Linking the Arizona AzMERIT Assessments to NWEA MAP Tests

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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 Arizona's Measurement of Educational Readiness to Inform Teaching (AzMERIT) English Language Arts (ELA) and Mathematics 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 AzMERIT ELA 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 3 (i.e., "Proficient") or higher performance designation on the AzMERIT 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

AzMERIT includes a series of vertically scaled achievement tests aligned to the Arizona College and Career Ready Standards in ELA for grades 3-11, math for grades 3-8, and end of high school coursework in Algebra I, Geometry, and Algebra II. AzMERIT tests can be delivered online or in the paper-and-pencil form. For each grade and subject, there are three cut scores that distinguish between performance levels: Level 1: *Minimally Proficient*, Level 2: *Partially Proficient*, Level 3: *Proficient*, and Level 4: *Highly Proficient*. The Level 3 cut score demarks the minimum level of performance considered to be "Proficient" for accountability purposes.

MAP tests are vertically scaled interim assessments that are administered in the form of a computerized adaptive test (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 Arizona

College and Career Ready Standards. MAP scores are reported on a **R**asch Un**it** (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 NWEA 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 AzMERIT Readiness Levels

Tables 1 to 4 report the AzMERIT scaled scores associated with each of the four performance levels, as well as the estimated cut scores on the MAP tests associated with the AzMERIT performance levels. 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 AzMERIT performance level, based on their observed MAP scores. For example, a 4th grade student who obtained a MAP math score of 230 in the spring testing season is likely to be at the very high end of Level 3 (Proficient) on the AzMERIT taken during that same testing season (see Table 2). Similarly, a 3rd grade student who obtained a MAP reading score of 220 in the fall testing season is likely to be at Level 4 (Highly Proficient) on the AzMERIT taken in the spring of 3rd grade (see Table 3).

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

Grade	AzMERIT			
	Level 1 *Minimally Proficient*	Level 2 *Partially Proficient*	Level 3 *Proficient*	Level 4 *Highly Proficient*
3	2395-2496	2497-2508	**2509**-2540	2541-2605
4	2400-2509	2510-2522	**2523**-2558	2559-2610
5	2419-2519	2520-2542	**2543**-2577	2578-2629
6	2431-2531	2532-2552	**2553**-2596	2597-2641
7	2438-2542	2543-2560	**2561**-2599	2600-2648
8	2448-2550	2551-2571	**2572**-2603	2604-2658

Grade	MAP							
	Level 1 *Minimally Proficient*		Level 2 *Partially Proficient*		Level 3 *Proficient*		Level 4 *Highly Proficient*	
	RIT	%ile	RIT	%ile	RIT	%ile	RIT	%ile
3	100-198	1-49	199-204	50-65	**205**-217	66-89	218-350	90-99
4	100-205	1-48	206-211	49-64	**212**-227	65-92	228-350	93-99
5	100-208	1-41	209-220	42-72	**221**-235	73-94	236-350	95-99
6	100-213	1-43	214-222	44-67	**223**-238	68-93	239-350	94-99
7	100-217	1-48	218-226	49-70	**227**-242	71-94	243-350	95-99
8	100-220	1-51	221-229	52-72	**230**-243	73-93[*]	244-350	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 2. CONCORDANCE OF PERFORMANCE LEVEL SCORE RANGES BETWEEN AzMERIT AND MAP MATH (WHEN MAP IS TAKEN IN SPRING)

Grade	AzMERIT							
	Level 1 *Minimally Proficient*		Level 2 *Partially Proficient*		Level 3 *Proficient*		Level 4 *Highly Proficient*	
3	3395-3494		3495-3530		**3531**-3572		3573-3605	
4	3435-3529		3530-3561		**3562**-3605		3606-3645	
5	3478-3562		3563-3594		**3595**-3634		3635-3688	
6	3512-3601		3602-3628		**3629**-3662		3663-3722	
7	3529-3628		3629-3651		**3652**-3679		3680-3739	
8	3566-3649		3650-3672		**3673**-3704		3705-3776	

Grade	MAP							
	Level 1 *Minimally Proficient*		Level 2 *Partially Proficient*		Level 3 *Proficient*		Level 4 *Highly Proficient*	
	RIT	%ile	RIT	%ile	RIT	%ile	RIT	%ile
3	100-196	1-30	197-208	31-64	**209**-219	65-87	220-350	88-99
4	100-207	1-34	208-220	35-68	**221**-234	69-91	235-350	92-99
5	100-215	1-35	216-230	36-71	**231**-244	72-92	245-350	93-99
6	100-224	1-48	225-236	49-74	**237**-246	75-89	247-350	90-99
7	100-230	1-54	231-240	55-74	**241**-250	75-89	251-350	90-99
8	100-231	1-51	232-242	52-72	**243**-254	73-89	255-350	90-99

Notes. 1. %ile=percentile.

