Linking Study Report: Predicting Performance on the Colorado Measures of Academic Success (CMAS) based on NWEA MAP Growth Scores

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NWEA Psychometric Solutions

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Executive Summary

To predict student achievement on the Colorado Measures of Academic Progress (CMAS) in Grades 3–8 English Language Arts (ELA) and Mathematics, NWEA® conducted a linking study using Spring 2018 data to derive Rasch Unit (RIT) cut scores on the MAP® Growth™ assessments that correspond to the CMAS performance levels. With this information, educators can identify students at risk of failing to meet state proficiency standards early in the year and provide tailored educational interventions. The linking study has been updated since the previous version published in February 2020 to incorporate the new 2020 NWEA MAP Growth norms (Thum & Kuhfeld, 2020).

Table E.1 presents the *Met Expectations* performance level cut scores and the corresponding MAP Growth RIT cut scores that allow teachers to identify students who are on track for proficiency on the state summative test and those who are not. For example, the *Met Expectations* cut score on the CMAS Grade 3 ELA test is 750. A Grade 3 student with a MAP Growth Reading RIT score of 194 in the fall is likely to meet proficiency on the CMAS ELA test in the spring, whereas a Grade 3 student with a MAP Growth Reading RIT score lower than 194 in the fall is in jeopardy of not meeting proficiency. MAP Growth cut scores for Grade 2 are also provided so educators can track early learners' progress toward proficiency on the CMAS test by Grade 3. These cut scores were derived based on the Grade 3 cuts and the 2020 NWEA growth norms for the adjacent grade (i.e., Grades 2 to 3).

Table E.1. MAP Growth Cut Scores for CMAS Proficiency

Assessment		*Met Expectations* Cut Scores by Grade						
		2	3	4	5	6	7	8
ELA/Reading								
CMAS Spring		–	750	750	750	750	750	750
MAP Growth	Fall	182	194	203	209	215	218	223
	Winter	190	201	208	213	219	221	225
	Spring	194	204	210	215	220	222	226
Mathematics								
CMAS Spring		–	750	750	750	750	750	750
MAP Growth	Fall	183	196	210	218	226	233	237
	Winter	192	203	217	224	231	237	240
	Spring	197	208	221	228	234	240	242

Please note that the results in this report may differ from those found in the NWEA reporting system for individual districts. The typical growth scores from fall to spring or winter to spring used in this report are based on the default instructional weeks most commonly encountered for each term (i.e., Weeks 4, 20, and 32 for fall, winter, and spring, respectively). However, instructional weeks often vary by district, so the cut scores in this report may differ slightly from the MAP Growth score reports that reflect spring instructional weeks set by partners.

E.1. Assessment Overview

The CMAS Grades 3–8 ELA and Mathematics tests are Colorado's state summative assessments aligned to the Colorado Academic Standards. Based on their test scores, students are placed into one of five performance levels: *Did Not Yet Meet Expectations, Partially Met Expectations, Approached Expectations, Met Expectations,* and *Exceeded Expectations*. These tests are used to provide evidence of student achievement in ELA and Mathematics for various test score uses such as meeting the requirements of the state's accountability program. The *Met Expectations* cut score demarks the minimum level of achievement considered to be proficient. MAP Growth tests are adaptive interim assessments aligned to state-specific content standards and administered in the fall, winter, and spring. Scores are reported on the RIT vertical scale with a range of 100–350.

E.2. Linking Methods

Based on scores from the Spring 2018 test administration, the equipercentile linking method was used to identify the spring MAP Growth scores that correspond to the spring CMAS performance level cut scores. Spring cuts for Grade 2 were derived based on the cuts for Grade 3 and the 2020 NWEA growth norms. MAP Growth fall and winter cut scores that predict proficiency on the spring CMAS test were then projected using the 2020 NWEA growth norms that provide expected score gains across test administrations.

E.3. Student Sample

Only students who took both the MAP Growth and CMAS assessments in Spring 2018 were included in the study sample. Table E.2 presents the weighted number of Colorado students from 15 districts and 106 schools who were included in the linking study. The linking study sample is voluntary and can only include student scores from partners who share their data. Also, not all students in a state take MAP Growth. The sample may therefore not represent the general student population as well as it should. To ensure that the linking study sample represents the state student population in terms of race, sex, and performance level, weighting (i.e., a statistical method that matches the distributions of the variables of interest to those of the target population) was applied to the sample. As a result, the RIT cuts derived from the study sample can be generalized to any student from the target population. All analyses in this study for Grades 3–8 were conducted based on the weighted sample.

