

Linking the Virginia SOL Assessments to NWEA MAP Growth Tests^{*}

^{*}As of June 2017 Measures of Academic Progress® (MAP®) is known as MAP® Growth™.

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Introduction

Northwest Evaluation Association™ (NWEA™) is committed to providing partners with useful tools to help make inferences from the Measures of Academic Progress® (MAP®) interim assessment scores. One important tool is the concordance table between MAP and state summative assessments. Concordance tables have been used for decades to relate scores on different tests measuring similar but distinct constructs. These tables, typically derived from statistical linking procedures, provide a direct link between scores on different tests and serve various purposes. Aside from describing how a score on one test relates to performance on another test, they can also be used to identify benchmark scores on one test corresponding to performance categories on another test, or to maintain continuity of scores on a test after the test is redesigned or changed. Concordance tables are helpful for educators, parents, administrators, researchers, and policy makers to evaluate and formulate academic standing and growth.

Recently, NWEA completed a concordance study to connect the scales of the Virginia Standards of Learning (SOL) reading and math tests with those of the MAP Reading and MAP for Mathematics assessments. In this report, we present the 3rd through 8th grade cut scores on MAP reading and mathematics scales that correspond to the benchmarks on the SOL reading and math tests. Information about the consistency rate of classification based on the estimated MAP cut scores is also provided, along with a series of tables that predict the probability of receiving a Level 2 (i.e., “Proficient”) or higher performance designation on the SOL assessments, based on the observed MAP scores taken during the same school year. A detailed description of the data and analysis method used in this study is provided in the Appendix.

Overview of Assessments

SOL assessments include a series of achievement tests aligned to the Virginia Common Core State Standards in English reading, mathematics, science and history/social science. Starting from spring 2016, SOL tests will be delivered in a Computer Adaptive Testing (CAT) format. For each grade and subject, there are two cut scores that distinguish between performance levels: Level 1: *Basic*, Level 2: *Proficient* and Level 3: *Advanced*. The Level 2 cut score demarks the minimum level of performance considered to be “Proficient” for accountability purposes.

MAP tests are interim assessments that are administered in the form of a CAT. MAP tests are constructed to measure student achievement from Grades K to 12 in math, reading, language usage, and science and aligned to the Virginia Common Core State Standards. Unlike SOL, MAP assessments are vertically scaled across grades, a feature that supports direct measurement of

academic growth and change. MAP scores are reported on a **Rasch Unit (RIT)** scale with a range from 100 to 350. Each subject has its own RIT scale.

To aid interpretation of MAP scores, NWEA periodically conducts norming studies of student and school performance on MAP. For example, the 2015 RIT Scale norming study (Thum & Hauser, 2015) employed multi-level growth models on nearly 500,000 longitudinal test scores from over 100,000 students that were weighted to create large, nationally representative norms for math, reading, language usage, and general science.

Estimated MAP Cut Scores Associated with SOL Readiness Levels

Tables 1 to 4 report the SOL scaled scores associated with each of the three performance levels, as well as the estimated score range on the MAP tests associated with each SOL performance level. Specifically, Tables 1 and 2 apply to MAP scores obtained during the spring testing season for reading and math, respectively. Tables 3 and 4 apply to MAP tests taken in a prior testing season (fall or winter) for reading and math, respectively. The tables also report the percentile rank (based on the *NWEA 2015 MAP Norms*) associated with each estimated MAP cut score. The MAP cut scores can be used to predict students' most probable SOL performance level, based on their observed MAP scores. For example, a 6th grade student who obtained a MAP math score of 240 in the spring testing season is likely to be at the very high end of Level 2 (Proficient) on the SOL taken during that same testing season (see Table 2). Similarly, a 3rd grade student who obtained a MAP reading score of 210 in the fall testing season is likely to be at Level 3 (Advanced) on the SOL taken in the spring of 3rd grade (see Table 3).

TABLE 1. CONCORDANCE OF PERFORMANCE LEVEL SCORE RANGES BETWEEN SOL AND MAP READING (WHEN MAP IS TAKEN IN SPRING)

		SOL				
Grade	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
	3	0-399		400-499		500-600
4	0-399		400-499		500-600	
5	0-399		400-499		500-600	
6	0-399		400-499		500-600	
7	0-399		400-499		500-600	
8	0-399		400-499		500-600	

		MAP				
Grade	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
	RIT	%ile	RIT	%ile	RIT	%ile
	3	100-198	1-49	199-214	50-85	215-350
4	100-204	1-46	205-220	47-83	221-350	84-99
5	100-209	1-43	210-226	44-84	227-350	85-99
6	100-213	1-43	214-231	44-85	232-350	86-99
7	100-216	1-45	217-235	46-87	236-350	88-99
8	100-220	1-51	221-242	52-92	243-350	93-99

Notes. 1. %ile=percentile.

2. Bolded numbers indicate the cut scores considered to be at least “proficient” for accountability purposes.

TABLE 2. CONCORDANCE OF PERFORMANCE LEVEL SCORE RANGES BETWEEN SOL AND MAP MATH (WHEN MAP IS TAKEN IN SPRING)

Grade	SOL					
	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
3	0-399		400-499		500-600	
4	0-399		400-499		500-600	
5	0-399		400-499		500-600	
6	0-399		400-499		500-600	
7	0-399		400-499		500-600	
8	0-399		400-499		500-600	

Grade	MAP					
	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
	RIT	%ile	RIT	%ile	RIT	%ile
3	100-202	1-47	203-216	48-82	217-350	83-99
4	100-207	1-34	208-223	35-74	224-350	75-99
5	100-217	1-40	218-233	41-77	234-350	78-99
6	100-218	1-34	219-245	35-88	246-350	89-99
7	100-228	1-49	229-250	50-89	251-350	90-99
8	100-228	1-44	229-255	45-90*	256-350	90*-99

Notes. 1. %ile=percentile.