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

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

AzMERIT

Grade	Level 1 Minimally Proficient	Level 2 Partially Proficient	Level 3 Proficient	Level 4 Highly Proficient
3	2395-2496	2497-2508	**2509**-2540	2541-2605
4	2400-2509	2510-2522	**2523**-2558	2559-2610
5	2419-2519	2520-2542	**2543**-2577	2578-2629
6	2431-2531	2532-2552	**2553**-2596	2597-2641
7	2438-2542	2543-2560	**2561**-2599	2600-2648
8	2448-2550	2551-2571	**2572**-2603	2604-2658

MAP FALL

Grade	Level 1 Minimally Proficient		Level 2 Partially Proficient		Level 3 Proficient		Level 4 Highly Proficient	
	RIT	%ile	RIT	%ile	RIT	%ile	RIT	%ile
3	100-188	1-50	189-195	51-67	**196**-210	68-91	211-350	92-99
4	100-197	1-48	198-204	49-65	**205**-223	66-94	224-350	95-99
5	100-201	1-39	202-215	40-74	**216**-233	75-96	234-350	97-99
6	100-208	1-43	209-218	44-69	**219**-236	70-95	237-350	96-99
7	100-213	1-47	214-223	48-72	**224**-240	73-95	241-350	96-99
8	100-217	1-50	218-227	51-74	**228**-241	75-93	242-350	94-99

MAP WINTER

Grade	Level 1 Minimally Proficient		Level 2 Partially Proficient		Level 3 Proficient		Level 4 Highly Proficient	
	RIT	%ile	RIT	%ile	RIT	%ile	RIT	%ile
3	100-195	1-49	196-201	50-65	**202**-215	66-90	216-350	91-99
4	100-203	1-49	204-209	50-65	**210**-226	66-93	227-350	94-99
5	100-206	1-41	207-219	42-74	**220**-234	75-95	235-350	96-99
6	100-211	1-42	212-221	43-69	**222**-237	70-94	238-350	95-99
7	100-216	1-48	217-225	49-71	**226**-241	72-94	242-350	95-99
8	100-219	1-51	220-228	52-72	**229**-242	73-93	243-350	94-99

Notes. 1. %ile=percentile.

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

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

	AzMERIT			
Grade	Level 1 Minimally Proficient	Level 2 Partially Proficient	Level 3 Proficient	Level 4 Highly Proficient
3	3395-3494	3495-3530	**3531**-3572	3573-3605
4	3435-3529	3530-3561	**3562**-3605	3606-3645
5	3478-3562	3563-3594	**3595**-3634	3635-3688
6	3512-3601	3602-3628	**3629**-3662	3663-3722
7	3529-3628	3629-3651	**3652**-3679	3680-3739
8	3566-3649	3650-3672	**3673**-3704	3705-3776

	MAP FALL							
Grade	Level 1 Minimally Proficient		Level 2 Partially Proficient		Level 3 Proficient		Level 4 Highly Proficient	
	RIT	%ile	RIT	%ile	RIT	%ile	RIT	%ile
3	100-183	1-29	184-195	30-65	**196**-207	66-90	208-350	91-99
4	100-195	1-31	196-209	32-70	**210**-223	71-94*	224-350	94*-99
5	100-205	1-34	206-220	35-73	**221**-234	74-94*	235-350	94*-99
6	100-216	1-47	217-228	48-75	**229**-239	76-92*	240-350	92*-99
7	100-224	1-54	225-234	55-76	**235**-244	77-90	245-350	91-99
8	100-226	1-50	227-238	51-75	**239**-250	76-91	251-350	92-99

	MAP WINTER							
Grade	Level 1 Minimally Proficient		Level 2 Partially Proficient		Level 3 Proficient		Level 4 Highly Proficient	
	RIT	%ile	RIT	%ile	RIT	%ile	RIT	%ile
3	100-191	1-30	192-203	31-65	**204**-214	66-88	215-350	89-99
4	100-202	1-33	203-215	34-68	**216**-229	69-92	230-350	93-99
5	100-211	1-35	212-226	36-72	**227**-240	73-93	241-350	94-99
6	100-221	1-48	222-233	49-76	**234**-243	77-90	244-350	91-99
7	100-228	1-55	229-238	56-76	**239**-248	77-90	249-350	91-99
8	100-229	1-50	230-240	51-73	**241**-252	74-89	253-350	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.

Consistency Rate of Classification

Consistency rate of classification (Pommerich, Hanson, Harris, & Sconing, 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 AzMERIT 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 AzMERIT and MAP scores. The results in Table 5 demonstrate that on average, MAP reading scores can consistently classify students' proficiency (Level 3 or higher) status on AzMERIT ELA test approximately 84% of the time and MAP math scores can consistently classify students on AzMERIT math test approximately 88% 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 AzMERIT tests.