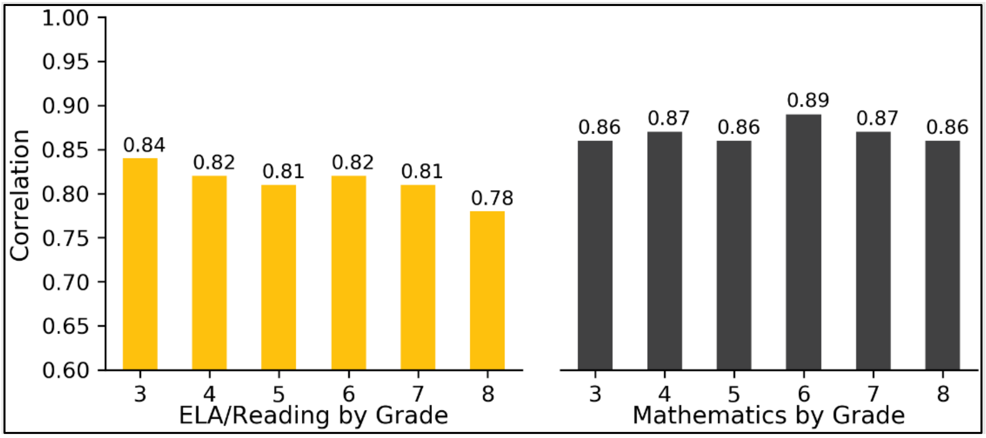
Table E.2. Linking Study Sample

	#Students	
Grade	**ELA/Reading**	**Mathematics**
3	3,518	4,528
4	4,671	4,636
5	4,427	4,767
6	4,436	4,743
7	4,144	4,293
8	3,152	3,484

E.4. Test Score Relationships

Correlations between MAP Growth RIT scores and CMAS scores range from 0.78 to 0.89 across both content areas, as shown in Figure E.1. These values indicate a strong relationship among the scores, which is important validity evidence for the claim that MAP Growth scores are good predictors of performance on the CMAS assessments.

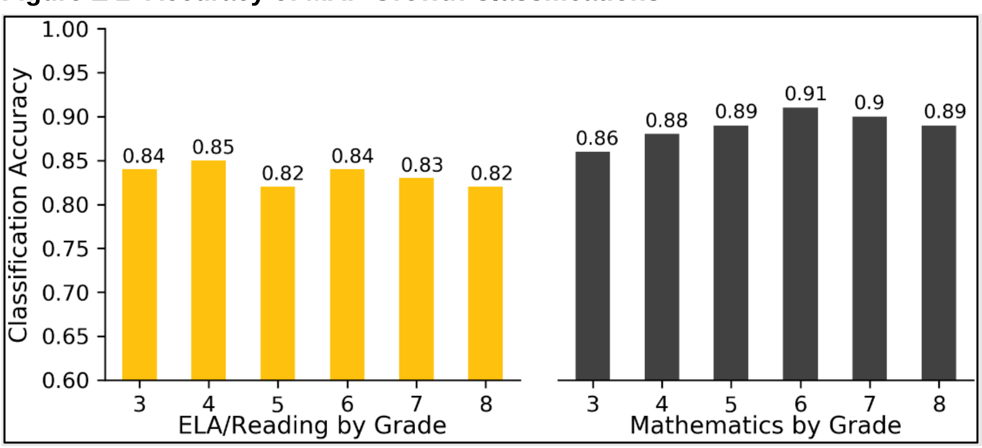
Figure E.1. Correlations between MAP Growth and CMAS



E.5. Accuracy of MAP Growth Classifications

Figure E.2 presents the classification accuracy statistics that show the proportion of students correctly classified by their RIT scores as proficient or not proficient on the CMAS tests. For example, the MAP Growth Reading Grade 3 *Met Expectations* cut score has a 0.84 accuracy rate, meaning it accurately classified student achievement on the state test for 84% of the sample. The results range from 0.82 to 0.91 across both content areas, indicating that RIT scores have a high accuracy rate of identifying student proficiency on the CMAS tests.

Figure E.2. Accuracy of MAP Growth Classifications



1. Introduction

1.1. Purpose of the Study

NWEA® is committed to providing partners with useful tools to help make inferences about student learning from MAP® Growth™ test scores. One important use of MAP Growth results is to predict a student's performance on the state summative assessment at different times throughout the year. This allows educators and parents to determine if a student is on track in their learning to meet state standards by the end of the year or, given a student's learning profile, is on track to obtain rigorous, realistic growth in their content knowledge and skills.

