	649	850
286	650	338	652	390	706	442	803	494	850	546	850	598	850	650	850
287	650	339	652	391	707	443	805	495	850	547	850	599	850		
288	650	340	653	392	709	444	807	496	850	548	850	600	850		
289	650	341	653	393	711	445	809	497	850	549	850	601	850		
290	650	342	654	394	713	446	811	498	850	550	850	602	850		
291	650	343	654	395	714	447	813	499	850	551	850	603	850		

Table 2.11

Concordance Table for HSA English Test and PARCC ELA10 Test (Condition 1.3)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	650	344	656	396	717	448	815	500	850	552	850	604	850
241	650	293	650	345	656	397	718	449	818	501	850	553	850	605	850
242	650	294	650	346	657	398	720	450	820	502	850	554	850	606	850
243	650	295	650	347	658	399	722	451	822	503	850	555	850	607	850
244	650	296	650	348	659	400	724	452	824	504	850	556	850	608	850
245	650	297	650	349	659	401	726	453	826	505	850	557	850	609	850
246	650	298	650	350	660	402	728	454	829	506	850	558	850	610	850
247	650	299	650	351	660	403	730	455	831	507	850	559	850	611	850
248	650	300	650	352	661	404	732	456	833	508	850	560	850	612	850
249	650	301	650	353	662	405	733	457	835	509	850	561	850	613	850
250	650	302	650	354	663	406	735	458	837	510	850	562	850	614	850
251	650	303	650	355	663	407	737	459	839	511	850	563	850	615	850
252	650	304	650	356	664	408	739	460	841	512	850	564	850	616	850
253	650	305	650	357	664	409	741	461	843	513	850	565	850	617	850
254	650	306	650	358	665	410	743	462	845	514	850	566	850	618	850
255	650	307	650	359	666	411	745	463	847	515	850	567	850	619	850
256	650	308	650	360	667	412	746	464	849	516	850	568	850	620	850
257	650	309	650	361	668	413	748	465	849	517	850	569	850	621	850
258	650	310	650	362	669	414	750	466	849	518	850	570	850	622	850
259	650	311	650	363	669	415	752	467	850	519	850	571	850	623	850
260	650	312	650	364	670	416	754	468	850	520	850	572	850	624	850
261	650	313	650	365	671	417	756	469	850	521	850	573	850	625	850
262	650	314	650	366	672	418	758	470	850	522	850	574	850	626	850
263	650	315	650	367	673	419	759	471	850	523	850	575	850	627	850
264	650	316	650	368	674	420	761	472	850	524	850	576	850	628	850
265	650	317	650	369	675	421	763	473	850	525	850	577	850	629	850
266	650	318	650	370	676	422	765	474	850	526	850	578	850	630	850
267	650	319	650	371	677	423	767	475	850	527	850	579	850	631	850
268	650	320	650	372	678	424	769	476	850	528	850	580	850	632	850
269	650	321	650	373	679	425	771	477	850	529	850	581	850	633	850
270	650	322	650	374	680	426	772	478	850	530	850	582	850	634	850
271	650	323	650	375	682	427	774	479	850	531	850	583	850	635	850
272	650	324	650	376	683	428	776	480	850	532	850	584	850	636	850
273	650	325	650	377	684	429	778	481	850	533	850	585	850	637	850
274	650	326	650	378	686	430	780	482	850	534	850	586	850	638	850
275	650	327	650	379	687	431	782	483	850	535	850	587	850	639	850
276	650	328	650	380	689	432	784	484	850	536	850	588	850	640	850
277	650	329	650	381	690	433	786	485	850	537	850	589	850	641	850
278	650	330	650	382	692	434	788	486	850	538	850	590	850	642	850
279	650	331	650	383	693	435	790	487	850	539	850	591	850	643	850
280	650	332	650	384	695	436	792	488	850	540	850	592	850	644	850
281	650	333	650	385	697	437	794	489	850	541	850	593	850	645	850
282	650	334	650	386	698	438	795	490	850	542	850	594	850	646	850
283	650	335	651	387	700	439	797	491	850	543	850	595	850	647	850
284	650	336	651	388	702	440	799	492	850	544	850	596	850	648	850
285	650	337	652	389	704	441	801	493	850	545	850	597	850	649	850
286	650	338	652	390	706	442	803	494	850	546	850	598	850	650	850
287	650	339	653	391	707	443	805	495	850	547	850	599	850		
288	650	340	653	392	709	444	807	496	850	548	850	600	850		
289	650	341	654	393	711	445	809	497	850	549	850	601	850		
290	650	342	654	394	713	446	811	498	850	550	850	602	850		
291	650	343	655	395	715	447	813	499	850	551	850	603	850		

Table 2.12

Concordance Table for HSA English Test and PARCC ELA10 Test (Condition 1.4)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	650	344	655	396	717	448	815	500	850	552	850	604	850
241	650	293	650	345	655	397	719	449	817	501	850	553	850	605	850
242	650	294	650	346	656	398	721	450	819	502	850	554	850	606	850
243	650	295	650	347	657	399	723	451	821	503	850	555	850	607	850
244	650	296	650	348	658	400	724	452	824	504	850	556	850	608	850
245	650	297	650	349	658	401	726	453	826	505	850	557	850	609	850
246	650	298	650	350	659	402	728	454	828	506	850	558	850	610	850
247	650	299	650	351	659	403	730	455	830	507	850	559	850	611	850
248	650	300	650	352	660	404	732	456	833	508	850	560	850	612	850
249	650	301	650	353	661	405	734	457	835	509	850	561	850	613	850
250	650	302	650	354	662	406	736	458	837	510	850	562	850	614	850
251	650	303	650	355	663	407	737	459	839	511	850	563	850	615	850
252	650	304	650	356	663	408	739	460	841	512	850	564	850	616	850
253	650	305	650	357	664	409	741	461	844	513	850	565	850	617	850
254	650	306	650	358	665	410	743	462	846	514	850	566	850	618	850
255	650	307	650	359	666	411	745	463	847	515	850	567	850	619	850
256	650	308	650	360	666	412	747	464	849	516	850	568	850	620	850
257	650	309	650	361	667	413	749	465	850	517	850	569	850	621	850
258	650	310	650	362	668	414	750	466	850	518	850	570	850	622	850
259	650	311	650	363	669	415	752	467	850	519	850	571	850	623	850
260	650	312	650	364	670	416	754	468	850	520	850	572	850	624	850
261	650	313	650	365	671	417	756	469	850	521	850	573	850	625	850
262	650	314	650	366	672	418	758	470	850	522	850	574	850	626	850
263	650	315	650	367	673	419	760	471	850	523	850	575	850	627	850
264	650	316	650	368	674	420	762	472	850	524	850	576	850	628	850
265	650	317	650	369	675	421	763	473	850	525	850	577	850	629	850
266	650	318	650	370	676	422	765	474	850	526	850	578	850	630	850
267	650	319	650	371	677	423	767	475	850	527	850	579	850	631	850
268	650	320	650	372	678	424	769	476	850	528	850	580	850	632	850
269	650	321	650	373	679	425	771	477	850	529	850	581	850	633	850
270	650	322	650	374	680	426	772	478	850	530	850	582	850	634	850
271	650	323	650	375	682	427	774	479	850	531	850	583	850	635	850
272	650	324	650	376	683	428	776	480	850	532	850	584	850	636	850
273	650	325	650	377	684	429	778	481	850	533	850	585	850	637	850
274	650	326	650	378	686	430	780	482	850	534	850	586	850	638	850
275	650	327	650	379	687	431	782	483	850	535	850	587	850	639	850
276	650	328	650	380	689	432	784	484	850	536	850	588	850	640	850
277	650	329	650	381	690	433	786	485	850	537	850	589	850	641	850
278	650	330	650	382	692	434	788	486	850	538	850	590	850	642	850
279	650	331	650	383	693	435	789	487	850	539	850	591	850	643	850
280	650	332	650	384	695	436	791	488	850	540	850	592	850	644	850
281	650	333	650	385	697	437	793	489	850	541	850	593	850	645	850
282	650	334	650	386	698	438	795	490	850	542	850	594	850	646	850
283	650	335	650	387	700	439	797	491	850	543	850	595	850	647	850
284	650	336	650	388	702	440	799	492	850	544	850	596	850	648	850
285	650	337	650	389	704	441	801	493	850	545	850	597	850	649	850
286	650	338	651	390	705	442	803	494	850	546	850	598	850	650	850
287	650	339	651	391	707	443	805	495	850	547	850	599	850		
288	650	340	652	392	709	444	807	496	850	548	850	600	850		
289	650	341	652	393	711	445	808	497	850	549	850	601	850		
290	650	342	653	394	713	446	810	498	850	550	850	602	850		
291	650	343	654	395	715	447	813	499	850	551	850	603	850		

Table 2.13

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 2.1)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	653	292	669	344	685	396	713	448	767	500	810	552	824	604	838
241	666	293	669	345	686	397	714	449	768	501	810	553	824	605	838
242	668	294	669	346	686	398	714	450	770	502	810	554	824	606	838
243	668	295	670	347	686	399	715	451	771	503	811	555	825	607	839
244	667	296	670	348	687	400	715	452	772	504	811	556	825	608	839
245	667	297	670	349	687	401	716	453	774	505	811	557	825	609	839
246	668	298	670	350	687	402	718	454	775	506	811	558	826	610	840
247	668	299	670	351	687	403	718	455	776	507	812	559	826	611	840
248	668	300	670	352	687	404	719	456	777	508	812	560	826	612	840
249	668	301	671	353	687	405	720	457	779	509	812	561	826	613	840
250	668	302	671	354	688	406	720	458	780	510	813	562	827	614	841
251	668	303	671	355	688	407	721	459	782	511	813	563	827	615	841
252	668	304	671	356	688	408	722	460	783	512	813	564	827	616	841
253	668	305	671	357	689	409	723	461	784	513	813	565	827	617	841
254	668	306	672	358	690	410	725	462	786	514	814	566	828	618	842
255	668	307	672	359	691	411	725	463	787	515	814	567	828	619	842
256	668	308	673	360	692	412	726	464	789	516	814	568	828	620	842
257	668	309	674	361	693	413	727	465	790	517	814	569	828	621	843
258	668	310	674	362	693	414	728	466	792	518	815	570	829	622	843
259	668	311	674	363	693	415	729	467	793	519	815	571	829	623	843
260	668	312	675	364	694	416	730	468	794	520	815	572	829	624	843
261	668	313	675	365	694	417	731	469	795	521	816	573	830	625	844
262	668	314	675	366	694	418	732	470	796	522	816	574	830	626	844
263	668	315	676	367	695	419	733	471	797	523	816	575	830	627	844
264	668	316	676	368	695	420	734	472	799	524	816	576	830	628	844
265	668	317	677	369	696	421	735	473	800	525	817	577	831	629	845
266	668	318	677	370	697	422	736	474	802	526	817	578	831	630	845
267	668	319	677	371	698	423	738	475	803	527	817	579	831	631	845
268	668	320	677	372	699	424	739	476	803	528	817	580	831	632	846
269	668	321	678	373	699	425	740	477	804	529	818	581	832	633	846
270	668	322	678	374	700	426	741	478	804	530	818	582	832	634	846
271	668	323	678	375	700	427	742	479	804	531	818	583	832	635	846
272	668	324	678	376	700	428	743	480	804	532	818	584	833	636	847
273	669	325	678	377	701	429	744	481	805	533	819	585	833	637	847
274	669	326	678	378	701	430	745	482	805	534	819	586	833	638	847
275	669	327	679	379	702	431	746	483	805	535	819	587	833	639	847
276	669	328	679	380	703	432	747	484	806	536	820	588	834	640	848
277	669	329	679	381	704	433	748	485	806	537	820	589	834	641	848
278	669	330	679	382	705	434	749	486	806	538	820	590	834	642	848
279	669	331	679	383	705	435	751	487	806	539	820	591	834	643	848
280	669	332	679	384	705	436	752	488	807	540	821	592	835	644	849
281	669	333	680	385	705	437	753	489	807	541	821	593	835	645	849
282	669	334	680	386	706	438	754	490	807	542	821	594	835	646	849
283	669	335	680	387	706	439	755	491	807	543	821	595	836	647	850
284	669	336	681	388	707	440	757	492	808	544	822	596	836	648	850
285	669	337	682	389	708	441	758	493	808	545	822	597	836	649	850
286	669	338	683	390	709	442	759	494	808	546	822	598	836	650	850
287	669	339	684	391	710	443	761	495	808	547	823	599	837		
288	669	340	684	392	710	444	762	496	809	548	823	600	837		
289	669	341	685	393	710	445	763	497	809	549	823	601	837		
290	669	342	685	394	711	446	764	498	809	550	823	602	837		
291	**669**	**343**	**685**	**395**	**712**	**447**	**765**	**499**	**810**	**551**	**824**	**603**	**838**		