TABLE 5. CONSISTENCY RATE OF CLASSIFICATION FOR MAP AND AzMERIT LEVEL 3 EQUIPERCENTILE CONCORDANCES

Grade	ELA/Reading			Math		
	Consistency Rate	False		Consistency Rate	False	
		Positives	Negatives		Positives	Negatives
3	0.85	0.07	0.08	0.85	0.07	0.08
4	0.81	0.10	0.09	0.87	0.05	0.08
5	0.86	0.06	0.08	0.88	0.05	0.07
6	0.87	0.06	0.07	0.90	0.05	0.05
7	0.82	0.09	0.09	0.89	0.05	0.06
8	0.85	0.07	0.08	0.88	0.06	0.06

Proficiency Projection

Proficiency projection tells how likely a student is classified as "proficient" on AzMERIT 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 AzMERIT tests are presented in Tables 6 to 8. These tables estimate the probability of scoring at Level 3 or above on AzMERIT in the spring and the prior fall or winter testing season. For example, if a 3rd grade student obtained a MAP math score of 201 in the fall, the probability of obtaining a Level 3 or higher AzMERIT score in the spring of 3rd grade is 73%. Table 6 presents the estimated probability of meeting Level 3 benchmark when MAP is taken in the spring, whereas Tables 7 and 8 present the estimated probability of meeting Level 3 benchmark when MAP is taken in the fall or winter prior to taking the AzMERIT tests.

TABLE 6. PROFICIENCY PROJECTION AND PROBABILITY FOR PASSING AzMERIT LEVEL 3 (PROFICIENT) WHEN MAP IS TAKEN IN THE SPRING

Grade	ELA/Reading					Math				
	Start %ile	RIT Spring	Projected Proficiency			Start %ile	RIT Spring	Projected Proficiency		
			Cut Score	Level 3	Prob.			Cut Score	Level 3	Prob.
3	5	174	205	No	<0.01	5	181	209	No	<0.01
	10	179	205	No	<0.01	10	186	209	No	<0.01
	15	183	205	No	<0.01	15	189	209	No	<0.01
	20	186	205	No	<0.01	20	192	209	No	<0.01
	25	188	205	No	<0.01	25	194	209	No	<0.01
	30	191	205	No	<0.01	30	196	209	No	<0.01
	35	193	205	No	<0.01	35	198	209	No	<0.01
	40	195	205	No	<0.01	40	200	209	No	<0.01
	45	197	205	No	0.01	45	202	209	No	0.01
	50	199	205	No	0.03	50	203	209	No	0.02
	55	201	205	No	0.11	55	205	209	No	0.08
	60	202	205	No	0.17	60	207	209	No	0.25
	65	204	205	No	0.38	65	209	209	Yes	0.50
	70	207	205	Yes	0.73	70	211	209	Yes	0.75
	75	209	205	Yes	0.89	75	213	209	Yes	0.92
	80	211	205	Yes	0.97	80	215	209	Yes	0.98
	85	214	205	Yes	>0.99	85	218	209	Yes	>0.99
	90	218	205	Yes	>0.99	90	221	209	Yes	>0.99
	95	223	205	Yes	>0.99	95	226	209	Yes	>0.99
4	5	181	212	No	<0.01	5	189	221	No	<0.01
	10	187	212	No	<0.01	10	194	221	No	<0.01
	15	190	212	No	<0.01	15	198	221	No	<0.01
	20	193	212	No	<0.01	20	201	221	No	<0.01
	25	196	212	No	<0.01	25	203	221	No	<0.01
	30	198	212	No	<0.01	30	206	221	No	<0.01
	35	200	212	No	<0.01	35	208	221	No	<0.01
	40	202	212	No	<0.01	40	210	221	No	<0.01
	45	204	212	No	0.01	45	212	221	No	<0.01
	50	206	212	No	0.03	50	213	221	No	<0.01
	55	208	212	No	0.11	55	215	221	No	0.02
	60	210	212	No	0.27	60	217	221	No	0.08
	65	212	212	Yes	0.50	65	219	221	No	0.25
	70	214	212	Yes	0.73	70	221	221	Yes	0.50
	75	216	212	Yes	0.89	75	224	221	Yes	0.85
	80	218	212	Yes	0.97	80	226	221	Yes	0.96
	85	221	212	Yes	>0.99	85	229	221	Yes	>0.99
	90	225	212	Yes	>0.99	90	233	221	Yes	>0.99
	95	230	212	Yes	>0.99	95	238	221	Yes	>0.99

TABLE 6. (CONTINUED)