2. Bolded numbers indicate the cut scores considered to be at least “proficient” for accountability purposes.

3. * reflects occasional departure from one-to-one correspondence between RITs and percentiles due to the larger range of the RIT scale relative to the percentile scale.

TABLE 3. CONCORDANCE OF PERFORMANCE LEVEL SCORE RANGES BETWEEN SOL AND MAP READING (WHEN MAP IS TAKEN IN FALL OR WINTER PRIOR TO SPRING SOL TESTS)

Grade	SOL					
	Level 1		Level 2		Level 3	
	<i>Basic</i>		<i>Proficient</i>		<i>Advanced</i>	
3	0-399		400-499		500-600	
4	0-399		400-499		500-600	
5	0-399		400-499		500-600	
6	0-399		400-499		500-600	
7	0-399		400-499		500-600	
8	0-399		400-499		500-600	
Grade	MAP FALL					
	Level 1		Level 2		Level 3	
	<i>Basic</i>		<i>Proficient</i>		<i>Advanced</i>	
	RIT	%ile	RIT	%ile	RIT	%ile
3	100-188	1-50	189-207	51-88	208-350	89-99
4	100-196	1-45	197-215	46-86	216-350	87-99
5	100-203	1-44	204-222	45-86	223-350	87-99
6	100-208	1-43	209-229	44-89	230-350	90-99
7	100-212	1-44	213-233	45-89	234-350	90-99
8	100-217	1-50	218-240	51-93*	241-350	93*-99
Grade	MAP WINTER					
	Level 1		Level 2		Level 3	
	<i>Basic</i>		<i>Proficient</i>		<i>Advanced</i>	
	RIT	%ile	RIT	%ile	RIT	%ile
3	100-195	1-49	196-212	50-86	213-350	87-99
4	100-202	1-47	203-219	48-85	220-350	86-99
5	100-207	1-43	208-225	44-85	226-350	86-99
6	100-211	1-42	212-230	43-86	231-350	87-99
7	100-215	1-46	216-234	47-87	235-350	88-99
8	100-219	1-51	220-241	52-92	242-350	93-99

Notes. 1. %ile=percentile.

2. Bolded numbers indicate the cut scores considered to be at least “proficient” for accountability purposes.

3. * reflects occasional departure from one-to-one correspondence between RITs and percentiles due to the larger range of the RIT scale relative to the percentile scale.

TABLE 4. CONCORDANCE OF PERFORMANCE LEVEL SCORE RANGES BETWEEN SOL AND MAP MATH (WHEN MAP IS TAKEN IN FALL OR WINTER PRIOR TO SPRING SOL TESTS)

Grade	SOL					
	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
	0-399		400-499		500-600	
3	0-399		400-499		500-600	
4	0-399		400-499		500-600	
5	0-399		400-499		500-600	
6	0-399		400-499		500-600	
7	0-399		400-499		500-600	
8	0-399		400-499		500-600	

Grade	MAP FALL					
	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
	RIT	%ile	RIT	%ile	RIT	%ile
	3	100-189	1-47	190-204	48-85	205-350
4	100-195	1-31	196-212	32-77	213-350	78-99
5	100-207	1-39	208-223	40-79	224-350	80-99
6	100-210	1-32	211-238	33-91	239-350	92-99
7	100-222	1-49	223-244	50-90	245-350	91-99
8	100-223	1-43	224-251	44-92*	252-350	92*-99

Grade	MAP WINTER					
	Level 1 <i>Basic</i>		Level 2 <i>Proficient</i>		Level 3 <i>Advanced</i>	
	RIT	%ile	RIT	%ile	RIT	%ile
	3	100-197	1-47	198-211	48-84	212-350
4	100-202	1-33	203-218	34-75	219-350	76-99
5	100-213	1-40	214-229	41-78	230-350	79-99
6	100-215	1-34	216-242	35-89	243-350	90-99
7	100-226	1-50	227-248	51-90	249-350	91-99
8	100-226	1-44	227-253	45-90	254-350	91-99

Notes. 1. %ile=percentile.

2. Bolded numbers indicate the cut scores considered to be at least “proficient” for accountability purposes.

3. * reflects occasional departure from one-to-one correspondence between RITs and percentiles due to the larger range of the RIT scale relative to the percentile scale.

Consistency Rate of Classification

Consistency rate of classification (Pommerich, Hanson, Harris, & Scoring, 2004), expressed in the form of a rate between 0 and 1, provides a means to measure the departure from equity for concordances (Hanson et al., 2001). This index can also be used as an indicator for the predictive validity of the MAP tests, i.e., how accurately the MAP scores can predict a student’s proficiency status in the SOL test. For each pair of concordant scores, a classification is considered consistent if the examinee is classified into the same performance category regardless of the test used for making a decision. Consistency rate provided in this report can be calculated as, for the “proficient” performance category concordant scores, the percentage of examinees who score at or above both concordant scores plus the percentage of examinees who score below both concordant scores on each test. Higher consistency rate indicates stronger congruence between SOL and MAP scores. The results in Table 5 demonstrate that on average MAP reading scores can consistently classify students’ proficiency (Level 2 or higher) status on SOL reading test 84% of the time and MAP math scores can consistently classify students on SOL math test 84% of the time. Those numbers are high suggesting that both MAP reading and math tests are great predictors of the students’ proficiency status on the SOL tests.