This document presents results from a linking study conducted by NWEA in July 2020 to statistically connect the scores of the Colorado Measures of Academic Success (CMAS) in Grades 3–8 English Language Arts (ELA) and Mathematics with Rasch Unit (RIT) scores from the MAP Growth assessments taken during the Spring 2018 term. The linking study has been updated since the previous version published in February 2020 to incorporate the new 2020 NWEA MAP Growth norms (Thum & Kuhfeld, 2020). In this updated study, MAP Growth cut scores are also included for Grade 2 so educators can track early learners' progress toward proficiency on the CMAS test by Grade 3. This report presents the following results:

1. Student sample demographics
2. Descriptive statistics of test scores
3. MAP Growth RIT cut scores that correspond to the CMAS performance levels using the equipercentile linking procedure for the spring results and the 2020 norms for the fall and winter results
4. Classification accuracy statistics to determine the degree to which MAP Growth accurately predicts student proficiency status on the CMAS tests
5. The probability of achieving grade-level proficiency on the CMAS assessment based on MAP Growth RIT scores from fall, winter, and spring using the 2020 norms

1.2. Assessment Overview

The CMAS Grades 3–8 ELA and Mathematics summative assessments are aligned to the Colorado Academic Standards. Each assessment has four cut scores (i.e., the minimum score a student must get on a test to be placed in a certain performance level) that distinguish between the following performance levels: *Did Not Yet Meet Expectations, Partially Met Expectations, Approached Expectations, Met Expectations,* and *Exceeded Expectations.* The *Met Expectations* cut score demarks the minimum level of performance considered to be proficient for accountability purposes.

MAP Growth interim assessments from NWEA are computer adaptive and aligned to state-specific content standards. Scores are reported on the RIT vertical scale with a range of 100–350. Each content area has its own scale. To aid the interpretation of scores, NWEA periodically conducts norming studies of student and school performance on MAP Growth. Achievement status norms show how well a student performed on the MAP Growth test compared to students in the norming group by associating the student's performance on the MAP Growth test, expressed as a RIT score, with a percentile ranking. Growth norms provide expected score gains across test administrations (e.g., the relative evaluation of a student's growth from fall to spring). The most recent norms study was conducted in 2020 (Thum & Kuhfeld, 2020).

2. Methods

2.1. Data Collection

This linking study is based on data from the Spring 2018 administrations of the MAP Growth and CMAS assessments. NWEA recruited Colorado districts to participate in the study by sharing their student and score data for the target term. Districts also gave NWEA permission to access students' associated MAP Growth scores from the NWEA in-house database. Once Colorado state score information was received by NWEA, each student's state testing record was matched to their MAP Growth score by using the student's first and last names, date of birth, student ID, and other available identifying information. Only students who took both the MAP Growth and CMAS assessments in Spring 2018 were included in the study sample.

2.2. Post-Stratification Weighting

Post-stratification weights were applied to the calculations to ensure that the linking study sample represented the state population in terms of race, sex, and performance level. These variables were selected because they are correlated with the student's academic achievement within this study and are often provided in the data for the state population. The weighted sample matches the target population as closely as possible on the key demographics and test score characteristics. Specifically, a raking procedure was used to calculate the post-stratification weights and improve the representativeness of the sample. Raking uses iterative procedures to obtain weights that match sample marginal distributions to known population margins. The following steps were taken during this process:

- Calculate marginal distributions of race, sex, and performance level for the sample and population.
- Calculate post-stratification weights with the rake function from the survey package in R (Lumley, 2019).
- Trim the weight if it is not in the range of 0.3 to 3.0.
- Apply the weights to the sample before conducting the linking study analyses.

2.3. MAP Growth Cut Scores

The equipercentile linking method (Kolen & Brennan, 2004) was used to identify the spring RIT scores that correspond to the spring CMAS performance level cut scores. Spring cuts for Grade 2 were derived based on the cuts for Grade 3 and the 2020 NWEA growth norms. RIT fall and winter cut scores that predict proficiency on the spring CMAS test were then projected using the 2020 growth norms. Percentile ranks are also provided that show how a nationally representative sample of students in the same grade scored on MAP Growth for each administration, which is an important interpretation of RIT scores. This is useful for understanding (1) how student scores compare to peers nationwide and (2) the relative rigor of a state's performance level designations for its summative assessment.

The MAP Growth spring cut scores for Grades 3–8 could be calculated using the equipercentile linking method because that data are directly connected to the CMAS spring data used in the study. The equipercentile linking procedure matches scores on the two scales that have the same percentile rank (i.e., the proportion of tests at or below each score). For example, let x represent a score on Test X (e.g., CMAS). Its equipercentile equivalent score on Test Y (e.g., MAP Growth), $e_y(x)$, can be obtained through a cumulative-distribution-based linking function defined in Equation 1:

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

where $e_y(x)$ is the equipercentile equivalent of score x on CMAS on the scale of MAP Growth, $P(x)$ is the percentile rank of a given score on CMAS, and G^{-1} is the inverse of the percentile rank function for MAP Growth that indicates the score on MAP Growth corresponding to a given percentile. Polynomial loglinear pre-smoothing was applied to reduce irregularities of the score distributions and equipercentile linking curve.