Grade	ELA/Reading					Math				
	Start %ile	RIT Spring	Projected Proficiency			Start %ile	RIT Spring	Projected Proficiency		
			Cut Score	Level 3	Prob.			Cut Score	Level 3	Prob.
5	5	188	221	No	<0.01	5	195	231	No	<0.01
	10	193	221	No	<0.01	10	201	231	No	<0.01
	15	197	221	No	<0.01	15	205	231	No	<0.01
	20	199	221	No	<0.01	20	208	231	No	<0.01
	25	202	221	No	<0.01	25	210	231	No	<0.01
	30	204	221	No	<0.01	30	213	231	No	<0.01
	35	206	221	No	<0.01	35	215	231	No	<0.01
	40	208	221	No	<0.01	40	217	231	No	<0.01
	45	210	221	No	<0.01	45	219	231	No	<0.01
	50	212	221	No	<0.01	50	221	231	No	<0.01
	55	214	221	No	0.01	55	223	231	No	<0.01
	60	216	221	No	0.06	60	225	231	No	0.02
	65	217	221	No	0.11	65	228	231	No	0.15
	70	220	221	No	0.38	70	230	231	No	0.37
	75	222	221	Yes	0.62	75	232	231	Yes	0.63
	80	224	221	Yes	0.83	80	235	231	Yes	0.92
	85	227	221	Yes	0.97	85	238	231	Yes	0.99
	90	231	221	Yes	>0.99	90	242	231	Yes	>0.99
	95	236	221	Yes	>0.99	95	248	231	Yes	>0.99
6	5	192	223	No	<0.01	5	198	237	No	<0.01
	10	197	223	No	<0.01	10	204	237	No	<0.01
	15	201	223	No	<0.01	15	208	237	No	<0.01
	20	203	223	No	<0.01	20	211	237	No	<0.01
	25	206	223	No	<0.01	25	214	237	No	<0.01
	30	208	223	No	<0.01	30	217	237	No	<0.01
	35	210	223	No	<0.01	35	219	237	No	<0.01
	40	212	223	No	<0.01	40	221	237	No	<0.01
	45	214	223	No	<0.01	45	223	237	No	<0.01
	50	216	223	No	0.01	50	225	237	No	<0.01
	55	218	223	No	0.06	55	227	237	No	<0.01
	60	219	223	No	0.11	60	230	237	No	0.01
	65	221	223	No	0.27	65	232	237	No	0.04
	70	223	223	Yes	0.50	70	234	237	No	0.15
	75	226	223	Yes	0.83	75	237	237	Yes	0.50
	80	228	223	Yes	0.94	80	239	237	Yes	0.75
	85	231	223	Yes	0.99	85	243	237	Yes	0.98
	90	235	223	Yes	>0.99	90	247	237	Yes	>0.99
	95	240	223	Yes	>0.99	95	253	237	Yes	>0.99

TABLE 6. (CONTINUED)

Grade	ELA/Reading					Math				
	Start %ile	RIT Spring	Projected Proficiency			Start %ile	RIT Spring	Projected Proficiency		
			Cut Score	Level 3	Prob.			Cut Score	Level 3	Prob.
7	5	193	227	No	<0.01	5	199	241	No	<0.01
	10	199	227	No	<0.01	10	206	241	No	<0.01
	15	202	227	No	<0.01	15	210	241	No	<0.01
	20	205	227	No	<0.01	20	214	241	No	<0.01
	25	208	227	No	<0.01	25	217	241	No	<0.01
	30	210	227	No	<0.01	30	219	241	No	<0.01
	35	212	227	No	<0.01	35	222	241	No	<0.01
	40	214	227	No	<0.01	40	224	241	No	<0.01
	45	216	227	No	<0.01	45	226	241	No	<0.01
	50	218	227	No	<0.01	50	229	241	No	<0.01
	55	220	227	No	0.01	55	231	241	No	<0.01
	60	222	227	No	0.06	60	233	241	No	<0.01
	65	224	227	No	0.17	65	235	241	No	0.02
	70	226	227	No	0.38	70	238	241	No	0.15
	75	228	227	Yes	0.62	75	241	241	Yes	0.50
	80	231	227	Yes	0.89	80	244	241	Yes	0.85
	85	234	227	Yes	0.99	85	247	241	Yes	0.98
	90	238	227	Yes	1.00	90	251	241	Yes	1.00
	95	243	227	Yes	1.00	95	258	241	Yes	1.00
8	5	194	230	No	<0.01	5	199	243	No	<0.01
	10	200	230	No	<0.01	10	206	243	No	<0.01
	15	204	230	No	<0.01	15	211	243	No	<0.01
	20	207	230	No	<0.01	20	215	243	No	<0.01
	25	209	230	No	<0.01	25	218	243	No	<0.01
	30	212	230	No	<0.01	30	221	243	No	<0.01
	35	214	230	No	<0.01	35	224	243	No	<0.01
	40	216	230	No	<0.01	40	226	243	No	<0.01
	45	218	230	No	<0.01	45	229	243	No	<0.01
	50	220	230	No	<0.01	50	231	243	No	<0.01
	55	222	230	No	0.01	55	233	243	No	<0.01
	60	224	230	No	0.03	60	236	243	No	0.01
	65	226	230	No	0.11	65	238	243	No	0.04
	70	228	230	No	0.27	70	241	243	No	0.25
	75	231	230	Yes	0.62	75	244	243	Yes	0.63
	80	233	230	Yes	0.83	80	247	243	Yes	0.92
	85	236	230	Yes	0.97	85	251	243	Yes	>0.99
	90	240	230	Yes	>0.99	90	255	243	Yes	>0.99
	95	246	230	Yes	>0.99	95	262	243	Yes	>0.99

Note. %ile=percentile

TABLE 7. PROFICIENCY PROJECTION AND PROBABILITY FOR PASSING AzMERIT ELA LEVEL 3 (PROFICIENT) WHEN MAP IS TAKEN IN THE FALL OR WINTER PRIOR TO SPRING AzMERIT TESTS