TABLE 5. CONSISTENCY RATE OF CLASSIFICATION FOR MAP AND SOL LEVEL 2 EQUIPERCENTILE CONCORDANCES

Grade	Reading			Math		
	Consistency Rate	False		Consistency Rate	False	
		Positives	Negatives		Positives	Negatives
3	0.84	0.08	0.08	0.83	0.09	0.08
4	0.83	0.11	0.06	0.86	0.07	0.07
5	0.83	0.08	0.09	0.84	0.08	0.08
6	0.82	0.10	0.08	0.86	0.07	0.07
7	0.84	0.08	0.08	0.82	0.09	0.09
8	0.85	0.10	0.05	0.81	0.09	0.10

Proficiency Projection

Proficiency projection tells how likely a student is classified as “proficient” on SOL tests based on his/her observed MAP scores. The conditional growth norms provided in the 2015 MAP Norms were used to calculate this information (Thum & Hauser, 2015). The results of proficiency

projection and corresponding probability of achieving “proficient” on the SOL tests are presented in Tables 6 to 8. These tables estimate the probability of scoring at Level 2 or above on SOL in the spring and the prior fall or winter testing season. For example, if a 3rd grade student obtained a MAP math score of 195 in the fall, the probability of obtaining a Level 2 or higher SOL score in the spring of 3rd grade is 78%. Table 6 presents the estimated probability of meeting Level 2 benchmark when MAP is taken in the spring, whereas Tables 7 and 8 present the estimated probability of meeting Level 2 benchmark when MAP is taken in the fall or winter prior to taking the SOL tests.

TABLE 6. PROFICIENCY PROJECTION AND PROBABILITY FOR PASSING SOL LEVEL 2 (PROFICIENT) WHEN MAP IS TAKEN IN THE SPRING

Grade	Reading					Math				
	Start %ile	RIT Spring	Projected Proficiency			Start %ile	RIT Spring	Projected Proficiency		
			Cut Score	Level 2	Prob.			Cut Score	Level 2	Prob.
3	5	174	199	No	<0.01	5	181	203	No	<0.01
	10	179	199	No	<0.01	10	186	203	No	<0.01
	15	183	199	No	<0.01	15	189	203	No	<0.01
	20	186	199	No	<0.01	20	192	203	No	<0.01
	25	188	199	No	<0.01	25	194	203	No	<0.01
	30	191	199	No	0.01	30	196	203	No	0.01
	35	193	199	No	0.03	35	198	203	No	0.04
	40	195	199	No	0.11	40	200	203	No	0.15
	45	197	199	No	0.27	45	202	203	No	0.37
	50	199	199	Yes	0.50	50	203	203	Yes	0.50
	55	201	199	Yes	0.73	55	205	203	Yes	0.75
	60	202	199	Yes	0.83	60	207	203	Yes	0.92
	65	204	199	Yes	0.94	65	209	203	Yes	0.98
	70	207	199	Yes	0.99	70	211	203	Yes	>0.99
	75	209	199	Yes	>0.99	75	213	203	Yes	>0.99
	80	211	199	Yes	>0.99	80	215	203	Yes	>0.99
85	214	199	Yes	>0.99	85	218	203	Yes	>0.99	
90	218	199	Yes	>0.99	90	221	203	Yes	>0.99	
95	223	199	Yes	>0.99	95	226	203	Yes	>0.99	
4	5	181	205	No	<0.01	5	189	208	No	<0.01
	10	187	205	No	<0.01	10	194	208	No	<0.01
	15	190	205	No	<0.01	15	198	208	No	<0.01
	20	193	205	No	<0.01	20	201	208	No	0.01
	25	196	205	No	<0.01	25	203	208	No	0.04
	30	198	205	No	0.01	30	206	208	No	0.25
	35	200	205	No	0.06	35	208	208	Yes	0.50
	40	202	205	No	0.17	40	210	208	Yes	0.75
	45	204	205	No	0.38	45	212	208	Yes	0.92
	50	206	205	Yes	0.62	50	213	208	Yes	0.96
	55	208	205	Yes	0.83	55	215	208	Yes	0.99
	60	210	205	Yes	0.94	60	217	208	Yes	>0.99
	65	212	205	Yes	0.99	65	219	208	Yes	>0.99
	70	214	205	Yes	>0.99	70	221	208	Yes	>0.99
	75	216	205	Yes	>0.99	75	224	208	Yes	>0.99
	80	218	205	Yes	>0.99	80	226	208	Yes	>0.99
85	221	205	Yes	>0.99	85	229	208	Yes	>0.99	
90	225	205	Yes	>0.99	90	233	208	Yes	>0.99	
95	230	205	Yes	>0.99	95	238	208	Yes	>0.99	

TABLE 6. (CONTINUED)