Table 2.14

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 2.2)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	654	292	671	344	685	396	713	448	767	500	808	552	823	604	837
241	666	293	671	345	686	397	714	449	768	501	808	553	823	605	838
242	668	294	672	346	686	398	715	450	770	502	809	554	823	606	838
243	668	295	672	347	686	399	715	451	771	503	809	555	824	607	838
244	668	296	672	348	687	400	716	452	772	504	809	556	824	608	838
245	668	297	672	349	687	401	717	453	774	505	809	557	824	609	839
246	668	298	672	350	687	402	718	454	775	506	810	558	824	610	839
247	668	299	673	351	687	403	719	455	776	507	810	559	825	611	839
248	668	300	673	352	687	404	719	456	777	508	810	560	825	612	840
249	668	301	674	353	687	405	720	457	778	509	811	561	825	613	840
250	668	302	674	354	688	406	721	458	780	510	811	562	825	614	840
251	668	303	674	355	688	407	722	459	781	511	811	563	826	615	840
252	668	304	675	356	688	408	723	460	782	512	811	564	826	616	841
253	668	305	675	357	689	409	724	461	783	513	812	565	826	617	841
254	668	306	675	358	690	410	725	462	785	514	812	566	827	618	841
255	668	307	675	359	691	411	726	463	786	515	812	567	827	619	842
256	669	308	675	360	692	412	727	464	787	516	812	568	827	620	842
257	669	309	675	361	693	413	728	465	788	517	813	569	827	621	842
258	669	310	675	362	693	414	729	466	790	518	813	570	828	622	842
259	669	311	675	363	693	415	730	467	791	519	813	571	828	623	843
260	669	312	676	364	694	416	731	468	792	520	814	572	828	624	843
261	669	313	676	365	694	417	732	469	793	521	814	573	829	625	843
262	669	314	677	366	694	418	733	470	795	522	814	574	829	626	844
263	669	315	677	367	695	419	734	471	796	523	814	575	829	627	844
264	669	316	677	368	695	420	735	472	797	524	815	576	829	628	844
265	669	317	677	369	696	421	736	473	798	525	815	577	830	629	844
266	669	318	677	370	697	422	737	474	800	526	815	578	830	630	845
267	669	319	678	371	698	423	738	475	801	527	816	579	830	631	845
268	669	320	678	372	699	424	739	476	801	528	816	580	831	632	845
269	669	321	678	373	699	425	741	477	801	529	816	581	831	633	846
270	669	322	678	374	700	426	741	478	802	530	816	582	831	634	846
271	669	323	678	375	700	427	742	479	802	531	817	583	831	635	846
272	669	324	678	376	701	428	743	480	802	532	817	584	832	636	846
273	669	325	679	377	701	429	744	481	803	533	817	585	832	637	847
274	669	326	679	378	702	430	746	482	803	534	818	586	832	638	847
275	669	327	679	379	702	431	747	483	803	535	818	587	833	639	847
276	670	328	679	380	703	432	748	484	803	536	818	588	833	640	848
277	670	329	679	381	704	433	749	485	804	537	818	589	833	641	848
278	670	330	679	382	705	434	750	486	804	538	819	590	833	642	848
279	670	331	680	383	705	435	751	487	804	539	819	591	834	643	848
280	670	332	680	384	705	436	752	488	805	540	819	592	834	644	849
281	670	333	680	385	706	437	753	489	805	541	820	593	834	645	849
282	670	334	681	386	706	438	754	490	805	542	820	594	835	646	849
283	670	335	681	387	707	439	756	491	805	543	820	595	835	647	850
284	670	336	682	388	708	440	757	492	806	544	820	596	835	648	850
285	670	337	683	389	709	441	758	493	806	545	821	597	835	649	850
286	670	338	684	390	709	442	760	494	806	546	821	598	836	650	850
287	670	339	684	391	710	443	761	495	807	547	821	599	836		
288	670	340	684	392	710	444	762	496	807	548	822	600	836		
289	671	341	685	393	711	445	763	497	807	549	822	601	837		
290	671	342	685	394	711	446	765	498	807	550	822	602	837		
291	671	343	685	395	712	447	766	499	808	551	822	603	837		

Table 2.15

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 2.3)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	653	292	669	344	685	396	712	448	766	500	809	552	824	604	838
241	666	293	669	345	686	397	714	449	768	501	810	553	824	605	838
242	668	294	669	346	686	398	714	450	769	502	810	554	824	606	838
243	667	295	669	347	686	399	715	451	770	503	810	555	824	607	839
244	667	296	669	348	687	400	715	452	772	504	811	556	825	608	839
245	667	297	670	349	687	401	716	453	773	505	811	557	825	609	839
246	667	298	670	350	687	402	717	454	775	506	811	558	825	610	839
247	668	299	670	351	687	403	718	455	776	507	811	559	826	611	840
248	668	300	670	352	687	404	719	456	777	508	812	560	826	612	840
249	668	301	670	353	687	405	719	457	778	509	812	561	826	613	840
250	668	302	671	354	687	406	720	458	780	510	812	562	826	614	841
251	668	303	671	355	688	407	721	459	781	511	812	563	827	615	841
252	668	304	671	356	688	408	722	460	783	512	813	564	827	616	841
253	668	305	671	357	688	409	723	461	784	513	813	565	827	617	841
254	668	306	671	358	689	410	724	462	785	514	813	566	827	618	842
255	668	307	672	359	690	411	725	463	787	515	814	567	828	619	842
256	668	308	673	360	692	412	726	464	788	516	814	568	828	620	842
257	668	309	673	361	693	413	727	465	790	517	814	569	828	621	842
258	668	310	674	362	693	414	728	466	791	518	814	570	829	622	843
259	668	311	674	363	693	415	729	467	792	519	815	571	829	623	843
260	668	312	675	364	694	416	729	468	794	520	815	572	829	624	843
261	668	313	675	365	694	417	731	469	795	521	815	573	829	625	844
262	668	314	675	366	694	418	732	470	796	522	815	574	830	626	844
263	668	315	676	367	695	419	733	471	797	523	816	575	830	627	844
264	668	316	676	368	695	420	734	472	798	524	816	576	830	628	844
265	668	317	677	369	695	421	735	473	800	525	816	577	830	629	845
266	668	318	677	370	696	422	736	474	801	526	817	578	831	630	845
267	668	319	677	371	697	423	737	475	803	527	817	579	831	631	845
268	668	320	677	372	698	424	738	476	803	528	817	580	831	632	845
269	668	321	678	373	699	425	740	477	803	529	817	581	832	633	846
270	668	322	678	374	699	426	741	478	803	530	818	582	832	634	846
271	668	323	678	375	700	427	741	479	804	531	818	583	832	635	846
272	668	324	678	376	700	428	743	480	804	532	818	584	832	636	847
273	668	325	678	377	700	429	743	481	804	533	818	585	833	637	847
274	668	326	678	378	701	430	745	482	804	534	819	586	833	638	847
275	668	327	679	379	701	431	746	483	805	535	819	587	833	639	847
276	668	328	679	380	702	432	747	484	805	536	819	588	833	640	848
277	669	329	679	381	704	433	748	485	805	537	820	589	834	641	848
278	669	330	679	382	704	434	749	486	806	538	820	590	834	642	848
279	669	331	679	383	705	435	750	487	806	539	820	591	834	643	848
280	669	332	679	384	705	436	751	488	806	540	820	592	835	644	849
281	669	333	680	385	705	437	752	489	806	541	821	593	835	645	849
282	669	334	680	386	706	438	754	490	807	542	821	594	835	646	849
283	669	335	680	387	706	439	755	491	807	543	821	595	835	647	850
284	669	336	680	388	706	440	756	492	807	544	821	596	836	648	850
285	669	337	681	389	707	441	758	493	808	545	822	597	836	649	850
286	669	338	682	390	709	442	759	494	808	546	822	598	836	650	850
287	669	339	683	391	709	443	760	495	808	547	822	599	836		
288	669	340	684	392	710	444	761	496	808	548	823	600	837		
289	669	341	684	393	710	445	763	497	809	549	823	601	837		
290	669	342	685	394	711	446	764	498	809	550	823	602	837		
291	669	343	685	395	711	447	765	499	809	551	823	603	838		