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut Score	Level 3	Prob.			Cut Score	Level 3	Prob.
3	5	162	205	No	<0.01	5	171	205	No	<0.01
	10	168	205	No	<0.01	10	176	205	No	<0.01
	15	172	205	No	<0.01	15	180	205	No	<0.01
	20	175	205	No	0.01	20	183	205	No	<0.01
	25	178	205	No	0.02	25	185	205	No	<0.01
	30	180	205	No	0.03	30	188	205	No	0.01
	35	182	205	No	0.05	35	190	205	No	0.01
	40	184	205	No	0.08	40	192	205	No	0.03
	45	186	205	No	0.13	45	194	205	No	0.06
	50	188	205	No	0.16	50	196	205	No	0.13
	55	190	205	No	0.24	55	198	205	No	0.22
	60	192	205	No	0.34	60	199	205	No	0.28
	65	194	205	No	0.39	65	201	205	No	0.42
	70	197	205	Yes	0.56	70	204	205	Yes	0.65
	75	199	205	Yes	0.66	75	206	205	Yes	0.72
	80	202	205	Yes	0.76	80	208	205	Yes	0.83
	85	205	205	Yes	0.87	85	211	205	Yes	0.94
	90	209	205	Yes	0.94	90	215	205	Yes	0.99
	95	214	205	Yes	0.98	95	221	205	Yes	>0.99
4	5	173	212	No	<0.01	5	179	212	No	<0.01
	10	178	212	No	<0.01	10	184	212	No	<0.01
	15	182	212	No	<0.01	15	188	212	No	<0.01
	20	185	212	No	0.01	20	191	212	No	<0.01
	25	188	212	No	0.01	25	194	212	No	<0.01
	30	190	212	No	0.03	30	196	212	No	0.01
	35	192	212	No	0.05	35	198	212	No	0.02
	40	194	212	No	0.07	40	200	212	No	0.04
	45	196	212	No	0.12	45	202	212	No	0.06
	50	198	212	No	0.18	50	204	212	No	0.12
	55	200	212	No	0.23	55	205	212	No	0.16
	60	202	212	No	0.33	60	207	212	No	0.28
	65	204	212	No	0.44	65	209	212	No	0.42
	70	206	212	Yes	0.56	70	211	212	Yes	0.58
	75	209	212	Yes	0.67	75	214	212	Yes	0.78
	80	211	212	Yes	0.77	80	216	212	Yes	0.88
	85	214	212	Yes	0.85	85	219	212	Yes	0.94
	90	218	212	Yes	0.95	90	223	212	Yes	0.99
	95	224	212	Yes	0.99	95	228	212	Yes	>0.99

TABLE 7. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 3	Prob.			Cut-Score	Level 3	Prob.
5	5	181	221	No	>0.01	5	186	221	No	<0.01
	10	186	221	No	<0.01	10	191	221	No	<0.01
	15	190	221	No	<0.01	15	195	221	No	<0.01
	20	193	221	No	<0.01	20	197	221	No	<0.01
	25	195	221	No	<0.01	25	200	221	No	<0.01
	30	198	221	No	0.01	30	202	221	No	<0.01
	35	200	221	No	0.02	35	204	221	No	<0.01
	40	202	221	No	0.04	40	206	221	No	0.01
	45	204	221	No	0.05	45	208	221	No	0.02
	50	206	221	No	0.09	50	210	221	No	0.04
	55	208	221	No	0.15	55	212	221	No	0.09
	60	210	221	No	0.23	60	214	221	No	0.17
	65	212	221	No	0.28	65	215	221	No	0.22
	70	214	221	No	0.38	70	218	221	No	0.42
	75	216	221	Yes	0.50	75	220	221	Yes	0.50
	80	218	221	Yes	0.56	80	222	221	Yes	0.65
	85	221	221	Yes	0.72	85	225	221	Yes	0.83
	90	225	221	Yes	0.85	90	229	221	Yes	0.96
	95	231	221	Yes	0.97	95	234	221	Yes	>0.99
6	5	186	223	No	<0.01	5	190	223	No	<0.01
	10	192	223	No	<0.01	10	196	223	No	<0.01
	15	196	223	No	<0.01	15	199	223	No	<0.01
	20	198	223	No	<0.01	20	202	223	No	<0.01
	25	201	223	No	0.01	25	204	223	No	<0.01
	30	203	223	No	0.02	30	207	223	No	<0.01
	35	205	223	No	0.04	35	209	223	No	0.01
	40	207	223	No	0.06	40	211	223	No	0.03
	45	209	223	No	0.10	45	212	223	No	0.04
	50	211	223	No	0.16	50	214	223	No	0.09
	55	213	223	No	0.23	55	216	223	No	0.12
	60	215	223	No	0.28	60	218	223	No	0.22
	65	217	223	No	0.39	65	220	223	No	0.35
	70	219	223	Yes	0.50	70	222	223	Yes	0.50
	75	221	223	Yes	0.56	75	224	223	Yes	0.65
	80	224	223	Yes	0.72	80	226	223	Yes	0.78
	85	226	223	Yes	0.81	85	229	223	Yes	0.91
	90	230	223	Yes	0.90	90	233	223	Yes	0.98
	95	236	223	Yes	0.99	95	238	223	Yes	>0.99