Grade	Reading					Math				
	Start %ile	RIT Spring	Projected Proficiency			Start %ile	RIT Spring	Projected Proficiency		
			Cut Score	Level 2	Prob.			Cut Score	Level 2	Prob.
5	5	188	210	No	<0.01	5	195	218	No	<0.01
	10	193	210	No	<0.01	10	201	218	No	<0.01
	15	197	210	No	<0.01	15	205	218	No	<0.01
	20	199	210	No	<0.01	20	208	218	No	<0.01
	25	202	210	No	0.01	25	210	218	No	<0.01
	30	204	210	No	0.03	30	213	218	No	0.04
	35	206	210	No	0.11	35	215	218	No	0.15
	40	208	210	No	0.27	40	217	218	No	0.37
	45	210	210	Yes	0.50	45	219	218	Yes	0.63
	50	212	210	Yes	0.73	50	221	218	Yes	0.85
	55	214	210	Yes	0.89	55	223	218	Yes	0.96
	60	216	210	Yes	0.97	60	225	218	Yes	0.99
	65	217	210	Yes	0.99	65	228	218	Yes	>0.99
	70	220	210	Yes	>0.99	70	230	218	Yes	>0.99
	75	222	210	Yes	>0.99	75	232	218	Yes	>0.99
	80	224	210	Yes	>0.99	80	235	218	Yes	>0.99
85	227	210	Yes	>0.99	85	238	218	Yes	>0.99	
90	231	210	Yes	>0.99	90	242	218	Yes	>0.99	
95	236	210	Yes	>0.99	95	248	218	Yes	>0.99	
6	5	192	214	No	<0.01	5	198	219	No	<0.01
	10	197	214	No	<0.01	10	204	219	No	<0.01
	15	201	214	No	<0.01	15	208	219	No	<0.01
	20	203	214	No	<0.01	20	211	219	No	<0.01
	25	206	214	No	0.01	25	214	219	No	0.04
	30	208	214	No	0.03	30	217	219	No	0.25
	35	210	214	No	0.11	35	219	219	Yes	0.50
	40	212	214	No	0.27	40	221	219	Yes	0.75
	45	214	214	Yes	0.50	45	223	219	Yes	0.92
	50	216	214	Yes	0.73	50	225	219	Yes	0.98
	55	218	214	Yes	0.89	55	227	219	Yes	>0.99
	60	219	214	Yes	0.94	60	230	219	Yes	>0.99
	65	221	214	Yes	0.99	65	232	219	Yes	>0.99
	70	223	214	Yes	>0.99	70	234	219	Yes	>0.99
	75	226	214	Yes	>0.99	75	237	219	Yes	>0.99
	80	228	214	Yes	>0.99	80	239	219	Yes	>0.99
85	231	214	Yes	>0.99	85	243	219	Yes	>0.99	
90	235	214	Yes	>0.99	90	247	219	Yes	>0.99	
95	240	214	Yes	>0.99	95	253	219	Yes	>0.99	

TABLE 6. (CONTINUED)

Grade	Reading					Math				
	Start %ile	RIT Spring	Projected Proficiency			Start %ile	RIT Spring	Projected Proficiency		
			Cut Score	Level 2	Prob.			Cut Score	Level 2	Prob.
7	5	193	217	No	<0.01	5	199	229	No	<0.01
	10	199	217	No	<0.01	10	206	229	No	<0.01
	15	202	217	No	<0.01	15	210	229	No	<0.01
	20	205	217	No	<0.01	20	214	229	No	<0.01
	25	208	217	No	<0.01	25	217	229	No	<0.01
	30	210	217	No	0.01	30	219	229	No	<0.01
	35	212	217	No	0.06	35	222	229	No	0.01
	40	214	217	No	0.17	40	224	229	No	0.04
	45	216	217	No	0.38	45	226	229	No	0.15
	50	218	217	Yes	0.62	50	229	229	Yes	0.50
	55	220	217	Yes	0.83	55	231	229	Yes	0.75
	60	222	217	Yes	0.94	60	233	229	Yes	0.92
	65	224	217	Yes	0.99	65	235	229	Yes	0.98
	70	226	217	Yes	>0.99	70	238	229	Yes	>0.99
	75	228	217	Yes	>0.99	75	241	229	Yes	>0.99
	80	231	217	Yes	>0.99	80	244	229	Yes	>0.99
	85	234	217	Yes	>0.99	85	247	229	Yes	>0.99
90	238	217	Yes	>0.99	90	251	229	Yes	>0.99	
95	243	217	Yes	>0.99	95	258	229	Yes	>0.99	
8	5	194	221	No	<0.01	5	199	229	No	<0.01
	10	200	221	No	<0.01	10	206	229	No	<0.01
	15	204	221	No	<0.01	15	211	229	No	<0.01
	20	207	221	No	<0.01	20	215	229	No	<0.01
	25	209	221	No	<0.01	25	218	229	No	<0.01
	30	212	221	No	<0.01	30	221	229	No	<0.01
	35	214	221	No	0.01	35	224	229	No	0.04
	40	216	221	No	0.06	40	226	229	No	0.15
	45	218	221	No	0.17	45	229	229	Yes	0.50
	50	220	221	No	0.38	50	231	229	Yes	0.75
	55	222	221	Yes	0.62	55	233	229	Yes	0.92
	60	224	221	Yes	0.83	60	236	229	Yes	0.99
	65	226	221	Yes	0.94	65	238	229	Yes	>0.99
	70	228	221	Yes	0.99	70	241	229	Yes	>0.99
	75	231	221	Yes	>0.99	75	244	229	Yes	>0.99
	80	233	221	Yes	>0.99	80	247	229	Yes	>0.99
	85	236	221	Yes	>0.99	85	251	229	Yes	>0.99
90	240	221	Yes	>0.99	90	255	229	Yes	>0.99	
95	246	221	Yes	>0.99	95	262	229	Yes	>0.99	

Note. %ile=percentile

TABLE 7. PROFICIENCY PROJECTION AND PROBABILITY FOR PASSING SOL READING LEVEL 2 (PROFICIENT) WHEN MAP IS TAKEN IN THE FALL OR WINTER PRIOR TO SPRING SOL TESTS