Table 2.16

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 2.4)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	653	292	670	344	685	396	713	448	767	500	811	552	824	604	838
241	660	293	670	345	685	397	714	449	768	501	811	553	825	605	838
242	661	294	670	346	686	398	714	450	770	502	811	554	825	606	839
243	662	295	670	347	686	399	715	451	771	503	811	555	825	607	839
244	663	296	670	348	686	400	716	452	772	504	812	556	825	608	839
245	664	297	670	349	686	401	717	453	774	505	812	557	826	609	839
246	665	298	670	350	687	402	717	454	775	506	812	558	826	610	840
247	666	299	670	351	687	403	718	455	776	507	812	559	826	611	840
248	666	300	671	352	687	404	719	456	778	508	813	560	826	612	840
249	666	301	671	353	687	405	720	457	779	509	813	561	827	613	841
250	667	302	671	354	688	406	721	458	780	510	813	562	827	614	841
251	667	303	671	355	688	407	722	459	782	511	813	563	827	615	841
252	667	304	672	356	688	408	723	460	783	512	814	564	828	616	841
253	667	305	672	357	689	409	724	461	784	513	814	565	828	617	842
254	667	306	673	358	690	410	725	462	786	514	814	566	828	618	842
255	667	307	673	359	690	411	725	463	787	515	815	567	828	619	842
256	667	308	673	360	691	412	726	464	789	516	815	568	829	620	842
257	667	309	674	361	692	413	727	465	790	517	815	569	829	621	843
258	667	310	674	362	693	414	728	466	792	518	815	570	829	622	843
259	667	311	674	363	693	415	729	467	793	519	816	571	829	623	843
260	667	312	675	364	694	416	730	468	794	520	816	572	830	624	843
261	668	313	675	365	694	417	731	469	795	521	816	573	830	625	844
262	668	314	675	366	694	418	732	470	797	522	816	574	830	626	844
263	668	315	675	367	695	419	733	471	798	523	817	575	830	627	844
264	668	316	676	368	695	420	734	472	800	524	817	576	831	628	845
265	668	317	676	369	696	421	735	473	801	525	817	577	831	629	845
266	668	318	676	370	697	422	737	474	803	526	817	578	831	630	845
267	668	319	677	371	698	423	738	475	804	527	818	579	832	631	845
268	668	320	677	372	698	424	739	476	804	528	818	580	832	632	846
269	668	321	677	373	699	425	740	477	804	529	818	581	832	633	846
270	668	322	677	374	700	426	741	478	805	530	819	582	832	634	846
271	668	323	677	375	700	427	742	479	805	531	819	583	833	635	846
272	668	324	678	376	701	428	743	480	805	532	819	584	833	636	847
273	668	325	678	377	701	429	744	481	806	533	819	585	833	637	847
274	668	326	678	378	702	430	745	482	806	534	820	586	833	638	847
275	668	327	678	379	702	431	746	483	806	535	820	587	834	639	847
276	669	328	678	380	703	432	747	484	806	536	820	588	834	640	848
277	669	329	679	381	704	433	748	485	807	537	820	589	834	641	848
278	669	330	679	382	704	434	750	486	807	538	821	590	834	642	848
279	669	331	679	383	705	435	751	487	807	539	821	591	835	643	849
280	669	332	679	384	705	436	752	488	807	540	821	592	835	644	849
281	669	333	680	385	706	437	753	489	808	541	821	593	835	645	849
282	669	334	680	386	706	438	754	490	808	542	822	594	836	646	849
283	669	335	680	387	707	439	755	491	808	543	822	595	836	647	850
284	669	336	681	388	707	440	757	492	808	544	822	596	836	648	850
285	669	337	681	389	708	441	758	493	809	545	823	597	836	649	850
286	669	338	682	390	709	442	759	494	809	546	823	598	837	650	850
287	669	339	683	391	710	443	760	495	809	547	823	599	837		
288	669	340	683	392	710	444	762	496	810	548	823	600	837		
289	669	341	684	393	711	445	763	497	810	549	824	601	837		
290	669	342	684	394	711	446	764	498	810	550	824	602	838		
291	670	343	684	395	712	447	766	499	810	551	824	603	838		

Table 2.17

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 3.1)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	673	344	691	396	721	448	775	500	833	552	839	604	845
241	650	293	674	345	691	397	722	449	777	501	833	553	839	605	845
242	651	294	674	346	692	398	723	450	778	502	833	554	839	606	845
243	651	295	674	347	692	399	724	451	779	503	833	555	839	607	845
244	652	296	675	348	692	400	725	452	780	504	833	556	839	608	846
245	652	297	675	349	693	401	725	453	782	505	834	557	840	609	846
246	653	298	675	350	693	402	726	454	783	506	834	558	840	610	846
247	654	299	675	351	694	403	727	455	784	507	834	559	840	611	846
248	654	300	676	352	694	404	728	456	785	508	834	560	840	612	846
249	655	301	676	353	695	405	729	457	787	509	834	561	840	613	846
250	655	302	676	354	695	406	730	458	788	510	834	562	840	614	846
251	656	303	677	355	696	407	731	459	789	511	834	563	840	615	846
252	656	304	677	356	696	408	732	460	790	512	834	564	840	616	846
253	657	305	677	357	697	409	733	461	791	513	834	565	841	617	847
254	657	306	678	358	697	410	734	462	793	514	835	566	841	618	847
255	658	307	678	359	698	411	735	463	794	515	835	567	841	619	847
256	658	308	678	360	698	412	736	464	795	516	835	568	841	620	847
257	659	309	679	361	699	413	737	465	796	517	835	569	841	621	847
258	660	310	679	362	699	414	738	466	797	518	835	570	841	622	847
259	660	311	679	363	700	415	739	467	799	519	835	571	841	623	847
260	661	312	680	364	700	416	740	468	800	520	835	572	841	624	847
261	661	313	680	365	701	417	741	469	801	521	835	573	841	625	848
262	662	314	680	366	701	418	742	470	802	522	836	574	842	626	848
263	662	315	681	367	702	419	743	471	803	523	836	575	842	627	848
264	663	316	681	368	702	420	744	472	804	524	836	576	842	628	848
265	663	317	681	369	703	421	745	473	805	525	836	577	842	629	848
266	664	318	682	370	704	422	746	474	807	526	836	578	842	630	848
267	664	319	682	371	704	423	747	475	808	527	836	579	842	631	848
268	665	320	682	372	705	424	748	476	809	528	836	580	842	632	848
269	665	321	683	373	705	425	749	477	810	529	836	581	842	633	848
270	666	322	683	374	706	426	750	478	811	530	836	582	843	634	849
271	666	323	683	375	706	427	751	479	812	531	837	583	843	635	849
272	667	324	684	376	707	428	752	480	813	532	837	584	843	636	849
273	667	325	684	377	708	429	753	481	814	533	837	585	843	637	849
274	667	326	684	378	708	430	754	482	815	534	837	586	843	638	849
275	668	327	685	379	709	431	755	483	816	535	837	587	843	639	849
276	668	328	685	380	710	432	756	484	817	536	837	588	843	640	849
277	668	329	685	381	710	433	757	485	818	537	837	589	843	641	849
278	669	330	686	382	711	434	759	486	819	538	837	590	843	642	850
279	669	331	686	383	711	435	760	487	820	539	837	591	844	643	850
280	669	332	686	384	712	436	761	488	821	540	838	592	844	644	850
281	670	333	687	385	713	437	762	489	822	541	838	593	844	645	850
282	670	334	687	386	714	438	763	490	823	542	838	594	844	646	850
283	670	335	687	387	714	439	764	491	824	543	838	595	844	647	850
284	670	336	688	388	715	440	766	492	825	544	838	596	844	648	850
285	671	337	688	389	716	441	767	493	826	545	838	597	844	649	850
286	671	338	688	390	716	442	768	494	827	546	838	598	844	650	850
287	672	339	689	391	717	443	769	495	828	547	838	599	844		
288	672	340	689	392	718	444	770	496	829	548	839	600	845		
289	672	341	690	393	719	445	772	497	830	549	839	601	845		
290	673	342	690	394	720	446	773	498	831	550	839	602	845		
291	673	343	690	395	720	447	774	499	832	551	839	603	845		

Table 2.18

Con*cordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 3.2)*

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	672	344	690	396	721	448	775	500	832	552	839	604	845
241	650	293	673	345	690	397	721	449	776	501	832	553	839	605	845
242	651	294	673	346	691	398	722	450	778	502	832	554	839	606	845
243	651	295	673	347	691	399	723	451	779	503	833	555	839	607	845
244	652	296	674	348	692	400	724	452	780	504	833	556	839	608	845
245	652	297	674	349	692	401	725	453	781	505	833	557	839	609	845
246	653	298	674	350	693	402	726	454	783	506	833	558	839	610	846
247	653	299	675	351	693	403	727	455	784	507	833	559	839	611	846
248	654	300	675	352	693	404	728	456	785	508	833	560	840	612	846
249	654	301	675	353	694	405	729	457	786	509	833	561	840	613	846
250	655	302	676	354	694	406	730	458	788	510	833	562	840	614	846
251	655	303	676	355	695	407	731	459	789	511	834	563	840	615	846
252	656	304	676	356	695	408	732	460	790	512	834	564	840	616	846
253	656	305	677	357	696	409	732	461	791	513	834	565	840	617	846
254	657	306	677	358	697	410	733	462	793	514	834	566	840	618	847
255	657	307	677	359	697	411	734	463	794	515	834	567	840	619	847
256	658	308	678	360	698	412	735	464	795	516	834	568	840	620	847
257	658	309	678	361	698	413	736	465	796	517	834	569	841	621	847
258	659	310	678	362	699	414	737	466	797	518	834	570	841	622	847
259	659	311	679	363	699	415	739	467	799	519	835	571	841	623	847
260	660	312	679	364	700	416	740	468	800	520	835	572	841	624	847
261	660	313	679	365	700	417	741	469	801	521	835	573	841	625	847
262	661	314	680	366	701	418	742	470	802	522	835	574	841	626	848
263	661	315	680	367	701	419	743	471	803	523	835	575	841	627	848
264	662	316	680	368	702	420	744	472	805	524	835	576	841	628	848
265	662	317	681	369	703	421	745	473	806	525	835	577	842	629	848
266	663	318	681	370	703	422	746	474	807	526	835	578	842	630	848
267	663	319	681	371	704	423	747	475	808	527	836	579	842	631	848
268	664	320	682	372	704	424	748	476	809	528	836	580	842	632	848
269	664	321	682	373	705	425	749	477	810	529	836	581	842	633	848
270	665	322	682	374	705	426	750	478	811	530	836	582	842	634	848
271	665	323	683	375	706	427	751	479	812	531	836	583	842	635	849
272	665	324	683	376	707	428	752	480	813	532	836	584	842	636	849
273	666	325	683	377	707	429	753	481	815	533	836	585	843	637	849
274	667	326	684	378	708	430	754	482	816	534	836	586	843	638	849
275	667	327	684	379	708	431	755	483	817	535	836	587	843	639	849
276	667	328	684	380	709	432	757	484	818	536	837	588	843	640	849
277	667	329	685	381	710	433	758	485	819	537	837	589	843	641	849
278	668	330	685	382	710	434	759	486	820	538	837	590	843	642	849
279	668	331	685	383	711	435	760	487	821	539	837	591	843	643	850
280	668	332	686	384	712	436	761	488	822	540	837	592	843	644	850
281	669	333	686	385	712	437	762	489	823	541	837	593	844	645	850
282	669	334	686	386	713	438	763	490	824	542	837	594	844	646	850
283	669	335	687	387	714	439	764	491	825	543	837	595	844	647	850
284	669	336	687	388	714	440	766	492	826	544	838	596	844	648	850
285	670	337	687	389	715	441	767	493	827	545	838	597	844	649	850
286	670	338	688	390	716	442	768	494	828	546	838	598	844	650	850
287	671	339	688	391	717	443	769	495	829	547	838	599	844		
288	671	340	688	392	717	444	770	496	831	548	838	600	844		
289	671	341	689	393	718	445	771	497	831	549	838	601	844		
290	672	342	689	394	719	446	773	498	832	550	838	602	845		
291	672	343	689	395	720	447	774	499	832	551	838	603	845		