TABLE 7. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 3	Prob.			Cut-Score	Level 3	Prob.
7	5	189	227	No	<0.01	5	192	227	No	<0.01
	10	195	227	No	<0.01	10	198	227	No	<0.01
	15	199	227	No	<0.01	15	201	227	No	<0.01
	20	202	227	No	<0.01	20	204	227	No	<0.01
	25	204	227	No	<0.01	25	207	227	No	<0.01
	30	206	227	No	0.01	30	209	227	No	<0.01
	35	209	227	No	0.02	35	211	227	No	<0.01
	40	211	227	No	0.04	40	213	227	No	0.01
	45	213	227	No	0.07	45	215	227	No	0.02
	50	214	227	No	0.10	50	217	227	No	0.04
	55	216	227	No	0.12	55	219	227	No	0.09
	60	218	227	No	0.19	60	221	227	No	0.17
	65	220	227	No	0.28	65	223	227	No	0.28
	70	222	227	No	0.39	70	225	227	No	0.42
	75	225	227	Yes	0.50	75	227	227	Yes	0.58
	80	227	227	Yes	0.61	80	230	227	Yes	0.78
	85	230	227	Yes	0.77	85	232	227	Yes	0.83
	90	234	227	Yes	0.88	90	236	227	Yes	0.96
	95	240	227	Yes	0.98	95	242	227	Yes	>0.99
8	5	191	230	No	<0.01	5	194	230	No	<0.01
	10	197	230	No	<0.01	10	199	230	No	<0.01
	15	201	230	No	<0.01	15	203	230	No	<0.01
	20	204	230	No	<0.01	20	206	230	No	<0.01
	25	207	230	No	0.01	25	209	230	No	<0.01
	30	209	230	No	0.02	30	211	230	No	<0.01
	35	211	230	No	0.03	35	213	230	No	<0.01
	40	213	230	No	0.04	40	215	230	No	0.01
	45	215	230	No	0.06	45	217	230	No	0.01
	50	217	230	No	0.10	50	219	230	No	0.03
	55	219	230	No	0.16	55	221	230	No	0.07
	60	221	230	No	0.19	60	223	230	No	0.14
	65	223	230	No	0.26	65	225	230	No	0.23
	70	225	230	No	0.35	70	227	230	No	0.36
	75	228	230	No	0.45	75	229	230	Yes	0.50
	80	230	230	Yes	0.55	80	232	230	Yes	0.64
	85	234	230	Yes	0.74	85	235	230	Yes	0.82
	90	237	230	Yes	0.81	90	239	230	Yes	0.95
	95	243	230	Yes	0.95	95	244	230	Yes	0.99

Note. %ile=percentile

TABLE 8. PROFICIENCY PROJECTION AND PROBABILITY FOR PASSING AzMERIT MATH LEVEL 3 (PROFICIENT) WHEN MAP IS TAKEN IN THE FALL OR WINTER PRIOR TO SPRING AzMERIT TESTS

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut Score	Level 3	Prob.			Cut Score	Level 3	Prob.
3	5	169	209	No	<0.01	5	176	209	No	<0.01
	10	174	209	No	<0.01	10	181	209	No	<0.01
	15	177	209	No	<0.01	15	184	209	No	<0.01
	20	179	209	No	0.01	20	187	209	No	<0.01
	25	182	209	No	0.02	25	189	209	No	<0.01
	30	184	209	No	0.03	30	191	209	No	<0.01
	35	185	209	No	0.04	35	193	209	No	0.01
	40	187	209	No	0.08	40	195	209	No	0.03
	45	189	209	No	0.14	45	197	209	No	0.07
	50	190	209	No	0.17	50	198	209	No	0.10
	55	192	209	No	0.27	55	200	209	No	0.20
	60	194	209	No	0.38	60	202	209	No	0.34
	65	195	209	No	0.44	65	203	209	No	0.42
	70	197	209	Yes	0.56	70	205	209	Yes	0.58
	75	199	209	Yes	0.62	75	207	209	Yes	0.74
	80	201	209	Yes	0.73	80	209	209	Yes	0.86
	85	204	209	Yes	0.86	85	212	209	Yes	0.95
	90	207	209	Yes	0.94	90	215	209	Yes	0.99
	95	212	209	Yes	0.99	95	220	209	Yes	>0.99
4	5	179	221	No	<0.01	5	185	221	No	<0.01
	10	184	221	No	<0.01	10	190	221	No	<0.01
	15	188	221	No	<0.01	15	194	221	No	<0.01
	20	190	221	No	<0.01	20	197	221	No	<0.01
	25	193	221	No	0.01	25	199	221	No	<0.01
	30	195	221	No	0.01	30	201	221	No	<0.01
	35	197	221	No	0.03	35	203	221	No	<0.01
	40	198	221	No	0.04	40	205	221	No	0.01
	45	200	221	No	0.08	45	207	221	No	0.03
	50	202	221	No	0.14	50	209	221	No	0.07
	55	204	221	No	0.22	55	211	221	No	0.14
	60	205	221	No	0.22	60	212	221	No	0.20
	65	207	221	No	0.32	65	214	221	No	0.34
	70	209	221	No	0.44	70	216	221	Yes	0.50
	75	211	221	Yes	0.56	75	218	221	Yes	0.66
	80	214	221	Yes	0.73	80	221	221	Yes	0.86
	85	216	221	Yes	0.83	85	223	221	Yes	0.93
	90	220	221	Yes	0.94	90	227	221	Yes	0.99
	95	225	221	Yes	0.99	95	232	221	Yes	>0.99