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut Score	Level 2	Prob.			Cut Score	Level 2	Prob.
3	5	162	199	No	<0.01	5	171	199	No	<0.01
	10	168	199	No	0.01	10	176	199	No	<0.01
	15	172	199	No	0.03	15	180	199	No	<0.01
	20	175	199	No	0.05	20	183	199	No	0.01
	25	178	199	No	0.10	25	185	199	No	0.03
	30	180	199	No	0.16	30	188	199	No	0.09
	35	182	199	No	0.20	35	190	199	No	0.13
	40	184	199	No	0.29	40	192	199	No	0.22
	45	186	199	No	0.39	45	194	199	No	0.35
	50	188	199	No	0.44	50	196	199	Yes	0.50
	55	190	199	Yes	0.56	55	198	199	Yes	0.65
	60	192	199	Yes	0.66	60	199	199	Yes	0.72
	65	194	199	Yes	0.71	65	201	199	Yes	0.83
	70	197	199	Yes	0.84	70	204	199	Yes	0.94
	75	199	199	Yes	0.90	75	206	199	Yes	0.96
	80	202	199	Yes	0.94	80	208	199	Yes	0.98
	85	205	199	Yes	0.97	85	211	199	Yes	>0.99
90	209	199	Yes	0.99	90	215	199	Yes	>0.99	
95	214	199	Yes	>0.99	95	221	199	Yes	>0.99	
4	5	173	205	No	<0.01	5	179	205	No	<0.01
	10	178	205	No	0.01	10	184	205	No	<0.01
	15	182	205	No	0.03	15	188	205	No	<0.01
	20	185	205	No	0.07	20	191	205	No	0.02
	25	188	205	No	0.12	25	194	205	No	0.06
	30	190	205	No	0.18	30	196	205	No	0.12
	35	192	205	No	0.27	35	198	205	No	0.22
	40	194	205	No	0.33	40	200	205	No	0.35
	45	196	205	No	0.44	45	202	205	No	0.42
	50	198	205	Yes	0.56	50	204	205	Yes	0.58
	55	200	205	Yes	0.62	55	205	205	Yes	0.65
	60	202	205	Yes	0.73	60	207	205	Yes	0.78
	65	204	205	Yes	0.82	65	209	205	Yes	0.88
	70	206	205	Yes	0.88	70	211	205	Yes	0.94
	75	209	205	Yes	0.93	75	214	205	Yes	0.98
	80	211	205	Yes	0.96	80	216	205	Yes	0.99
	85	214	205	Yes	0.98	85	219	205	Yes	>0.99
90	218	205	Yes	>0.99	90	223	205	Yes	>0.99	
95	224	205	Yes	>0.99	95	228	205	Yes	>0.99	

TABLE 7. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 2	Prob.			Cut-Score	Level 2	Prob.
5	5	181	210	No	<0.01	5	186	210	No	<0.01
	10	186	210	No	0.01	10	191	210	No	<0.01
	15	190	210	No	0.04	15	195	210	No	0.01
	20	193	210	No	0.09	20	197	210	No	0.03
	25	195	210	No	0.15	25	200	210	No	0.09
	30	198	210	No	0.23	30	202	210	No	0.12
	35	200	210	No	0.33	35	204	210	No	0.22
	40	202	210	No	0.44	40	206	210	No	0.35
	45	204	210	Yes	0.50	45	208	210	Yes	0.50
	50	206	210	Yes	0.62	50	210	210	Yes	0.65
	55	208	210	Yes	0.72	55	212	210	Yes	0.78
	60	210	210	Yes	0.81	60	214	210	Yes	0.88
	65	212	210	Yes	0.85	65	215	210	Yes	0.91
	70	214	210	Yes	0.91	70	218	210	Yes	0.97
	75	216	210	Yes	0.95	75	220	210	Yes	0.98
	80	218	210	Yes	0.96	80	222	210	Yes	0.99
	85	221	210	Yes	0.99	85	225	210	Yes	>0.99
90	225	210	Yes	>0.99	90	229	210	Yes	>0.99	
95	231	210	Yes	>0.99	95	234	210	Yes	>0.99	
6	5	186	214	No	<0.01	5	190	214	No	<0.01
	10	192	214	No	0.01	10	196	214	No	<0.01
	15	196	214	No	0.06	15	199	214	No	0.01
	20	198	214	No	0.07	20	202	214	No	0.03
	25	201	214	No	0.16	25	204	214	No	0.06
	30	203	214	No	0.23	30	207	214	No	0.17
	35	205	214	No	0.33	35	209	214	No	0.28
	40	207	214	No	0.39	40	211	214	No	0.42
	45	209	214	Yes	0.50	45	212	214	Yes	0.50
	50	211	214	Yes	0.61	50	214	214	Yes	0.65
	55	213	214	Yes	0.72	55	216	214	Yes	0.72
	60	215	214	Yes	0.77	60	218	214	Yes	0.83
	65	217	214	Yes	0.84	65	220	214	Yes	0.91
	70	219	214	Yes	0.90	70	222	214	Yes	0.96
	75	221	214	Yes	0.93	75	224	214	Yes	0.98
	80	224	214	Yes	0.97	80	226	214	Yes	0.99
	85	226	214	Yes	0.99	85	229	214	Yes	>0.99
90	230	214	Yes	>0.99	90	233	214	Yes	>0.99	
95	236	214	Yes	>0.99	95	238	214	Yes	>0.99	