The MAP Growth conditional growth norms provide students' expected score gains across terms, such as growth from fall or winter to spring within the same grade or from spring of a lower grade to the spring of the adjacent higher grade. This information can be used to calculate the fall and winter cut scores for Grades 3–8 and the fall, winter, and spring cut scores for Grade 2. Equation 2 was used to determine the previous term's or grade's MAP Growth score needed to reach the spring cut score, considering the expected growth associated with the previous RIT score:

$$RIT_{PredSpring} = RIT_{previous} + g \tag{2}$$

where:

- $RIT_{PredSpring}$ is the predicted MAP Growth spring score.
- $RIT_{previous}$ is the previous term's or grade's RIT score.
- g is the expected growth from the previous RIT (e.g., fall or winter) to the spring RIT.

To derive the spring cut scores for Grade 2, the growth score from spring of one year to the next was used (i.e., the growth score from spring Grade 2 to spring Grade 3). The calculation of fall and winter cuts for Grade 2 followed the same process as the other grades. For example, the growth score from fall to spring in Grade 2 was used to calculate the fall cuts for Grade 2.

2.4. Classification Accuracy

The degree to which MAP Growth predicts student proficiency status on the CMAS tests can be described using classification accuracy statistics based on the MAP Growth RIT spring cut scores that show the proportion of students correctly classified by their RIT scores as proficient (*Met Expectations* or *Exceeded Expectations*) or not proficient (*Did Not Yet Meet Expectations, Partially Met Expectations, or Approached Expectations*). Table 2.1 describes the classification accuracy statistics provided in this report (Pommerich, Hanson, Harris, & Sconing, 2004). The results are based on the Spring 2018 MAP Growth and CMAS data for the *Met Expectations* cut score.

Since Colorado students do not begin taking the CMAS assessment until Grade 3, longitudinal data were collected for the 2017–2018 Grade 3 cohort in order to link the CMAS assessment to MAP Growth for Grade 2 to calculate the classification accuracy statistics. To accomplish this, 2017–2018 CMAS Grade 3 results were linked to MAP Growth data from Grade 3 students in 2017–2018 and Grade 2 students in 2016–2017. In this way, the data came from the same cohort of students beginning when they were in Grade 2 and continuing through Grade 3.

Table 2.1. Description of Classification Accuracy Summary Statistics

Statistic	Description*	Interpretation
Overall Classification Accuracy Rate	(TP + TN) / (total sample size)	Proportion of the study sample whose proficiency classification on the state test was correctly predicted by MAP Growth cut scores
False Negative (FN) Rate	FN / (FN + TP)	Proportion of not-proficient students identified by MAP Growth in those observed as proficient on the state test
False Positive (FP) Rate	FP / (FP + TN)	Proportion of proficient students identified by MAP Growth in those observed as not proficient on the state test
Sensitivity	TP / (TP + FN)	Proportion of proficient students identified by MAP Growth in those observed as such on the state test
Specificity	TN / (TN + FP)	Proportion of not-proficient students identified by MAP Growth in those observed as such on the state test
Precision	TP / (TP + FP)	Proportion of observed proficient students on the state test in those identified as such by the MAP Growth test
Area Under the Curve (AUC)	Area under the receiver operating characteristics (ROC) curve	How well MAP Growth cut scores separate the study sample into proficiency categories that match those from the state test cut scores. An AUC at or above 0.80 is considered "good" accuracy.

*FP = false positives. FN = false negatives. TP = true positives. TN = true negatives.

2.5. Proficiency Projection

In addition to calculating the MAP Growth fall and winter cut scores, the MAP Growth conditional growth norms data were also used to calculate the probability of reaching proficiency on the CMAS test based on a student's RIT scores from fall, winter, and spring. Equation 3 was used to calculate the probability of a student achieving *Met Expectations* proficiency on the CMAS test based on their fall or winter RIT score:

$$Pr(Achieving\ Met\ Expectations\ in\ spring|\ starting\ RIT) = \Phi\left(\frac{RIT_{previous} + g - RIT_{SpringCut}}{SD}\right) \quad (3)$$

where:

- Φ is a standardized normal cumulative distribution.
- $RIT_{previous}$ is the student's RIT score in fall or winter (or in spring of Grade 2).
- g is the expected growth from the previous RIT (e.g., fall or winter) to the spring RIT.
- $RIT_{SpringCut}$ is the MAP Growth *Met Expectations* cut score for spring. For Grade 2, this is the Grade 3 cut score for spring.
- SD is the conditional standard deviation of the expected growth, g.