Table 2.19

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 3.3)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	673	344	690	396	720	448	775	500	834	552	839	604	845
241	650	293	673	345	690	397	721	449	776	501	834	553	840	605	845
242	651	294	673	346	690	398	722	450	778	502	834	554	840	606	846
243	651	295	674	347	691	399	723	451	779	503	834	555	840	607	846
244	652	296	674	348	691	400	724	452	780	504	834	556	840	608	846
245	652	297	674	349	692	401	724	453	781	505	834	557	840	609	846
246	653	298	674	350	692	402	725	454	783	506	834	558	840	610	846
247	653	299	675	351	693	403	726	455	784	507	834	559	840	611	846
248	654	300	675	352	693	404	727	456	785	508	835	560	840	612	846
249	654	301	675	353	694	405	728	457	787	509	835	561	840	613	846
250	655	302	676	354	694	406	729	458	788	510	835	562	841	614	846
251	655	303	676	355	695	407	730	459	789	511	835	563	841	615	847
252	656	304	676	356	695	408	731	460	790	512	835	564	841	616	847
253	656	305	677	357	696	409	732	461	792	513	835	565	841	617	847
254	657	306	677	358	696	410	733	462	793	514	835	566	841	618	847
255	657	307	677	359	697	411	734	463	794	515	835	567	841	619	847
256	658	308	677	360	697	412	735	464	795	516	835	568	841	620	847
257	658	309	678	361	698	413	736	465	796	517	836	569	841	621	847
258	659	310	678	362	698	414	737	466	798	518	836	570	841	622	847
259	659	311	678	363	699	415	738	467	799	519	836	571	842	623	847
260	660	312	679	364	699	416	739	468	800	520	836	572	842	624	848
261	660	313	679	365	700	417	740	469	801	521	836	573	842	625	848
262	661	314	679	366	700	418	741	470	803	522	836	574	842	626	848
263	661	315	680	367	701	419	742	471	804	523	836	575	842	627	848
264	662	316	680	368	702	420	743	472	805	524	836	576	842	628	848
265	662	317	680	369	702	421	744	473	806	525	836	577	842	629	848
266	663	318	681	370	703	422	745	474	807	526	837	578	842	630	848
267	664	319	681	371	703	423	746	475	808	527	837	579	842	631	848
268	664	320	681	372	704	424	747	476	810	528	837	580	843	632	848
269	665	321	682	373	704	425	748	477	811	529	837	581	843	633	849
270	665	322	682	374	705	426	749	478	812	530	837	582	843	634	849
271	666	323	682	375	706	427	750	479	813	531	837	583	843	635	849
272	666	324	683	376	706	428	751	480	814	532	837	584	843	636	849
273	666	325	683	377	707	429	752	481	815	533	837	585	843	637	849
274	666	326	683	378	707	430	754	482	816	534	837	586	843	638	849
275	667	327	684	379	708	431	755	483	817	535	838	587	843	639	849
276	667	328	684	380	709	432	756	484	819	536	838	588	843	640	849
277	668	329	685	381	709	433	757	485	820	537	838	589	844	641	849
278	668	330	685	382	710	434	758	486	821	538	838	590	844	642	850
279	668	331	685	383	711	435	759	487	822	539	838	591	844	643	850
280	669	332	686	384	711	436	760	488	823	540	838	592	844	644	850
281	669	333	686	385	712	437	761	489	824	541	838	593	844	645	850
282	669	334	686	386	713	438	763	490	825	542	838	594	844	646	850
283	669	335	686	387	713	439	764	491	826	543	838	595	844	647	850
284	670	336	687	388	714	440	765	492	827	544	839	596	844	648	850
285	670	337	687	389	715	441	766	493	828	545	839	597	844	649	850
286	670	338	687	390	715	442	767	494	829	546	839	598	845	650	850
287	671	339	688	391	716	443	769	495	830	547	839	599	845		
288	671	340	688	392	717	444	770	496	831	548	839	600	845		
289	672	341	688	393	718	445	771	497	832	549	839	601	845		
290	672	342	689	394	718	446	773	498	832	550	839	602	845		
291	672	343	689	395	719	447	774	499	833	551	839	603	845		

Table 2.20

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Condition 3.4)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	650	292	674	344	691	396	720	448	775	500	833	552	839	604	845
241	650	293	675	345	691	397	721	449	776	501	833	553	839	605	845
242	651	294	675	346	692	398	722	450	777	502	833	554	839	606	845
243	651	295	675	347	692	399	723	451	779	503	833	555	839	607	845
244	652	296	676	348	693	400	723	452	780	504	833	556	839	608	846
245	653	297	676	349	693	401	724	453	781	505	833	557	840	609	846
246	653	298	676	350	693	402	725	454	783	506	834	558	840	610	846
247	654	299	677	351	694	403	726	455	784	507	834	559	840	611	846
248	654	300	677	352	694	404	727	456	785	508	834	560	840	612	846
249	655	301	677	353	695	405	728	457	786	509	834	561	840	613	846
250	655	302	677	354	695	406	729	458	787	510	834	562	840	614	846
251	656	303	678	355	696	407	730	459	789	511	834	563	840	615	846
252	656	304	678	356	696	408	731	460	790	512	834	564	840	616	846
253	657	305	678	357	697	409	732	461	791	513	834	565	841	617	847
254	658	306	679	358	697	410	733	462	792	514	835	566	841	618	847
255	658	307	679	359	697	411	734	463	794	515	835	567	841	619	847
256	659	308	679	360	698	412	735	464	795	516	835	568	841	620	847
257	659	309	680	361	698	413	736	465	796	517	835	569	841	621	847
258	660	310	680	362	699	414	737	466	797	518	835	570	841	622	847
259	660	311	680	363	699	415	738	467	798	519	835	571	841	623	847
260	661	312	681	364	700	416	739	468	800	520	835	572	841	624	847
261	661	313	681	365	700	417	740	469	801	521	835	573	841	625	848
262	662	314	681	366	701	418	741	470	802	522	835	574	842	626	848
263	663	315	681	367	701	419	742	471	803	523	836	575	842	627	848
264	663	316	682	368	702	420	743	472	804	524	836	576	842	628	848
265	664	317	682	369	703	421	744	473	806	525	836	577	842	629	848
266	664	318	682	370	703	422	745	474	807	526	836	578	842	630	848
267	665	319	683	371	704	423	746	475	808	527	836	579	842	631	848
268	665	320	683	372	704	424	747	476	809	528	836	580	842	632	848
269	666	321	683	373	705	425	748	477	810	529	836	581	842	633	848
270	666	322	684	374	705	426	749	478	812	530	836	582	842	634	849
271	667	323	684	375	706	427	750	479	813	531	837	583	843	635	849
272	667	324	684	376	706	428	751	480	814	532	837	584	843	636	849
273	667	325	685	377	707	429	753	481	815	533	837	585	843	637	849
274	668	326	685	378	708	430	754	482	816	534	837	586	843	638	849
275	668	327	685	379	708	431	755	483	817	535	837	587	843	639	849
276	669	328	685	380	709	432	756	484	818	536	837	588	843	640	849
277	669	329	686	381	709	433	757	485	820	537	837	589	843	641	849
278	669	330	686	382	710	434	758	486	821	538	837	590	843	642	850
279	670	331	686	383	711	435	759	487	822	539	837	591	844	643	850
280	670	332	687	384	711	436	760	488	823	540	838	592	844	644	850
281	670	333	687	385	712	437	761	489	824	541	838	593	844	645	850
282	671	334	687	386	713	438	763	490	825	542	838	594	844	646	850
283	671	335	688	387	713	439	764	491	826	543	838	595	844	647	850
284	671	336	688	388	714	440	765	492	827	544	838	596	844	648	850
285	672	337	688	389	715	441	766	493	828	545	838	597	844	649	850
286	672	338	689	390	715	442	767	494	829	546	838	598	844	650	850
287	673	339	689	391	716	443	769	495	830	547	838	599	844		
288	673	340	689	392	717	444	770	496	831	548	839	600	845		
289	673	341	690	393	718	445	771	497	832	549	839	601	845		
290	674	342	690	394	718	446	772	498	833	550	839	602	845		
291	674	343	691	395	719	447	774	499	833	551	839	603	845		

Table 2.21

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Combined Condition 1)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	654	292	671	344	686	396	715	448	773	500	824	552	833	604	842
241	666	293	671	345	686	397	716	449	774	501	824	553	834	605	843
242	668	294	671	346	687	398	717	450	775	502	825	554	834	606	843
243	668	295	671	347	687	399	718	451	777	503	825	555	834	607	843
244	668	296	672	348	687	400	719	452	778	504	825	556	834	608	843
245	668	297	672	349	687	401	719	453	779	505	825	557	834	609	843
246	668	298	672	350	687	402	720	454	781	506	825	558	834	610	843
247	668	299	672	351	688	403	721	455	782	507	826	559	835	611	844
248	668	300	673	352	688	404	722	456	783	508	826	560	835	612	844
249	668	301	673	353	688	405	723	457	785	509	826	561	835	613	844
250	668	302	674	354	689	406	724	458	786	510	826	562	835	614	844
251	668	303	674	355	690	407	725	459	788	511	826	563	835	615	844
252	668	304	674	356	691	408	726	460	789	512	826	564	835	616	844
253	668	305	674	357	692	409	727	461	790	513	827	565	836	617	845
254	668	306	675	358	693	410	728	462	791	514	827	566	836	618	845
255	668	307	675	359	693	411	729	463	793	515	827	567	836	619	845
256	668	308	675	360	693	412	730	464	794	516	827	568	836	620	845
257	668	309	675	361	694	413	731	465	795	517	827	569	836	621	845
258	668	310	675	362	694	414	732	466	796	518	827	570	836	622	846
259	669	311	676	363	695	415	733	467	797	519	828	571	837	623	846
260	669	312	676	364	695	416	734	468	799	520	828	572	837	624	846
261	669	313	677	365	695	417	735	469	800	521	828	573	837	625	846
262	669	314	677	366	696	418	736	470	801	522	828	574	837	626	846
263	669	315	677	367	697	419	737	471	803	523	828	575	837	627	846
264	669	316	677	368	698	420	739	472	804	524	828	576	838	628	847
265	669	317	678	369	699	421	740	473	805	525	829	577	838	629	847
266	669	318	678	370	699	422	741	474	806	526	829	578	838	630	847
267	669	319	678	371	699	423	742	475	807	527	829	579	838	631	847
268	669	320	678	372	700	424	743	476	808	528	829	580	838	632	847
269	669	321	678	373	700	425	744	477	809	529	829	581	838	633	847
270	669	322	678	374	701	426	745	478	810	530	830	582	839	634	848
271	669	323	679	375	701	427	746	479	811	531	830	583	839	635	848
272	669	324	679	376	702	428	747	480	812	532	830	584	839	636	848
273	669	325	679	377	703	429	749	481	813	533	830	585	839	637	848
274	669	326	679	378	704	430	750	482	814	534	830	586	839	638	848
275	669	327	679	379	704	431	751	483	815	535	830	587	839	639	848
276	669	328	680	380	705	432	752	484	816	536	831	588	840	640	849
277	669	329	680	381	705	433	753	485	817	537	831	589	840	641	849
278	669	330	680	382	705	434	754	486	818	538	831	590	840	642	849
279	669	331	681	383	706	435	755	487	819	539	831	591	840	643	849
280	669	332	681	384	706	436	757	488	820	540	831	592	840	644	849
281	670	333	682	385	707	437	758	489	821	541	831	593	840	645	850
282	670	334	683	386	708	438	760	490	822	542	832	594	841	646	850
283	670	335	684	387	709	439	761	491	823	543	832	595	841	647	850
284	670	336	684	388	710	440	762	492	823	544	832	596	841	648	850
285	670	337	684	389	710	441	763	493	823	545	832	597	841	649	850
286	670	338	685	390	711	442	764	494	823	546	832	598	841	650	850
287	670	339	685	391	711	443	766	495	823	547	832	599	842		
288	670	340	685	392	712	444	767	496	824	548	833	600	842		
289	670	341	685	393	713	445	769	497	824	549	833	601	842		
290	670	342	686	394	714	446	770	498	824	550	833	602	842		
291	671	343	686	395	715	447	771	499	824	551	833	603	842		