TABLE 7. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 2	Prob.			Cut-Score	Level 2	Prob.
7	5	189	217	No	<0.01	5	192	217	No	<0.01
	10	195	217	No	0.01	10	198	217	No	<0.01
	15	199	217	No	0.04	15	201	217	No	<0.01
	20	202	217	No	0.07	20	204	217	No	0.02
	25	204	217	No	0.12	25	207	217	No	0.06
	30	206	217	No	0.19	30	209	217	No	0.12
	35	209	217	No	0.28	35	211	217	No	0.22
	40	211	217	No	0.39	40	213	217	No	0.28
	45	213	217	Yes	0.50	45	215	217	No	0.42
	50	214	217	Yes	0.56	50	217	217	Yes	0.58
	55	216	217	Yes	0.61	55	219	217	Yes	0.72
	60	218	217	Yes	0.72	60	221	217	Yes	0.83
	65	220	217	Yes	0.81	65	223	217	Yes	0.91
	70	222	217	Yes	0.88	70	225	217	Yes	0.96
	75	225	217	Yes	0.93	75	227	217	Yes	0.98
	80	227	217	Yes	0.96	80	230	217	Yes	>0.99
	85	230	217	Yes	0.99	85	232	217	Yes	>0.99
90	234	217	Yes	>0.99	90	236	217	Yes	>0.99	
95	240	217	Yes	>0.99	95	242	217	Yes	>0.99	
8	5	191	221	No	<0.01	5	194	221	No	<0.01
	10	197	221	No	0.01	10	199	221	No	<0.01
	15	201	221	No	0.03	15	203	221	No	<0.01
	20	204	221	No	0.06	20	206	221	No	0.01
	25	207	221	No	0.10	25	209	221	No	0.02
	30	209	221	No	0.16	30	211	221	No	0.05
	35	211	221	No	0.22	35	213	221	No	0.10
	40	213	221	No	0.26	40	215	221	No	0.18
	45	215	221	No	0.35	45	217	221	No	0.29
	50	217	221	No	0.45	50	219	221	No	0.43
	55	219	221	Yes	0.55	55	221	221	Yes	0.57
	60	221	221	Yes	0.60	60	223	221	Yes	0.71
	65	223	221	Yes	0.69	65	225	221	Yes	0.82
	70	225	221	Yes	0.78	70	227	221	Yes	0.90
	75	228	221	Yes	0.84	75	229	221	Yes	0.95
	80	230	221	Yes	0.90	80	232	221	Yes	0.98
	85	234	221	Yes	0.96	85	235	221	Yes	0.99
90	237	221	Yes	0.98	90	239	221	Yes	>0.99	
95	243	221	Yes	>0.99	95	244	221	Yes	>0.99	

Note. %ile=percentile

TABLE 8. PROFICIENCY PROJECTION AND PROBABILITY FOR PASSING SOL MATH LEVEL 2 (PROFICIENT) WHEN MAP IS TAKEN IN THE FALL OR WINTER PRIOR TO SPRING SOL TESTS

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut Score	Level 2	Prob.			Cut Score	Level 2	Prob.
3	5	169	203	No	<0.01	5	176	203	No	<0.01
	10	174	203	No	0.01	10	181	203	No	<0.01
	15	177	203	No	0.03	15	184	203	No	<0.01
	20	179	203	No	0.06	20	187	203	No	0.01
	25	182	203	No	0.14	25	189	203	No	0.03
	30	184	203	No	0.17	30	191	203	No	0.07
	35	185	203	No	0.22	35	193	203	No	0.14
	40	187	203	No	0.32	40	195	203	No	0.26
	45	189	203	No	0.44	45	197	203	No	0.42
	50	190	203	Yes	0.50	50	198	203	Yes	0.50
	55	192	203	Yes	0.62	55	200	203	Yes	0.66
	60	194	203	Yes	0.73	60	202	203	Yes	0.80
	65	195	203	Yes	0.78	65	203	203	Yes	0.86
	70	197	203	Yes	0.86	70	205	203	Yes	0.93
	75	199	203	Yes	0.89	75	207	203	Yes	0.97
	80	201	203	Yes	0.94	80	209	203	Yes	0.99
	85	204	203	Yes	0.98	85	212	203	Yes	>0.99
90	207	203	Yes	0.99	90	215	203	Yes	>0.99	
95	212	203	Yes	>0.99	95	220	203	Yes	>0.99	
4	5	179	208	No	<0.01	5	185	208	No	<0.01
	10	184	208	No	0.03	10	190	208	No	<0.01
	15	188	208	No	0.11	15	194	208	No	0.03
	20	190	208	No	0.17	20	197	208	No	0.10
	25	193	208	No	0.32	25	199	208	No	0.20
	30	195	208	No	0.44	30	201	208	No	0.34
	35	197	208	Yes	0.56	35	203	208	Yes	0.50
	40	198	208	Yes	0.62	40	205	208	Yes	0.66
	45	200	208	Yes	0.73	45	207	208	Yes	0.80
	50	202	208	Yes	0.83	50	209	208	Yes	0.90
	55	204	208	Yes	0.89	55	211	208	Yes	0.95
	60	205	208	Yes	0.89	60	212	208	Yes	0.97
	65	207	208	Yes	0.94	65	214	208	Yes	0.99
	70	209	208	Yes	0.97	70	216	208	Yes	>0.99
	75	211	208	Yes	0.99	75	218	208	Yes	>0.99
	80	214	208	Yes	>0.99	80	221	208	Yes	>0.99
	85	216	208	Yes	>0.99	85	223	208	Yes	>0.99
90	220	208	Yes	>0.99	90	227	208	Yes	>0.99	
95	225	208	Yes	>0.99	95	232	208	Yes	>0.99	