TABLE 8. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 3	Prob.			Cut-Score	Level 3	Prob.
5	5	187	231	No	<0.01	5	192	231	No	<0.01
	10	193	231	No	<0.01	10	198	231	No	<0.01
	15	196	231	No	<0.01	15	201	231	No	<0.01
	20	199	231	No	<0.01	20	204	231	No	<0.01
	25	202	231	No	<0.01	25	207	231	No	<0.01
	30	204	231	No	0.01	30	209	231	No	<0.01
	35	206	231	No	0.01	35	211	231	No	<0.01
	40	208	231	No	0.03	40	213	231	No	<0.01
	45	210	231	No	0.05	45	215	231	No	0.01
	50	211	231	No	0.07	50	217	231	No	0.02
	55	213	231	No	0.12	55	219	231	No	0.05
	60	215	231	No	0.19	60	221	231	No	0.11
	65	217	231	No	0.28	65	223	231	No	0.20
	70	219	231	No	0.38	70	225	231	No	0.34
	75	221	231	Yes	0.50	75	228	231	Yes	0.58
	80	224	231	Yes	0.67	80	230	231	Yes	0.73
	85	227	231	Yes	0.81	85	233	231	Yes	0.89
	90	230	231	Yes	0.91	90	237	231	Yes	0.98
	95	236	231	Yes	0.99	95	242	231	Yes	>0.99
6	5	192	237	No	<0.01	5	196	237	No	<0.01
	10	198	237	No	<0.01	10	202	237	No	<0.01
	15	202	237	No	<0.01	15	205	237	No	<0.01
	20	205	237	No	<0.01	20	209	237	No	<0.01
	25	207	237	No	<0.01	25	211	237	No	<0.01
	30	209	237	No	<0.01	30	214	237	No	<0.01
	35	212	237	No	0.01	35	216	237	No	<0.01
	40	214	237	No	0.01	40	218	237	No	<0.01
	45	216	237	No	0.03	45	220	237	No	<0.01
	50	218	237	No	0.05	50	222	237	No	0.01
	55	220	237	No	0.09	55	224	237	No	0.02
	60	222	237	No	0.15	60	226	237	No	0.05
	65	224	237	No	0.23	65	228	237	No	0.11
	70	226	237	No	0.33	70	230	237	No	0.20
	75	228	237	No	0.44	75	233	237	No	0.42
	80	231	237	Yes	0.62	80	236	237	Yes	0.66
	85	234	237	Yes	0.72	85	239	237	Yes	0.85
	90	238	237	Yes	0.88	90	243	237	Yes	0.97
	95	243	237	Yes	0.97	95	248	237	Yes	>0.99

TABLE 8. (CONTINUED)

Grade	Start %ile	RIT Fall	Projected Proficiency			Start %ile	RIT Winter	Projected Proficiency		
			Cut-Score	Level 3	Prob.			Cut-Score	Level 3	Prob.
7	5	195	241	No	<0.01	5	198	241	No	<0.01
	10	201	241	No	<0.01	10	204	241	No	<0.01
	15	205	241	No	<0.01	15	208	241	No	<0.01
	20	209	241	No	<0.01	20	212	241	No	<0.01
	25	211	241	No	<0.01	25	215	241	No	<0.01
	30	214	241	No	<0.01	30	217	241	No	<0.01
	35	216	241	No	<0.01	35	220	241	No	<0.01
	40	218	241	No	<0.01	40	222	241	No	<0.01
	45	221	241	No	0.02	45	224	241	No	<0.01
	50	223	241	No	0.03	50	226	241	No	<0.01
	55	225	241	No	0.06	55	228	241	No	0.01
	60	227	241	No	0.11	60	230	241	No	0.03
	65	229	241	No	0.18	65	233	241	No	0.10
	70	231	241	No	0.27	70	235	241	No	0.20
	75	234	241	No	0.44	75	238	241	No	0.42
	80	237	241	Yes	0.62	80	240	241	Yes	0.58
	85	240	241	Yes	0.78	85	244	241	Yes	0.85
	90	244	241	Yes	0.92	90	248	241	Yes	0.97
	95	250	241	Yes	0.99	95	254	241	Yes	>0.99
8	5	197	243	No	<0.01	5	199	243	No	<0.01
	10	203	243	No	<0.01	10	206	243	No	<0.01
	15	208	243	No	<0.01	15	210	243	No	<0.01
	20	211	243	No	<0.01	20	214	243	No	<0.01
	25	214	243	No	<0.01	25	217	243	No	<0.01
	30	217	243	No	<0.01	30	220	243	No	<0.01
	35	219	243	No	0.01	35	222	243	No	<0.01
	40	222	243	No	0.02	40	225	243	No	<0.01
	45	224	243	No	0.03	45	227	243	No	<0.01
	50	226	243	No	0.06	50	229	243	No	0.01
	55	229	243	No	0.12	55	231	243	No	0.02
	60	231	243	No	0.18	60	234	243	No	0.08
	65	233	243	No	0.26	65	236	243	No	0.16
	70	236	243	No	0.35	70	239	243	No	0.35
	75	238	243	No	0.45	75	241	243	Yes	0.50
	80	241	243	Yes	0.60	80	245	243	Yes	0.79
	85	245	243	Yes	0.78	85	248	243	Yes	0.92
	90	249	243	Yes	0.90	90	253	243	Yes	0.99
	95	256	243	Yes	>0.99	95	259	243	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 AzMERIT performance level. By using matched score data from a sample of students from Arizona, 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 NWEA 2015 RIT Scale 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 AzMERIT 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 AzMERIT 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 37 schools in Arizona, which may limit the generalizability of the results to test takers who differ significantly from this sample. Finally, cautions should also be exercised if the concorded scores are used for a subpopulation. NWEA will continue to gather information about AzMERIT performance from other schools to enhance the quality and generalizability of the study.