Table 2.22

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Combined Condition 2)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	661	292	676	344	688	396	719	448	777	500	828	552	836	604	843
241	668	293	676	345	688	397	720	449	778	501	828	553	836	605	844
242	668	294	676	346	688	398	721	450	779	502	828	554	836	606	844
243	669	295	676	347	689	399	722	451	781	503	828	555	836	607	844
244	669	296	677	348	690	400	723	452	782	504	828	556	836	608	844
245	669	297	677	349	690	401	724	453	783	505	828	557	836	609	844
246	669	298	677	350	691	402	725	454	784	506	829	558	836	610	844
247	669	299	678	351	692	403	726	455	786	507	829	559	837	611	844
248	669	300	678	352	692	404	727	456	787	508	829	560	837	612	845
249	669	301	678	353	693	405	728	457	788	509	829	561	837	613	845
250	670	302	678	354	693	406	729	458	790	510	829	562	837	614	845
251	670	303	678	355	693	407	730	459	791	511	829	563	837	615	845
252	670	304	678	356	694	408	731	460	792	512	829	564	837	616	845
253	670	305	679	357	694	409	732	461	793	513	830	565	837	617	845
254	670	306	679	358	695	410	733	462	794	514	830	566	838	618	846
255	671	307	679	359	695	411	734	463	796	515	830	567	838	619	846
256	671	308	679	360	696	412	735	464	797	516	830	568	838	620	846
257	671	309	679	361	696	413	736	465	798	517	830	569	838	621	846
258	671	310	679	362	697	414	737	466	800	518	830	570	838	622	846
259	671	311	679	363	698	415	738	467	801	519	830	571	838	623	846
260	671	312	679	364	698	416	739	468	802	520	831	572	839	624	846
261	671	313	680	365	699	417	740	469	804	521	831	573	839	625	847
262	671	314	680	366	700	418	741	470	805	522	831	574	839	626	847
263	671	315	680	367	700	419	742	471	806	523	831	575	839	627	847
264	671	316	680	368	701	420	743	472	807	524	831	576	839	628	847
265	672	317	680	369	701	421	744	473	808	525	831	577	839	629	847
266	672	318	680	370	702	422	745	474	809	526	832	578	839	630	847
267	672	319	681	371	702	423	747	475	810	527	832	579	840	631	848
268	672	320	681	372	703	424	748	476	811	528	832	580	840	632	848
269	672	321	681	373	704	425	749	477	812	529	832	581	840	633	848
270	672	322	682	374	704	426	750	478	813	530	832	582	840	634	848
271	672	323	682	375	705	427	751	479	815	531	832	583	840	635	848
272	672	324	683	376	705	428	752	480	816	532	832	584	840	636	848
273	672	325	683	377	706	429	753	481	817	533	833	585	841	637	848
274	673	326	684	378	706	430	754	482	818	534	833	586	841	638	849
275	673	327	684	379	707	431	755	483	819	535	833	587	841	639	849
276	673	328	684	380	708	432	757	484	820	536	833	588	841	640	849
277	673	329	684	381	708	433	758	485	822	537	833	589	841	641	849
278	673	330	684	382	709	434	759	486	823	538	833	590	841	642	849
279	673	331	685	383	710	435	760	487	824	539	834	591	841	643	849
280	674	332	685	384	710	436	761	488	826	540	834	592	842	644	850
281	674	333	685	385	711	437	763	489	826	541	834	593	842	645	850
282	674	334	686	386	712	438	764	490	826	542	834	594	842	646	850
283	675	335	686	387	712	439	765	491	826	543	834	595	842	647	850
284	675	336	686	388	713	440	766	492	826	544	834	596	842	648	850
285	675	337	686	389	714	441	768	493	827	545	834	597	842	649	850
286	675	338	686	390	715	442	769	494	827	546	835	598	843	650	850
287	676	339	687	391	715	443	770	495	827	547	835	599	843		
288	676	340	687	392	716	444	772	496	827	548	835	600	843		
289	676	341	687	393	717	445	773	497	827	549	835	601	843		
290	676	342	687	394	718	446	774	498	827	550	835	602	843		
291	676	343	687	395	718	447	775	499	827	551	835	603	843		

Table 2.23

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Combined Condition 3)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	653	292	670	344	686	396	715	448	772	500	825	552	834	604	843
241	667	293	670	345	686	397	715	449	774	501	825	553	834	605	843
242	668	294	671	346	686	398	716	450	775	502	826	554	834	606	843
243	668	295	671	347	687	399	717	451	776	503	826	555	834	607	843
244	668	296	671	348	687	400	718	452	778	504	826	556	835	608	843
245	668	297	671	349	687	401	719	453	779	505	826	557	835	609	844
246	668	298	671	350	687	402	719	454	781	506	826	558	835	610	844
247	668	299	671	351	687	403	720	455	782	507	826	559	835	611	844
248	668	300	672	352	687	404	721	456	783	508	827	560	835	612	844
249	668	301	672	353	688	405	722	457	785	509	827	561	835	613	844
250	668	302	672	354	688	406	723	458	786	510	827	562	836	614	844
251	668	303	673	355	689	407	724	459	788	511	827	563	836	615	845
252	668	304	673	356	690	408	725	460	789	512	827	564	836	616	845
253	668	305	674	357	692	409	726	461	790	513	827	565	836	617	845
254	668	306	674	358	693	410	727	462	791	514	828	566	836	618	845
255	668	307	674	359	693	411	728	463	792	515	828	567	836	619	845
256	668	308	674	360	693	412	729	464	794	516	828	568	837	620	845
257	668	309	675	361	694	413	731	465	795	517	828	569	837	621	846
258	668	310	675	362	694	414	732	466	796	518	828	570	837	622	846
259	668	311	675	363	694	415	733	467	797	519	828	571	837	623	846
260	668	312	675	364	695	416	734	468	799	520	829	572	837	624	846
261	668	313	676	365	695	417	735	469	800	521	829	573	837	625	846
262	668	314	676	366	695	418	736	470	801	522	829	574	838	626	846
263	668	315	677	367	696	419	737	471	803	523	829	575	838	627	847
264	669	316	677	368	697	420	738	472	804	524	829	576	838	628	847
265	669	317	677	369	698	421	739	473	805	525	829	577	838	629	847
266	669	318	677	370	699	422	741	474	807	526	830	578	838	630	847
267	669	319	678	371	699	423	741	475	808	527	830	579	838	631	847
268	669	320	678	372	699	424	743	476	809	528	830	580	839	632	847
269	669	321	678	373	700	425	743	477	810	529	830	581	839	633	848
270	669	322	678	374	700	426	745	478	811	530	830	582	839	634	848
271	669	323	678	375	701	427	746	479	812	531	830	583	839	635	848
272	669	324	679	376	701	428	747	480	813	532	831	584	839	636	848
273	669	325	679	377	702	429	748	481	814	533	831	585	839	637	848
274	669	326	679	378	703	430	749	482	815	534	831	586	840	638	848
275	669	327	679	379	704	431	750	483	816	535	831	587	840	639	849
276	669	328	679	380	705	432	751	484	817	536	831	588	840	640	849
277	669	329	679	381	705	433	752	485	819	537	831	589	840	641	849
278	669	330	680	382	705	434	753	486	820	538	832	590	840	642	849
279	669	331	680	383	706	435	755	487	821	539	832	591	840	643	849
280	669	332	680	384	706	436	756	488	822	540	832	592	841	644	849
281	669	333	681	385	706	437	758	489	823	541	832	593	841	645	850
282	669	334	681	386	707	438	759	490	824	542	832	594	841	646	850
283	669	335	682	387	709	439	760	491	824	543	832	595	841	647	850
284	669	336	683	388	709	440	761	492	824	544	833	596	841	648	850
285	669	337	684	389	710	441	763	493	824	545	833	597	842	649	850
286	670	338	684	390	710	442	764	494	824	546	833	598	842	650	850
287	670	339	685	391	711	443	765	495	824	547	833	599	842		
288	670	340	685	392	711	444	767	496	825	548	833	600	842		
289	670	341	685	393	712	445	768	497	825	549	833	601	842		
290	670	342	685	394	714	446	770	498	825	550	834	602	842		
291	670	343	686	395	714	447	771	499	825	551	834	603	843		

Table 2.24

Concordance Table for HSA Algebra Test and PARCC Algebra I Test (Combined Condition 4)

HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC	HSA	PARCC
240	654	292	675	344	688	396	719	448	776	500	827	552	835	604	843
241	667	293	675	345	688	397	719	449	778	501	828	553	836	605	844
242	669	294	675	346	688	398	720	450	779	502	828	554	836	606	844
243	668	295	675	347	689	399	721	451	781	503	828	555	836	607	844
244	669	296	675	348	689	400	722	452	782	504	828	556	836	608	844
245	669	297	676	349	690	401	723	453	783	505	828	557	836	609	844
246	669	298	676	350	691	402	724	454	784	506	828	558	836	610	844
247	669	299	676	351	692	403	725	455	786	507	829	559	837	611	844
248	669	300	677	352	692	404	726	456	787	508	829	560	837	612	845
249	669	301	677	353	693	405	727	457	788	509	829	561	837	613	845
250	669	302	677	354	693	406	728	458	790	510	829	562	837	614	845
251	669	303	677	355	694	407	729	459	791	511	829	563	837	615	845
252	669	304	677	356	694	408	730	460	792	512	829	564	837	616	845
253	669	305	678	357	694	409	731	461	793	513	829	565	837	617	845
254	669	306	678	358	695	410	732	462	795	514	830	566	838	618	846
255	670	307	678	359	695	411	733	463	796	515	830	567	838	619	846
256	670	308	678	360	695	412	734	464	797	516	830	568	838	620	846
257	670	309	678	361	696	413	735	465	798	517	830	569	838	621	846
258	670	310	678	362	697	414	736	466	800	518	830	570	838	622	846
259	670	311	679	363	698	415	738	467	801	519	830	571	838	623	846
260	670	312	679	364	699	416	739	468	802	520	831	572	838	624	846
261	670	313	679	365	699	417	740	469	804	521	831	573	839	625	847
262	670	314	679	366	699	418	741	470	805	522	831	574	839	626	847
263	670	315	679	367	700	419	742	471	806	523	831	575	839	627	847
264	670	316	679	368	700	420	743	472	807	524	831	576	839	628	847
265	670	317	680	369	701	421	744	473	808	525	831	577	839	629	847
266	670	318	680	370	701	422	745	474	809	526	831	578	839	630	847
267	670	319	680	371	702	423	746	475	810	527	832	579	840	631	848
268	670	320	680	372	703	424	747	476	812	528	832	580	840	632	848
269	670	321	680	373	704	425	748	477	813	529	832	581	840	633	848
270	671	322	681	374	704	426	749	478	815	530	832	582	840	634	848
271	671	323	681	375	705	427	751	479	816	531	832	583	840	635	848
272	671	324	682	376	705	428	752	480	817	532	832	584	840	636	848
273	671	325	682	377	705	429	753	481	818	533	833	585	840	637	848
274	671	326	683	378	706	430	753	482	819	534	833	586	841	638	849
275	672	327	684	379	706	431	755	483	820	535	833	587	841	639	849
276	672	328	684	380	707	432	756	484	822	536	833	588	841	640	849
277	672	329	684	381	708	433	757	485	823	537	833	589	841	641	849
278	672	330	684	382	709	434	758	486	824	538	833	590	841	642	849
279	672	331	685	383	710	435	760	487	825	539	833	591	841	643	849
280	672	332	685	384	710	436	761	488	826	540	834	592	842	644	850
281	672	333	685	385	711	437	762	489	826	541	834	593	842	645	850
282	672	334	685	386	711	438	763	490	826	542	834	594	842	646	850
283	672	335	686	387	712	439	765	491	826	543	834	595	842	647	850
284	673	336	686	388	713	440	766	492	826	544	834	596	842	648	850
285	673	337	686	389	714	441	767	493	826	545	834	597	842	649	850
286	673	338	686	390	714	442	769	494	827	546	835	598	842	650	850
287	673	339	687	391	715	443	770	495	827	547	835	599	843		
288	674	340	687	392	715	444	771	496	827	548	835	600	843		
289	675	341	687	393	716	445	773	497	827	549	835	601	843		
290	675	342	687	394	717	446	774	498	827	550	835	602	843		
291	675	343	687	395	718	447	775	499	827	551	835	603	843		