TABLE 8. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 2	Prob.			Cut-Score	Level 2	Prob.
5	5	187	218	No	<0.01	5	192	218	No	<0.01
	10	193	218	No	0.01	10	198	218	No	<0.01
	15	196	218	No	0.04	15	201	218	No	<0.01
	20	199	218	No	0.09	20	204	218	No	0.02
	25	202	218	No	0.19	25	207	218	No	0.07
	30	204	218	No	0.28	30	209	218	No	0.15
	35	206	218	No	0.38	35	211	218	No	0.27
	40	208	218	Yes	0.50	40	213	218	No	0.42
	45	210	218	Yes	0.62	45	215	218	Yes	0.58
	50	211	218	Yes	0.67	50	217	218	Yes	0.73
	55	213	218	Yes	0.77	55	219	218	Yes	0.85
	60	215	218	Yes	0.85	60	221	218	Yes	0.93
	65	217	218	Yes	0.91	65	223	218	Yes	0.97
	70	219	218	Yes	0.95	70	225	218	Yes	0.99
	75	221	218	Yes	0.97	75	228	218	Yes	>0.99
	80	224	218	Yes	0.99	80	230	218	Yes	>0.99
	6	5	192	219	No	<0.01	5	196	219	No
10		198	219	No	0.03	10	202	219	No	<0.01
15		202	219	No	0.09	15	205	219	No	0.01
20		205	219	No	0.19	20	209	219	No	0.07
25		207	219	No	0.28	25	211	219	No	0.15
30		209	219	No	0.38	30	214	219	No	0.34
35		212	219	Yes	0.56	35	216	219	Yes	0.50
40		214	219	Yes	0.67	40	218	219	Yes	0.66
45		216	219	Yes	0.77	45	220	219	Yes	0.80
50		218	219	Yes	0.85	50	222	219	Yes	0.89
55		220	219	Yes	0.91	55	224	219	Yes	0.95
60		222	219	Yes	0.95	60	226	219	Yes	0.98
65		224	219	Yes	0.97	65	228	219	Yes	0.99
70		226	219	Yes	0.99	70	230	219	Yes	>0.99
75		228	219	Yes	0.99	75	233	219	Yes	>0.99
80		231	219	Yes	>0.99	80	236	219	Yes	>0.99
85		234	219	Yes	>0.99	85	239	219	Yes	>0.99
90	238	219	Yes	>0.99	90	243	219	Yes	>0.99	
95	243	219	Yes	>0.99	95	248	219	Yes	>0.99	

TABLE 8. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 2	Prob.			Cut-Score	Level 2	Prob.
7	5	195	229	No	<0.01	5	198	229	No	<0.01
	10	201	229	No	<0.01	10	204	229	No	<0.01
	15	205	229	No	<0.01	15	208	229	No	<0.01
	20	209	229	No	0.02	20	212	229	No	<0.01
	25	211	229	No	0.03	25	215	229	No	0.01
	30	214	229	No	0.08	30	217	229	No	0.02
	35	216	229	No	0.14	35	220	229	No	0.07
	40	218	229	No	0.22	40	222	229	No	0.15
	45	221	229	No	0.38	45	224	229	No	0.26
	50	223	229	Yes	0.50	50	226	229	No	0.42
	55	225	229	Yes	0.62	55	228	229	Yes	0.58
	60	227	229	Yes	0.73	60	230	229	Yes	0.74
	65	229	229	Yes	0.82	65	233	229	Yes	0.90
	70	231	229	Yes	0.89	70	235	229	Yes	0.95
	75	234	229	Yes	0.95	75	238	229	Yes	0.99
	80	237	229	Yes	0.98	80	240	229	Yes	>0.99
	85	240	229	Yes	>0.99	85	244	229	Yes	>0.99
90	244	229	Yes	>0.99	90	248	229	Yes	>0.99	
95	250	229	Yes	>0.99	95	254	229	Yes	>0.99	
8	5	197	229	No	<0.01	5	199	229	No	<0.01
	10	203	229	No	<0.01	10	206	229	No	<0.01
	15	208	229	No	0.02	15	210	229	No	<0.01
	20	211	229	No	0.04	20	214	229	No	<0.01
	25	214	229	No	0.10	25	217	229	No	0.02
	30	217	229	No	0.18	30	220	229	No	0.08
	35	219	229	No	0.26	35	222	229	No	0.16
	40	222	229	No	0.40	40	225	229	No	0.35
	45	224	229	Yes	0.50	45	227	229	Yes	0.50
	50	226	229	Yes	0.60	50	229	229	Yes	0.65
	55	229	229	Yes	0.74	55	231	229	Yes	0.79
	60	231	229	Yes	0.82	60	234	229	Yes	0.92
	65	233	229	Yes	0.88	65	236	229	Yes	0.96
	70	236	229	Yes	0.92	70	239	229	Yes	0.99
	75	238	229	Yes	0.96	75	241	229	Yes	>0.99
	80	241	229	Yes	0.98	80	245	229	Yes	>0.99
	85	245	229	Yes	>0.99	85	248	229	Yes	>0.99
90	249	229	Yes	>0.99	90	253	229	Yes	>0.99	
95	256	229	Yes	>0.99	95	259	229	Yes	>0.99	

Note. %ile=percentile

Summary and Discussion

This study produced a set of cut scores on MAP reading and math tests for Grades 3 to 8 that correspond to each SOL performance level. By using matched score data from a sample of students from Virginia, the study demonstrates that MAP scores can accurately predict whether a student could be proficient or above on the basis of his/her MAP scores. This study also used the 2015 NWEA norming study results to project a student's probability to meet proficiency based on that student's prior MAP scores in fall and winter. These results will help educators predict student performance in SOL tests as early as possible and identify those students who are at risk of failing to meet required standards so that they can receive necessary resources and assistance to meet their goals.

While concordance tables can be helpful and informative, they have general limitations. First, the concordance tables provide information about score comparability on different tests, but the scores cannot be assumed to be interchangeable. In the case for SOL and MAP tests, as they are not parallel in content, scores from these two tests should not be directly compared. Second, the sample data used in this study were collected from 4 school districts in Virginia and the sample size of grade 8 was much smaller than those of other grades. Caution should be exercised when generalizing the results to test takers who differ significantly from this sample. Finally, caution should also be exercised if the concorded scores are used for a subpopulation. NWEA will continue to gather information about SOL performance from other school districts in Virginia to enhance the quality and generalizability of the study.