Equation 4 was used to estimate the probability of a student achieving *Met Expectations* proficiency on the CMAS test based on their spring RIT score (RIT_{Spring}):

$$Pr(Achieving\ Met\ Expectations\ in\ spring\ |\ spring\ RIT) = \Phi\left(\frac{RIT_{Spring} - RIT_{SpringCut}}{SE}\right) \quad (4)$$

where SE is the standard error of measurement for MAP Growth.

3. Results

3.1. Study Sample

Only students who took both the MAP Growth and CMAS assessments in Spring 2018 were included in the study sample. Data used in this study were collected from 15 districts and 106 schools in Colorado. Table 3.1 presents the demographic distributions of race, sex, and performance level in the original unweighted study sample, and Table 3.2 presents the distributions of the student population that took the Spring 2018 CMAS tests (CDE, 2018). Since the unweighted data are different from the general CMAS population, post-stratification weights were applied to the linking study sample to improve its representativeness. Table 3.3 presents the demographic distributions of the sample after weighting, which are almost identical to the CMAS student population distributions. The analyses in this study were therefore conducted based on the weighted sample.

Table 3.1. Linking Study Sample Demographics (Unweighted)

Linking Study Sample (Unweighted)							
Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
ELA/Reading							
	Total N	3,514	4,676	4,423	4,436	4,144	3,152
Race	Asian	4.5	3.5	4.0	3.9	4.1	5.0
	Black	1.2	1.3	1.6	1.6	1.6	1.7
	Hispanic	39.9	35.7	36.4	38.9	42.5	41.8
	Multiracial	3.7	3.8	3.6	2.6	2.8	2.3
	Other	6.7	5.5	5.2	2.1	0.8	0.6
	White	44.0	50.1	49.2	51.1	48.	48.5
Sex	Female	47.3	47.6	48.3	48.4	49.2	46.2
	Male	52.7	52.4	51.7	51.6	50.8	53.8
Performance Level	*Did Not Yet Meet*	19.2	11.1	10.2	12.5	15.4	17.0
	Partially Met	19.0	18.1	17.2	21.8	17.7	18.0
	Approached	24.2	26.3	27.7	28.6	24.3	24.0
	Met	33.5	33.8	39.2	30.6	30.0	31.6
	Exceeded	4.1	10.6	5.7	6.5	12.7	9.4
Mathematics							
	Total N	4,523	4,641	4,767	4,738	4,293	3,484
Race	Asian	3.7	3.6	3.9	3.8	4.0	4.3
	Black	1.1	1.3	1.5	1.5	1.6	1.7
	Hispanic	36.7	35.6	35.9	38.1	42.0	40.2
	Multiracial	3.6	3.9	3.5	2.5	3.0	2.7
	Other	6.1	6.3	5.7	1.5	1.0	0.6
	White	48.8	49.3	49.5	52.6	48.5	50.5
Sex	Female	47.3	47.6	48.3	48.4	48.9	47.2
	Male	52.7	52.4	51.7	51.6	51.1	52.8

Linking Study Sample (Unweighted)							
Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
Performance Level	*Did Not Yet Meet*	18.3	17.3	15.5	15.6	11.4	19.9
	Partially Met	23.6	25.6	24.7	28.5	26.5	20.6
	Approached	27.0	27.0	27.2	28.7	34.1	24.0
	Met	25.1	27.9	27.3	22.7	25.5	30.0
	Exceeded	6.1	2.2	5.4	4.4	2.5	5.5

Table 3.2. Spring 2018 CMAS Student Population Demographics

Spring 2018 CMAS Population							
Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
ELA							
	Total N	63,016	64,789	65,359	63,647	60,907	58,684
Race	Asian	3.0	3.1	3.1	3.1	3.4	3.4
	Black	4.8	4.6	4.6	4.5	4.6	4.5
	Hispanic	33.3	33.9	34.9	34.3	35.2	34.9
	Multiracial	4.6	4.6	4.5	4.2	4.1	3.8
	Other	0.9	0.9	1.0	1.0	1.0	1.0
	White	53.3	52.8	52.0	52.9	51.7	52.5
Sex	Female	48.7	48.5	48.7	48.6	48.6	48.3
	Male	51.3	51.5	51.3	51.4	51.4	51.7
Performance Level	*Did Not Yet Meet*	17.8	10.6	9.9	10.5	14.4	14.7
	Partially Met	18.1	17.2	16.1	18.9	15.7	17.1
	Approached	23.8	26.1	26.7	27.8	23.3	24.4
	Met	36.7	35.6	41.9	35.1	31.5	33.4
	Exceeded	3.7	10.4	5.5	7.7	15.1	10.4
Mathematics							
	Total N	64,714	65,995	65,516	63,765	59,983	49,189
Race	Asian	3.0	3.1	3.1	3.2	3.2	2.8
	Black	4.7	4.6	4.6	4.5	4.6	5.0
	Hispanic	35.0	35.0	35.0	34.4	35.8	38.8
	Multiracial	4.5	4.5	4.5	4.2	4.1	3.7
	Other	0.9	0.9	0.9	1.0	1.0	1.1
	White	52.0	51.8	51.9	52.8	51.2	48.5
Sex	Female	48.7	48.6	48.7	48.6	48.8	48.3
	Male	51.3	51.4	51.3	51.4	51.2	51.7
Performance Level	*Did Not Yet Meet*	14.3	15.4	13.7	14.1	12.3	22.9
	Partially Met	19.8	23.5	23.1	27.2	24.7	23.6
	Approached	26.9	27.2	27.7	28.4	34.2	25.4
	Met	31.0	31.1	29.3	26.2	26.0	25.4
	Exceeded	8.1	2.7	6.2	4.2	2.8	2.7