References

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Appendix

Data and Analysis

Data

Data used in this study were collected from 37 schools in Arizona. The sample contained matched AzMERIT ELA and MAP reading scores from 9,598 students in Grades 3 to 8 and matched AzMERIT and MAP math scores from 9,918 students in Grades 3 to 8 who completed both AzMERIT and MAP in the spring of 2015.

To understand the statistical characteristics of the test scores, descriptive statistics are provided in Table A1. As Table A1 indicates, the correlation coefficients between MAP reading and AzMERIT ELA scores range from 0.81 to 0.84, and the correlation coefficients between MAP and AzMERIT math scores range from 0.84 to 0.89. All these correlations indicate a strong relationship between MAP and AzMERIT test scores.

TABLE A1. DESCRIPTIVE STATISTICS OF THE SAMPLE DATA

Subject	Grade	N	r	AzMERIT				MAP			
				Mean	SD	Min	Max	Mean	SD	Min	Max
ELA/ Reading	3	1,779	0.83	2502	29.97	2421	2605	199	15.73	143	240
	4	1,572	0.84	2515	27.65	2437	2610	207	15.18	144	246
	5	1,651	0.83	2528	27.13	2443	2620	212	14.77	145	253
	6	1,501	0.82	2542	29.80	2471	2641	216	15.01	145	277
	7	1,493	0.81	2550	27.84	2473	2642	220	14.79	146	258
	8	1,602	0.82	2561	28.33	2481	2658	224	14.81	155	263
Math	3	1,776	0.84	3522	40.15	3420	3605	205	14.13	150	266
	4	1,573	0.88	3553	37.55	3466	3645	215	15.86	145	270
	5	1,652	0.87	3583	36.46	3479	3688	223	16.47	169	291
	6	1,503	0.85	3612	34.49	3534	3722	226	16.32	151	283
	7	1,559	0.88	3636	40.51	3529	3787	232	17.33	171	286
	8	1,855	0.89	3665	40.71	3566	3789	237	18.06	171	291

Equipercentile Linking Procedure

The equipercentile procedure (e.g., Kolen & Brennan, 2004) was used to establish the concordance relationship between AzMERIT and MAP scores for grades 3 to 8 in ELA/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., AzMERIT). 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):

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

where $e_y(x)$ is the equipercentile equivalent of scores on AzMERIT 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 be proficient (i.e., Level 3 or higher) on AzMERIT tests.

To calculate consistency rate of classification, sample students were designated "Below AzMERIT cut" or "At or above AzMERIT cut" based on their actual AzMERIT 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 AzMERIT 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 AzMERIT 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 AzMERIT 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 AzMERIT cut scores. Students classified in the *false negative* (FN) category were those predicated to be Not Proficient based on the MAP cut scores but were classified as Proficient based on the AzMERIT 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 AzMERIT TO MAP CONCORDANCE

		AzMERIT Score	
		Below AzMERIT cut	At or Above AzMERIT cut
MAP Score	Below MAP cut	True Negative	False Positive
	At or Above MAP cut	False Negative	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 AzMERIT based on that student's MAP scores in prior seasons (e.g. fall and winter). The probability of a student achieving Level 3 (Proficient) on AzMERIT, based on his/her fall or winter MAP score is given in Equation (A2):

$$Pr(Achieveing\ Level\ 3\ in\ spring | a\ RIT\ score\ of\ x) = 1 - \Phi\left(\frac{x + g - c}{SD}\right) \qquad (A2)$$

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 3 on the AzMERIT tests, based on his/her spring score s, it can be calculated by Equation (A3):

$$Pr(Achieveing\ Level\ 3\ in\ spring | a\ RIT\ score\ of\ s\ in\ spring) = 1 - \Phi\left(\frac{s - c}{SE}\right) \qquad (A3)$$

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