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- Virginia Education Agency (2015). *Technical Digest for the academic year 2014-2015*. Austin, TX: TE Agency.
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Appendix

Data and Analysis

Data

Data used in this study were collected from 4 school districts in Virginia. The sample contained matched SOL and MAP reading scores of 7,388 students in Grades 3 to 8 and matched SOL and MAP math scores of 7,625 students in Grades 3 to 8 who completed both MAP and SOL tests in the spring of 2014.

To understand the statistical characteristics of the test scores, descriptive statistics are provided in Table A1 below. As Table A1 indicates, the correlation coefficients between MAP and SOL reading scores range from 0.75 to 0.81, and the correlation coefficients between MAP and SOL math scores range from 0.76 to 0.81. In general, all these correlations indicate a strong relationship between MAP and SOL test scores.

TABLE A1. DESCRIPTIVE STATISTICS OF THE SAMPLE DATA

Subject	Grade	N	<i>r</i>	SOL				MAP			
				Mean	SD	Min	Max	Mean	SD	Min	Max
Reading	3	1,573	0.76	435	66.99	208	600	204	12.69	148	236
	4	1,573	0.76	437	68.86	243	600	210	12.52	147	241
	5	1,556	0.75	435	62.69	221	600	215	12.10	149	246
	6	1,249	0.77	429	59.81	244	600	218	12.51	154	249
	7	1,179	0.75	433	54.10	285	600	222	12.30	158	258
	8	258	0.81	413	59.73	249	591	222	16.38	155	257
Math	3	1,550	0.79	423	66.71	257	600	206	10.63	155	247
	4	1,550	0.81	453	66.74	289	600	216	11.40	159	253
	5	1,522	0.79	445	69.53	239	600	224	12.66	176	269
	6	1,229	0.76	429	45.44	308	600	226	13.63	174	264
	7	1,052	0.77	414	53.27	263	600	231	13.68	149	269
	8	722	0.79	411	48.39	264	600	231	16.09	164	280

Equipercentile Linking Procedure

The equipercentile procedure (e.g., Kolen & Brennan, 2004) was used to establish the concordance relationship between SOL and MAP scores for grades 3 to 8 in reading and math. This procedure matches scores on the two scales that have the same percentile rank (i.e., the proportion of scores at or below each score).

Suppose we need to establish the concorded scores between two tests. x is a score on Test X (e.g., SOL). Its equipercentile equivalent score on Test Y (e.g., MAP), $e_y(x)$, can be obtained through a cumulative-distribution-based linking function defined in Equation (A1):

$$e_y(x) = G^{-1}[P(x)] \quad (\text{A1})$$

where $e_y(x)$ is the equipercentile equivalent of scores on SOL on the scale of MAP, $P(x)$ is the percentile rank of a given score on Test X . G^{-1} is the inverse of the percentile rank function for scores on Test Y which indicates the scores on Test Y corresponding to a given percentile. Polynomial loglinear pre-smoothing was applied to reduce irregularities of the frequency distributions as well as equipercentile linking curve.

Consistency Rate of Classification

Consistency rate of classification accuracy, expressed in the form of a rate between 0 and 1, measures the extent to which MAP scores (and the estimated MAP cut scores) accurately predicted whether students in the sample would pass (i.e., Level 2 or higher) on SOL tests.

To calculate consistency rate of classification, sample students were designated “Below SOL cut” or “At or above SOL cut” based on their actual SOL scores. Similarly, they were also designated as “Below MAP cut” or “At or above MAP cut” based on their actual MAP scores. A 2-way contingency table was then tabulated (see Table A2), classifying students as “Proficient” on the basis of SOL cut score and concordant MAP cut score. Students classified in the *true positive* (TP) category were those predicted to be Proficient based on the MAP cut scores and were also classified as Proficient based on the SOL cut scores. Students classified in the *true negative* (TN) category were those predicted to be Not Proficient based on the MAP cut scores and were also classified as Not Proficient based on the SOL cut scores. Students classified in the *false positive* (FP) category were those predicted to be Proficient based on the MAP cut scores but were classified as Not Proficient based on the SOL cut scores. Students classified in the *false negative* (FN) category were those predicted to be Not Proficient based on the MAP cut scores but were classified as Proficient based on the SOL cut scores. The overall consistency rate of classification was computed as the proportion of correct classifications among the entire sample by $(TP+TN) / (TP+TN+FP+FN)$.

TABLE A2. DEFINITION OF CONSISTENCY RATE FOR SOL TO MAP CONCORDANCE

		SOL Score	
		Below SOL cut	At or Above SOL cut
MAP Score	Below MAP cut	True Negative	False Negative
	At or Above MAP cut	False Positive	True Positive

Note. Shaded cells are summed to compute the consistency rate.

Proficiency Projection

MAP conditional growth norms provide student’s expected gain scores across testing seasons (Thum & Hauser, 2015). This information is utilized to predict a student’s performance on the SOL based on that student’s MAP scores in prior seasons (e.g. fall and winter). The probability of a student achieving Level 2 (Proficient) on SOL, based on his/her fall or winter MAP score is given in Equation (A2):

$$Pr(\text{Achieving Level 2 in spring} | a \text{ RIT score of } x) = \Phi\left(\frac{x + g - c}{SD}\right) \quad (A2)$$

where, Φ is a standardized normal cumulative distribution, x is the student’s RIT score in fall or winter, g is the expected growth from fall or winter to spring corresponding to x , c is the MAP cut-score for spring, and SD is the conditional standard deviation of growth from fall or winter to spring.

For the probability of a student achieving Level 2 on the SOL tests, based on his/her spring score s , it can be calculated by Equation (A3):

$$Pr(\text{Achieving Level 2 in spring} | a \text{ RIT score of } s \text{ in spring}) = \Phi\left(\frac{s - c}{SE}\right) \quad (A3)$$

where SE is the standard error of measurement for MAP reading or math test.

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