Table 3.3. Linking Study Sample Demographics (Weighted)

Linking Study Sample (Weighted)							
Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
ELA/Reading							
	Total N	3,518	4,671	4,427	4,436	4,144	3,152
Race	Asian	3.0	3.1	3.1	3.1	3.4	3.4
	Black	4.8	4.6	4.6	4.5	4.6	4.5
	Hispanic	33.3	33.9	34.9	34.3	35.2	34.9
	Multiracial	4.6	4.6	4.5	4.2	4.1	3.8
	Other	0.9	0.9	1.0	1.0	1.0	1.0
	White	53.4	52.9	52.0	52.9	51.7	52.5
Sex	Female	48.7	48.5	48.7	48.6	48.6	48.3
	Male	51.3	51.5	51.3	51.4	51.4	51.7
Performance Level	*Did Not Yet Meet*	17.8	10.6	9.9	10.5	14.4	14.7
	Partially Met	18.1	17.2	16.1	18.9	15.7	17.1
	Approached	23.8	26.1	26.7	27.8	23.3	24.4
	Met	36.7	35.6	41.9	35.1	31.5	33.4
	Exceeded	3.7	10.4	5.5	7.7	15.1	10.4
Mathematics							
	Total N	4,528	4,636	4,767	4,743	4,293	3,484
Race	Asian	3.0	3.1	3.1	3.2	3.2	2.8
	Black	4.7	4.6	4.6	4.5	4.6	5.0
	Hispanic	35.0	35.0	35.0	34.4	35.8	38.8
	Multiracial	4.5	4.5	4.5	4.2	4.1	3.7
	Other	0.9	0.9	0.9	1.0	1.0	1.1
	White	51.9	51.9	51.9	52.8	51.3	48.5
Sex	Female	48.7	48.6	48.7	48.6	48.8	48.3
	Male	51.3	51.4	51.3	51.4	51.2	51.7
Performance Level	*Did Not Yet Meet*	14.3	15.4	13.7	14.1	12.3	22.9
	Partially Met	19.8	23.5	23.1	27.2	24.7	23.6
	Approached	26.9	27.2	27.7	28.4	34.2	25.4
	Met	31.0	31.1	29.3	26.2	26.0	25.4
	Exceeded	8.1	2.7	6.2	4.2	2.8	2.7

3.2. Descriptive Statistics

Table 3.4 presents descriptive statistics of the MAP Growth and CMAS test scores from Spring 2018, including the correlation coefficient (*r*) between them. The correlation coefficients between the scores range from 0.78 to 0.84 for ELA/Reading and 0.86 to 0.89 for Mathematics. These values indicate a strong relationship among the scores, which is important validity evidence for the claim that MAP Growth scores are good predictors of performance on the CMAS assessments.

Table 3.4. Descriptive Statistics of Test Scores

Grade	N	*r*	CMAS*				MAP Growth*			
			Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
ELA/Reading										
3	3,518	0.84	738.6	39.7	650	850	198.5	16.1	139	242
4	4,671	0.82	745.3	35.8	650	850	206.2	15.8	147	249
5	4,427	0.81	745.5	34.2	650	850	211.8	15.3	150	251
6	4,436	0.82	742.4	33.6	650	850	215.4	15.8	150	252
7	4,144	0.81	744.1	39.5	650	850	219.4	16.0	150	262
8	3,152	0.78	742.8	39.6	650	850	222.1	17.1	149	264
Mathematics										
3	4,528	0.86	738.6	36.7	650	850	202.9	14.4	140	266
4	4,636	0.87	734.2	33.3	650	850	213.2	16.4	142	294
5	4,767	0.86	736.7	33.9	650	850	220.9	17.1	137	281
6	4,743	0.89	732.9	31.6	650	850	223.6	17.7	157	292
7	4,293	0.87	733.1	28.6	650	833	228.9	18.8	150	294
8	3,484	0.86	728.5	38.0	650	850	230.3	19.7	155	293

*SD = standard deviation. Min. = minimum. Max. = maximum.