Impact

To evaluate the impact of the cut scores obtained using different methods to link HSA and PARCC tests, the percentage of passing for each cut score is summarized in Tables 2.25 and 2.26 for ELA10 and Algebra respectively. The red color indicates the cut scores obtained using PSAT as an external linking test while the green color indicates the cut scores obtained using the propensity score matching method. For Algebra I, the green indicates the mapped cut scores based on Design II using grade 9 student responses while the orange color indicates those based on Design III using grade 8 student responses. Further, the blue color indicates the cut scores using the combined matched samples from Design II and III using propensity score matching. Please note that Design II sample and the combined sample both lead to a mapped cut score of 735. The black color indicates the passing rates for other PARCC scores adjacent to the cut scores obtained in this study.

Table 2.25
Passing Rates for the PARCC ELA10 Test

Cut score	700	701	702	703	704	705	706	707	708	709	710	711	712
Passing rate	78.19%	77.69%	77.68%	76.81%	76.43%	75.56%	75.24%	74.79%	74.01%	73.99%	72.78%	72.76%	71.56%
Count	49,265	48,948	48,940	48,394	48,157	47,609	47,404	47,121	46,628	46,620	45,858	45,840	45,088
Cut score	713	714	**715**	**716**	**717**	718	719	720	721	722	723	724	725
Passing rate	71.49%	70.27%	**70.14%**	**68.98%**	**68.83%**	67.55%	67.47%	66.27%	66.24%	65.06%	65.01%	63.79%	63.68%
Count	45,045	44,274	**44,192**	**43,460**	**43,368**	42,558	42,511	41,755	41,733	40,994	40,959	40,190	40,120

Table 2.26
Passing Rates for the PARCC Algebra I Test

Cut score	700	701	702	703	704	705	706	707	708	709	710	711	712	713
Passing rate	85.01%	83.72%	82.59%	81.86%	81.86%	81.21%	78.89%	77.56%	76.84%	76.83%	76.19%	74.01%	72.74%	72.07%
Count	56,977	56,110	55,352	54,863	54,863	54,429	52,874	51,981	51,497	51,496	51,066	49,602	48,753	48,304
Cut score	714	715	**716**	717	718	719	720	721	722	723	724	725	**726**	**727**
Passing rate	72.07%	70.45%	**68.20%**	67.57%	67.57%	66.16%	64.29%	63.57%	62.73%	61.51%	60.66%	60.00%	**58.61%**	**57.41%**
Count	48,304	47,214	**45,708**	45,284	45,284	44,340	43,087	42,608	42,044	41,222	40,658	40,214	**39,283**	**38,476**
Cut score	728	**729**	**730**	731	732	733	**734**	**735**	**736**	737	738	739	740	741
Passing rate	57.41%	**55.43%**	**54.42%**	54.39%	52.54%	52.21%	**51.10%**	**50.05%**	**48.93%**	47.89%	47.46%	45.93%	45.42%	45.05%
Count	38,474	**37,152**	**36,471**	36,456	35,211	34,991	**34,248**	**33,542**	**32,795**	32,099	31,807	30,783	30,440	30,191

These passing rates are also compared with the HSA historical passing rates as shown in Tables 2.27 and 2.28 for English and Algebra respectively. Figures 1 and 2 present the trend of the passing rate for HSA tests across years. Figures 3 and 4 give the visual comparison between historical HSA passing rates from 2008 to 2014 and passing rates for PARCC cut scores found in this study and in the previous 2015 study. In general, students taking HSA in different months differed in their test scores for both English and Algebra. Within each year, a majority of the students took the May HSA tests. Students who took the 2016 PARCC would be expected to resemble the May test takers of HSA better than other months' test-takers. The passing rates for the May HSA

English tests ranged from 68.78 % to 76.74% while those for Algebra ranged from 67.70% to 75.23%. The yearly passing rates from 2008 to 2014 go from 64.32 % to 75.62% for English and from 65.51% to 73.77% for Algebra.

Overall, the PARCC ELA10 equivalent cut scores based on PSAT linking methods produced the passing rates falling within the range of the HSA historical yearly passing rates and passing rates for May administration. Compared with the propensity score matching method, the PSAT linking produced a slightly lower PARCC equivalent cut score which leads to slightly higher passing rate for ELA10.

Table 2.27

Passing Rates for the HSA English Test and PARCC ELA 10 Cutscores

Month	Year	Min	Max	Mean	SD	N	%pass	year %pass
Jan	2008	240	650	391.88	36.99	11125	44.41%	64.32%
Jan	2009	240	650	402.72	34.97	7492	60.76%	71.27%
Jan	2010	240	650	408.03	33.40	6883	68.63%	73.62%
Jan	2011	240	650	405.02	34.49	7497	67.77%	73.68%
Jan	2012	240	650	407.42	33.23	6765	68.38%	75.62%
Jan	2013	240	522	403.82	36.00	5568	68.12%	73.05%
Jan	2014	240	650	402.70	36.73	4911	67.28%	74.04%
April	2009	240	455	382.67	38.00	307	41.37%	71.27%
April	2010	240	650	387.94	43.51	129	41.09%	73.62%
April	2011	240	450	382.96	34.24	144	37.50%	73.68%
April	2012	240	448	378.82	37.04	101	34.65%	75.62%
April	2013	240	475	385.79	34.69	140	35.00%	73.05%
April	2014	240	447	376.51	46.04	122	37.70%	74.04%
May	2008	240	650	409.82	34.70	58173	68.78%	64.32%
May	2009	240	650	411.41	33.43	55007	73.35%	71.27%
May	2010	240	650	411.39	32.37	54679	74.58%	73.62%
May	2011	240	650	411.34	33.03	53671	74.75%	73.68%
May	2012	240	650	413.29	30.09	52767	76.74%	75.62%
May	2013	240	650	409.94	34.19	52480	73.68%	73.05%
May	2014	240	650	410.76	32.07	52961	74.96%	74.04%
July	2008	240	462	385.70	38.60	310	47.42%	64.32%
July	2009	240	469	391.81	40.94	160	55.00%	71.27%
July	2010	240	484	393.81	39.99	126	57.14%	73.62%
July	2011	240	463	388.22	44.73	103	58.25%	73.68%
July	2012	240	447	394.38	31.11	125	56.80%	75.62%
July	2013	240	449	389.37	40.40	104	49.04%	73.05%
July	2014	240	471	381.80	46.44	154	46.75%	74.04%
Oct	2008	240	538	392.54	30.94	1154	54.59%	64.32%
Oct	2009	240	468	392.63	34.52	700	58.14%	71.27%
Oct	2010	240	500	398.16	30.95	715	65.87%	73.62%
Oct	2011	240	482	399.78	33.35	567	68.08%	73.68%
Oct	2012	240	507	402.92	35.30	587	75.98%	75.62%

Oct	2013	240	510	395.25	36.60	717	62.20%	73.05%
Oct	2014	240	479	392.30	38.55	847	56.67%	74.04%

2015	704	76.07%
	705	75.30%
	706	74.67%
	707	73.96%
2016	715	70.14%
	716	68.98%
	717	68.83%

The PARCC Algebra I equivalent cut score based on PSAT linking produced the lowest cut score which leads to a passing rate that falls within the range of the historical yearly passing rates and passing rates for May administration. On the other hand, the PARCC cut scores obtained based on propensity score matching produced even higher cut scores yielding even lower passing rates when compared with both the May and yearly HSA passing rates for Algebra. Compared with the propensity score matching method, the PSAT linking produced a lower PARCC equivalent cut score which leads to a higher passing rate for Algebra.

Table 2.28

Passing Rates for the HSA Algebra Test and PARCC ALG I Cutscores

Month	Year	Min	Max	Mean	SD	N	%pass	year %pass
Jan.	2008	240	650	391.65	37.65	11210	26.39%	65.51%
Jan.	2009	240	538	400.24	40.63	6272	41.65%	67.03%
Jan	2010	240	540	401.42	41.02	5057	44.24%	66.98%
Jan	2011	240	650	408.50	46.16	3245	56.12%	72.88%
Jan	2012	240	522	401.74	47.18	3318	49.46%	73.77%
Jan	2013	240	650	410.06	42.49	2852	57.43%	71.59%
Jan	2014	240	502	402.30	48.21	2789	52.35%	66.88%
April	2009	240	460	376.12	45.84	195	17.95%	67.03%
April	2010	240	478	386.84	43.06	164	26.22%	66.98%
April	2011	240	488	394.48	44.13	88	34.09%	72.88%
April	2012	256	499	408.42	48.58	59	55.93%	73.77%
April	2013	240	509	415.43	40.58	79	53.16%	71.59%
April	2014	295	471	394.77	39.59	48	31.25%	66.88%
May	2008	240	650	428.63	37.25	69227	72.59%	65.51%
May	2009	240	650	427.26	41.93	73165	69.88%	67.03%
May	2010	240	650	426.13	40.48	64195	69.11%	66.98%
May	2011	240	650	431.90	39.55	57107	74.08%	72.88%
May	2012	240	650	428.90	39.98	58817	75.23%	73.77%
May	2013	240	650	428.38	38.93	62026	72.33%	71.59%
May	2014	240	650	421.99	43.32	55817	67.70%	66.88%
July	2008	240	500	401.25	50.38	321	48.91%	65.51%

July	2009	240	486	412.33	43.05	161	55.28%	67.03%
July	2010	240	501	407.16	50.64	114	56.14%	66.98%
July	2011	240	500	417.00	48.15	85	64.71%	72.88%
July	2012	240	489	415.85	50.72	96	63.54%	73.77%
July	2013	240	489	417.21	46.94	70	65.71%	71.59%
July	2014	240	469	391.84	51.64	80	42.50%	66.88%
Oct.	2008	240	516	396.61	41.56	1355	41.92%	65.51%
Oct	2009	240	650	401.75	47.04	698	47.99%	67.03%
Oct	2010	240	498	405.89	42.46	513	55.36%	66.98%
Oct	2011	240	506	413.09	47.31	388	65.21%	72.88%
Oct	2012	240	540	409.65	50.07	325	61.85%	73.77%
Oct	2013	240	524	398.66	57.04	359	55.99%	71.59%
Oct	2014	240	519	394.84	52.11	773	45.15%	66.88%

2015	720	65.06%
	721	63.58%
	722	62.08%
	724	60.34%
	725	58.37%
	727	56.35%
2016	716	68.20%
	726	58.61%
	727	57.41%
	729	55.43%
	730	54.42%
	734	51.10%
	735	50.05%
	736	48.93%

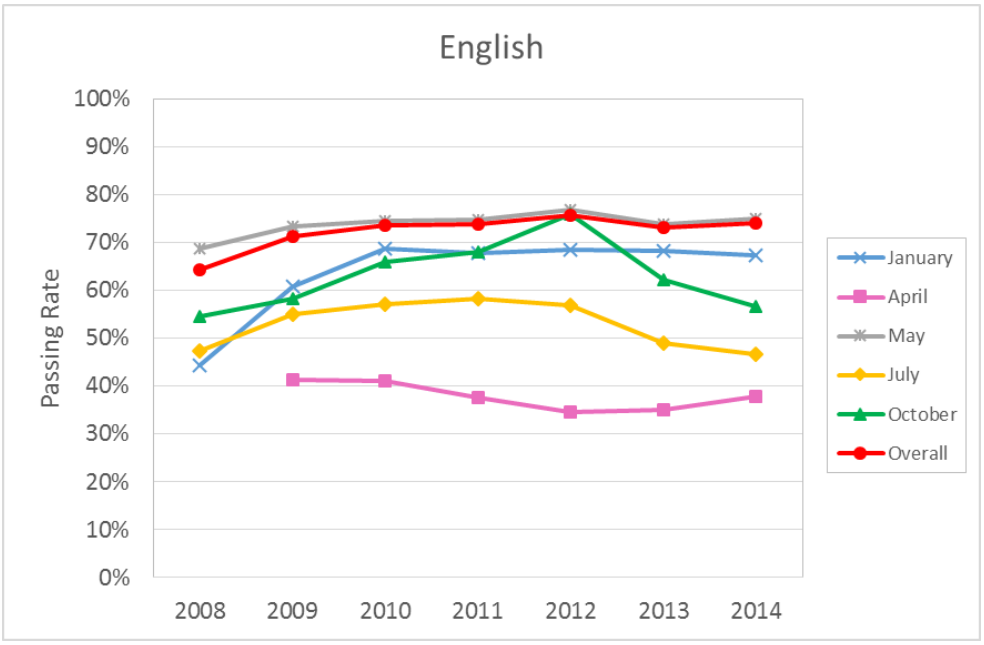

Figure 1. *Passing Rates for the HSA English Test*

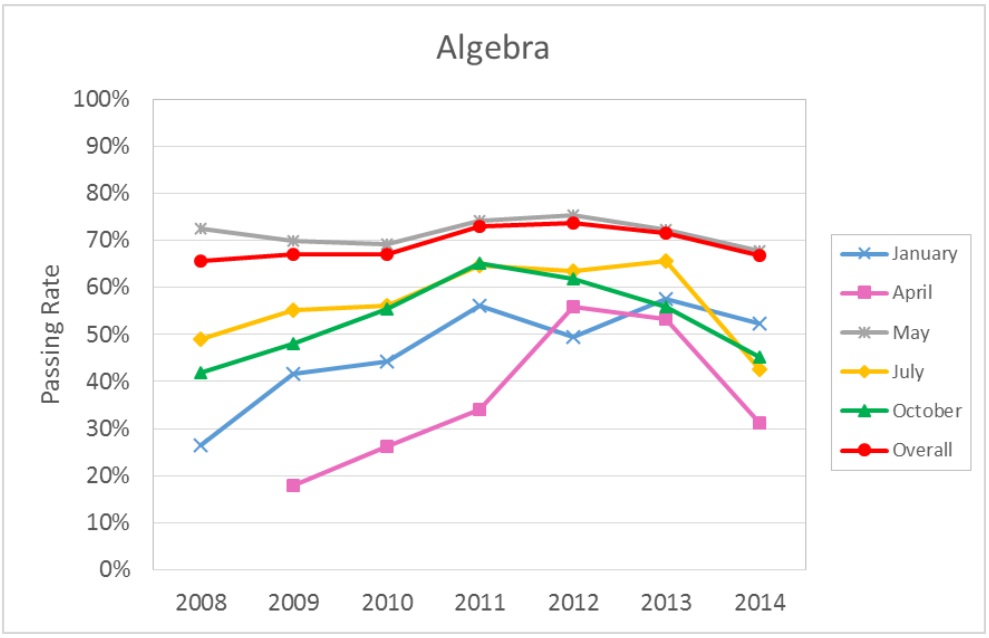

Figure 2. *Passing Rates for the HSA Algebra Test*

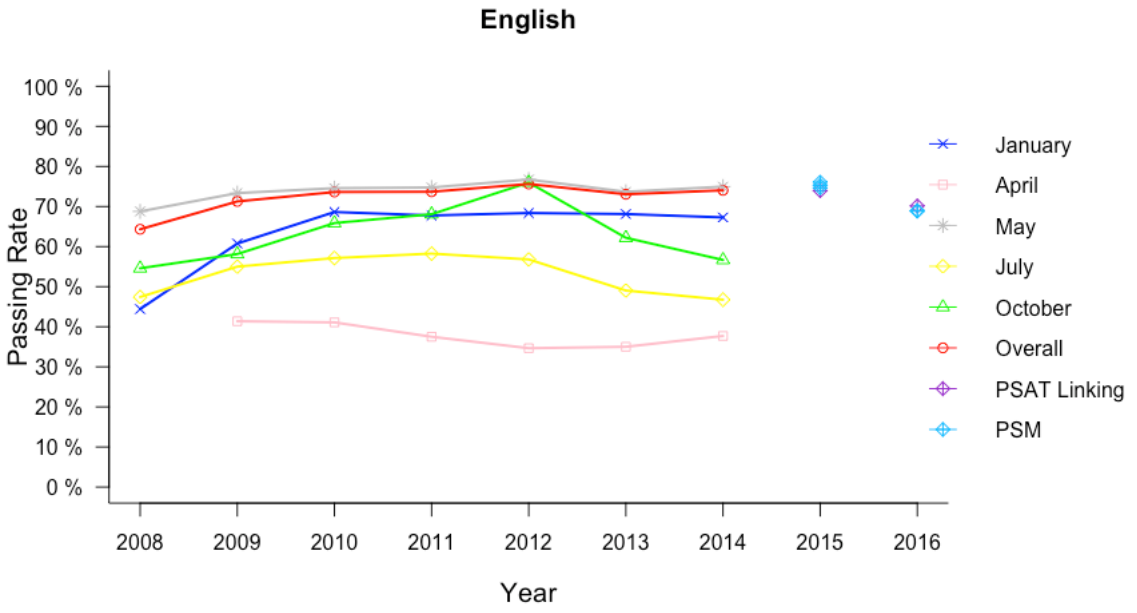

Figure 3. *Passing Rates for the HSA English Test and PARCC ELA 10 Cutscores*

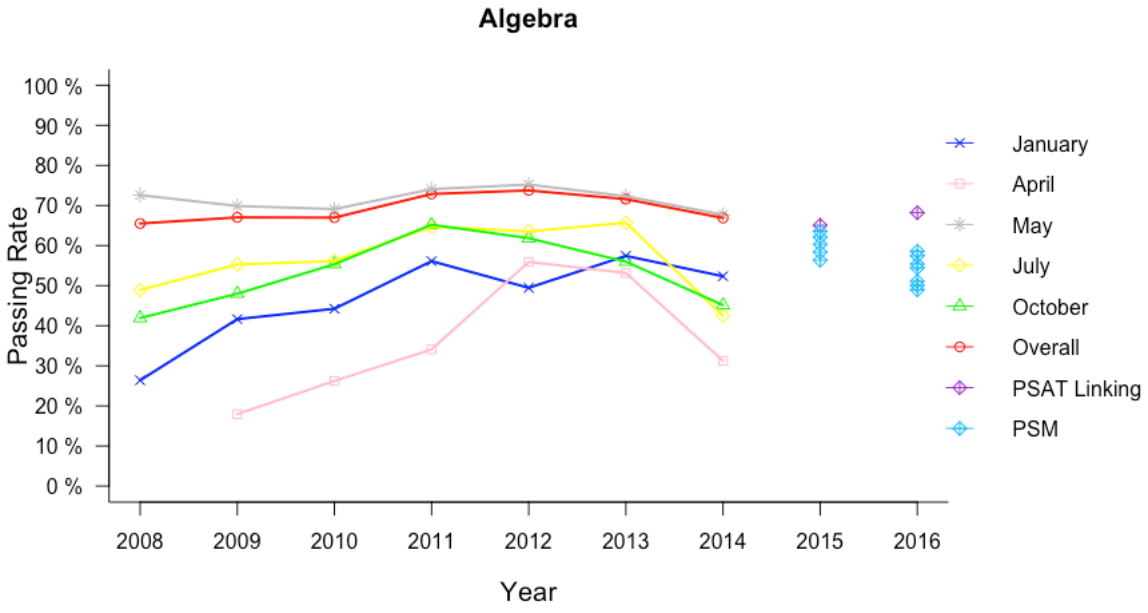

Figure 4. *Passing Rates for the HSA English Test and PARCC ALG I Cutscores*

To further investigate the relationship between the mapped PARCC equivalents of HSA cut scores and the PARCC cut scores, especially the cut score that divides performance level 2 from 3 (a PARCC score of 725 for both ELA10 and Algebra I), the conditional standard error of measurement (CSEM) for the mapped PARCC cut score is utilized to construct a 95% confidence interval and 1 standard deviation above and below the mapped cut scores using different methods. As multiple forms were constructed for the PARCC tests, the CSEM for the same PARCC score could be different for different forms. Thus, the mean, minimum, and maximum CSEM were used to construct the intervals respectively. The two intervals around the PARCC equivalent cut scores obtained using PSAT for linking are summarized in Tables 2.29. For ELA10, the 95% confidence interval around the mapped PARCC equivalent score of the HSA cut score using the mean, the minimum, and the maximum CSEM captured the PARCC cut score of 725 dividing level 2 and3. For Algebra I, all intervals contained the PARCC cut score of 725 as seen in Table 2.29. Similar patterns were found for most (with a few exceptions) cut scores obtained using the propensity score matching method as shown in Tables 2.30 and 2.31.