3.3. MAP Growth Cut Scores

Table 3.5 and Table 3.6 present the CMAS scale score ranges and the corresponding MAP Growth RIT cut scores and percentile ranges by content area and grade. These tables can be used to predict a student's likely performance level on the CMAS spring assessment when MAP Growth is taken in the fall, winter, or spring. For example, a Grade 3 student who obtained a MAP Growth Reading RIT score of 194 in the fall is likely to reach *Met Expectations* proficiency on the CMAS ELA test. A Grade 3 student who obtained a MAP Growth Reading RIT score of 204 in the spring is also likely to reach *Met Expectations* proficiency on the CMAS. The spring cut score is higher than the fall cut score because growth is expected between fall and spring as students receive more instruction during the school year.

Within this report, the cut scores for fall and winter are derived from the spring cuts and the typical growth scores from fall-to-spring or winter-to-spring. The typical growth scores are based on the default instructional weeks most commonly encountered for each term (Weeks 4, 20, and 32 for fall, winter, and spring, respectively). Since instructional weeks often vary by district, the cut scores in this report may differ slightly from the MAP Growth score reports that reflect instructional weeks set by partners. If the actual instructional weeks deviate from the default ones, a student's projected performance level could be different from the generic projection presented in this document. Partners are therefore encouraged to use the projected performance level in students' profile, classroom, and grade reports in the NWEA reporting system since they reflect the specific instructional weeks set by partners.

Table 3.5. MAP Growth Cut Scores—ELA/Reading

CMAS ELA					
Grade	***Did Not Yet Meet***	***Partially Met***	***Approached***	***Met***	***Exceeded***
3	650–699	700–724	725–749	**750**–809	810–850
4	650–699	700–724	725–749	**750**–789	790–850
5	650–699	700–724	725–749	**750**–798	799–850
6	650–699	700–724	725–749	**750**–789	790–850
7	650–699	700–724	725–749	**750**–784	785–850
8	650–699	700–724	725–749	**750**–793	794–850

MAP Growth Reading*										
	Did Not Yet Meet		***Partially Met***		***Approached***		***Met***		***Exceeded***	
Grade	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**
Fall										
2	100–155	1–13	156–168	14–40	169–181	41–73	**182**–207	74–98	208–350	99–99
3	100–172	1–20	173–183	21–43	184–193	44–66	**194**–215	67–95	216–350	96–99
4	100–175	1–10	176–189	11–34	190–202	35–64	**203**–218	65–90	219–350	91–99
5	100–182	1–8	183–195	9–29	196–208	30–60	**209**–229	61–93	230–350	94–99
6	100–187	1–8	188–202	9–32	203–214	33–61	**215**–233	62–92	234–350	93–99
7	100–197	1–15	198–207	16–34	208–217	35–58	**218**–234	59–89	235–350	90–99
8	100–199	1–14	200–212	15–37	213–222	38–61	**223**–239	62–89	240–350	90–99
Winter										
2	100–165	1–15	166–178	16–43	179–189	44–71	**190**–213	72–98	214–350	99–99
3	100–180	1–20	181–191	21–44	192–200	45–66	**201**–220	67–94	221–350	95–99
4	100–183	1–12	184–195	13–33	196–207	34–62	**208**–222	63–89	223–350	90–99
5	100–188	1–9	189–201	10–32	202–212	33–59	**213**–231	60–92	232–350	93–99
6	100–192	1–9	193–206	10–32	207–218	33–62	**219**–234	63–90	235–350	91–99
7	100–201	1–17	202–210	18–34	211–220	35–59	**221**–235	60–87	236–350	88–99
8	100–203	1–15	204–215	16–38	216–224	39–60	**225**–240	61–88	241–350	89–99
Spring										
2	100–170	1–16	171–182	17–42	183–193	43–70	**194**–216	71–97	217–350	98–99
3	100–184	1–22	185–194	23–44	195–203	45–65	**204**–222	66–93	223–350	94–99
4	100–186	1–13	187–198	14–35	199–209	36–61	**210**–223	62–87	224–350	88–99
5	100–191	1–11	192–203	12–32	204–214	33–59	**215**–232	60–91	233–350	92–99
6	100–195	1–10	196–208	11–34	209–219	35–60	**220**–235	61–89	236–350	90–99
7	100–203	1–18	204–212	19–36	213–221	37–58	**222**–236	59–86	237–350	87–99
8	100–205	1–17	206–216	18–38	217–225	39–59	**226**–241	60–88	242–350	89–99

*Cut scores for fall and winter are derived from the spring cuts and growth norms based on the typical instructional weeks. Spring cut scores for Grade 2 were derived from the Grade 3 cuts using the growth norms. Bolded numbers indicate the cut scores considered to be at least proficient for accountability purposes.