Table 2.29

95% Confidence Intervals and One Standard Deviation above and below the Mapped PARCC Equivalent Cut Scores for Option I Using PSAT for Linking

Subject	Cut Score	Mean CSEM	Minimum CSEM	Maximum CSEM	95% CI Mean CSEM	1 SD Mean CSEM	95% CI Minimum CSEM	1 SD Minimum CSEM	95% CI Maximum CSEM	1 SD Maximum CSEM
ELA10	715	10.93	10	11.1	(694, 736)	(704, 726)	(695, 735)	(705, 725)	(693, 737)	(704, 726)
Algebra I	716	12.43	11.6	12.6	(692, 740)	(704, 728)	(693, 739)	(704, 728)	(691, 741)	(703, 729)

Table 2.30

95% Confidence Intervals and One Standard Deviation above and below the Mapped PARCC Equivalent Cut Scores for Option II Using Propensity Score Matching

Subject	Cut Score	Mean CSEM	Minimum CSEM	Maximum CSEM	95% CI Mean CSEM	1 SD Mean CSEM	95% CI Minimum CSEM	1 SD Minimum CSEM	95% CI Maximum CSEM	1 SD Maximum CSEM
ELA10	716	9.74	8.7	11.2	(697, 735)	(706, 726)	(699, 733)	(707, 725)	(694, 738)	(705, 727)
	717	10.74	9.1	10.9	(696, 738)	(706, 728)	(699, 735)	(708, 726)	(696, 738)	(706, 728)
Algebra I	726	10.55	10.4	10.8	(705, 747)	(715, 737)	(706, 746)	(716, 736)	(705, 747)	(715, 737)
	727	9.9	9.9	9.9	(708, 746)	(717, 737)	(708, 746)	(717, 737)	(708, 746)	(717, 737)
	735	9.66	9.3	10.5	(716, 754)	(725, 745)	(717, 753)	(726, 744)	(714, 756)	(725, 746)
	736	8.81	8.7	8.9	(719, 753)	(727, 745)	(719, 753)	(727, 745)	(719, 753)	(727, 745)

Table 2.31

95% Confidence Intervals and One Standard Deviation above and below the Mapped PARCC Equivalent Cut Scores for Option II (Combining Design II and III) Using Propensity Score Matching

Subject	Cut Score	Mean CSEM	Minimum CSEM	Maximum CSEM	95% CI Mean CSEM	1 SD Mean CSEM	95% CI Minimum CSEM	1 SD Minimum CSEM	95% CI Maximum CSEM	1 SD Maximum CSEM
Algebra I	729	10.13	10	10.4	(709 , 749)	(719, 739)	(709, 749)	(719, 739)	(709, 749)	(719, 739)
	730	10.6	10.6	10.6	(709, 751)	(719, 741)	(709, 751)	(719, 741)	(709, 751)	(719, 741)
	734	9.72	9.2	10.6	(715, 753)	(724, 744)	(716, 752)	(725, 743)	(713, 755)	(723, 745)
	735	9.66	9.3	10.5	(716, 754)	(725, 745)	(717, 753)	(726, 744)	(714, 756)	(725, 746)

In addition, the HSA equivalents of the PARCC cut score of 725 dividing performance level 2 from 3 are summarized in Table 2.32 when using PSAT for linking and in Table 2.33 for propensity score matching. For PSAT linking, there were no PARCC scores of 725 in the conversion tables for both tests. Thus, a reversed mapping was also implemented to find a HSA equivalent score of a 725 PARCC cut score (as marked in blue color in Table 2.32). When propensity score matching was used, conversion tables from some matching conditions did not contain a PARCC score of 725 or had two HSA scores mapped to 725. A reversed mapping was implemented to find a HSA equivalent (as marked in blue color in Table 2.33) of a PARCC score of 725 in this case. In general, the HSA equivalents of the PARCC cut score, 725 for both ELA10 and Algebra I were higher than the original HSA cut scores for PSAT linking method. For the propensity score matching method, however, 725 for ELA10 was higher than the original HSA cut scores but was lower for ALG I.

Table 2.32

HSA Equivalent Scores of the PARCC Cut Score of 725 for Dividing Performance Level 2 from 3 (Option I Using PSAT for Linking)

Subject	Mapped HAS Score
English	400
Algebra	416

Table 2.33

HSA Equivalent Scores of the PARCC Cut Score of 725 for Dividing Performance Level 2 from 3 (Option II Based on Propensity Score Matching)

Design	Matching Condition			
	1	2	3	4
Design I (English)	400	401	400	400
Design II (ALG I)	410	410	411	410
Design III (ALG I)	401	401	402	402
Design II & III Combined	407	402	408	403

Summary

This study is a replication of the 2015 study using the same linking methods and the lastest 2016 PARCC data to obtain the PARCC equivalent scores of the HSA cut scores and the HSA equivalent scores of the PARCC cut scores that divides performance level 2 from 3. Specifically, this study explored two methods of obtaining the PARCC equivalent scores of the HSA cut scores for PARRC ELA10 and Algebra I, and vice versa using the latest available data from 2016. One method used PSAT as an external linking test to link HSA and PARCC based on a two-step single group linking design. Specifically, the HSA English and Algebra tests were linked to the PSAT EBRW and Math tests respectively and then the PSAT tests were linked to the corresponding PARCC tests. Based on the first-time test-takers' scores, the corresponding PARCC Algebra I score to the HSA Algebra passing score of 412 is 716 and the corresponding PARCC ELA10 score to the HSA English passing score of 396 is 715. Table 3.1 summarizes the mapped cut scores on the PARCC test scale based on the PSAT linking method using the 2015 and 2016 PARCC test data respectively.

Table 3.1
Summary of the Mapped PARCC Cut Scores from the PSAT Linking Method

Year	Subject	Mapped Score
2015	ELA 10	707
	ALG I	720
2016	ELA 10	715
	ALG I	716

Table 3.2
Summary of the Mapped PARCC Cut Scores from the Propensity Score Matching Method

Year	Design (Subject)	Matching Condition			
		1	2	3	4
2015	Design I (ELA 10)	706	706	705	704
	Design II (ALG I)	721	721	721	721
	Design III (ALG I)	725	725	725	725
	Design II & III Combined (ALG I)	722	727	722	724
2016	Design I (ELA 10)	717	716	717	717
	Design II (ALG I)	726	727	726	726
	Design III (ALG I)	736	735	735	735
	Design II & III Combined (ALG I)	730	735	729	734

The other method used propensity score matching to come up with equivalent groups between students taking HSA and PARCC. Four matching conditions were explored based on the use of different caliper values and the use of replacement of cases

for each design. Among the 16 designs, the corresponding PARCC ELA10 equivalent scores of the HSA English passing score are 716, and 717 while the corresponding PARCC Algebra I scores equivalent to the HSA Algebra passing scores are 726, 727 and 735, 736 for Design II and III respectively, and 729, 730, 734, and 735 for the combined Design II and III samples. Table 3.2 summarizes the mapped cut scores on the PARCC test scale based on the 2015 and 2016 PARCC test data using the propensity score matching method.

Compared with the results from the previous study using the 2015 PARCC data, the equivalent cut scores for the 2016 PARCC test increased by an average of eight scale score points. For PARCC ELA 10 test, the equivalent PARCC cut score increased from 707 to 715-717. For the PARCC ALG I test, the equivalent PARCC cut score increased from 720 to around 730. This may be because the average scores for the 2016 PARCC test increased as compared to those for the 2015 PARCC test. Table 3.3 summarizes the PARCC test scores in 2015 and 2016 respectively.

Table 3.3
Summary Statistics for PARCC Test Scores in 2015 and 2016

	Test	N	Mean	SD	Min	Max
2015	ELA10	55,629	737.8	44.95	650	850
	ALG I	61,760	734.3	32.81	650	850
2016	ELA10	63,005	741.4	48.01	650	850
	ALG I	67,022	736.0	35.46	650	850

Two intervals, 95% confidence intervals and one standard deviation above and below the PARCC equivalents of the HSA cut scores, were also constructed. For ELA10, the 95% confidence interval around the mapped PARCC equivalent score of the HSA cut score using the mean and the maximum CSEM captured the PARCC cut score of 725 between performance levels 2 vs. 3. For Algebra I, majority of the intervals captured the PARCC cut score of 725. The patterns were consistent across linking methods.

The HSA equivalents of the PARCC cut score of 725 dividing performance levels 2 from 3 are summarized in the report. In general, the HSA equivalents of the PARCC cut score, 725 for both ELA10 and Algebra I were higher than the original HSA cut scores based on the PSAT linking method. For the propensity score matching method, however, 725 for ELA10 was higher than the original HSA cut scores but was lower for ALG I.

This replication study provides additional empirical evidence about the PARCC equivalents of the HSA cut scores and the HSA equivalents of the PARCC cut score of 725 between performance level 2 and 3 for ELA10 and Algebra I. In general, students performed better in 2016 than in 2015. Thus, the mapped PARCC equivalent scores for HSA cut scores were all higher than those obtained using the 2015 data. The final adoption of cut scores obtained in this study depends on considerations from psychometric, policy, and practical perspectives.

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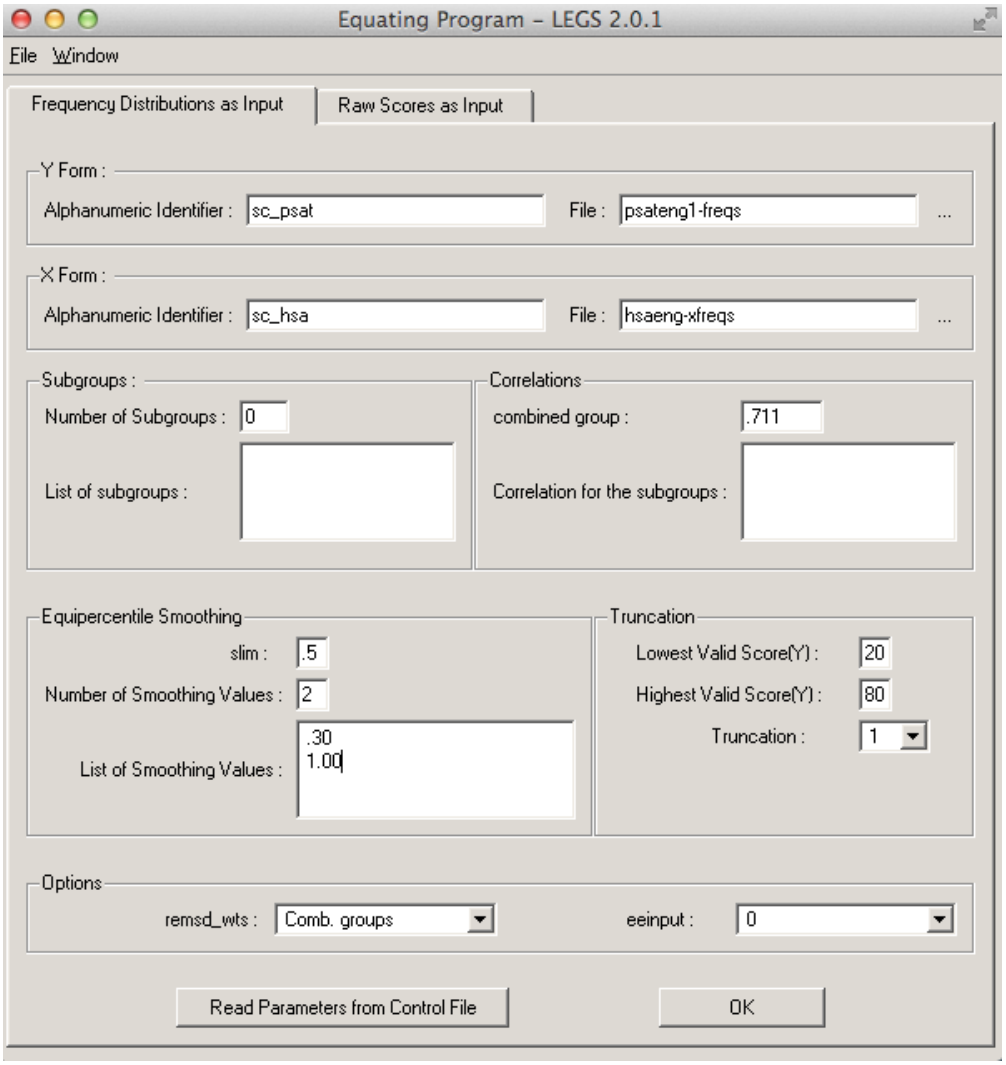
Appendix A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Raw Scores as Input
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