Table 3.6. MAP Growth Cut Scores—Mathematics

CMAS Mathematics					
Grade	***Did Not Yet Meet***	***Partially Met***	***Approached***	***Met***	***Exceeded***
3	650–699	700–724	725–749	**750**–789	790–850
4	650–699	700–724	725–749	**750**–795	796–850
5	650–699	700–724	725–749	**750**–789	790–850
6	650–699	700–724	725–749	**750**–787	788–850
7	650–699	700–724	725–749	**750**–785	786–850
8	650–699	700–724	725–749	**750**–800	801–850

MAP Growth Mathematics*										
	Did Not Yet Meet		***Partially Met***		***Approached***		***Met***		***Exceeded***	
Grade	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**
Fall										
2	100–159	1–11	160–170	12–37	171–182	38–72	**183**–199	73–96	200–350	97–99
3	100–175	1–17	176–184	18–39	185–195	40–70	**196**–210	71–94	211–350	95–99
4	100–185	1–16	186–197	17–45	198–209	46–76	**210**–230	77–98	231–350	99–99
5	100–193	1–15	194–205	16–41	206–217	42–71	**218**–236	72–96	237–350	97–99
6	100–197	1–14	198–211	15–42	212–225	43–75	**226**–243	76–96	244–350	97–99
7	100–201	1–14	202–216	15–42	217–232	43–76	**233**–254	77–97	255–350	98–99
8	100–211	1–24	212–224	25–49	225–236	50–73	**237**–259	74–96	260–350	97–99
Winter										
2	100–169	1–13	170–180	14–40	181–191	41–72	**192**–206	73–95	207–350	96–99
3	100–183	1–17	184–192	18–40	193–202	41–68	**203**–217	69–93	218–350	94–99
4	100–191	1–16	192–204	17–46	205–216	47–76	**217**–237	77–97	238–350	98–99
5	100–198	1–15	199–211	16–42	212–223	43–71	**224**–242	72–95	243–350	96–99
6	100–202	1–15	203–216	16–43	217–230	44–74	**231**–248	75–95	249–350	96–99
7	100–204	1–13	205–220	14–42	221–236	43–75	**237**–258	76–96	259–350	97–99
8	100–215	1–26	216–227	27–49	228–239	50–72	**240**–262	73–95	263–350	96–99
Spring										
2	100–175	1–15	176–185	16–39	186–196	40–70	**197**–211	71–94	212–350	95–99
3	100–188	1–19	189–197	20–40	198–207	41–68	**208**–221	69–92	222–350	93–99
4	100–196	1–18	197–208	19–45	209–220	46–74	**221**–241	75–97	242–350	98–99
5	100–202	1–16	203–215	17–42	216–227	43–70	**228**–246	71–94	247–350	95–99
6	100–205	1–16	206–219	17–42	220–233	43–73	**234**–251	74–94	252–350	95–99
7	100–207	1–15	208–223	16–43	224–239	44–75	**240**–261	76–96	262–350	97–99
8	100–217	1–26	218–229	27–48	230–241	49–71	**242**–264	72–95	265–350	96–99

*Cut scores for fall and winter are derived from the spring cuts and growth norms based on the typical instructional weeks. Spring cut scores for Grade 2 were derived from the Grade 3 cuts using the growth norms. Bolded numbers indicate the cut scores considered to be at least proficient for accountability purposes.

3.4. Classification Accuracy

Table 3.7 presents the classification accuracy summary statistics, including the overall classification accuracy rate. These results indicate how well MAP Growth spring RIT scores predict proficiency on the CMAS tests, providing insight into the predictive validity of MAP Growth. The overall classification accuracy rate ranges from 0.82 to 0.85 for ELA/Reading and 0.83 to 0.91 for Mathematics. These values suggest that the RIT cut scores are good at classifying students as proficient or not proficient on the CMAS assessment. For Grade 2, the classification accuracy rate refers to how well the MAP Growth cuts can predict students' proficiency status on CMAS in Grade 3.

Although the results show that MAP Growth scores can be used to accurately classify students as likely to be proficient on the CMAS tests, there is a notable limitation to how these results should be used and interpreted. CMAS and MAP Growth assessments are designed for different purposes and measure slightly different constructs even within the same content area. Therefore, scores on the two tests cannot be assumed to be interchangeable. MAP Growth may not be used as a substitute for the state tests and vice versa.

Table 3.7. Classification Accuracy Results

		Cut Score		Class.	Rate*					
Grade	N	MAP Growth	CMAS	Accuracy*	FP	FN	Sensitivity	Specificity	Precision	AUC*
ELA/Reading										
2	3,029	194	750	0.82	0.19	0.18	0.82	0.81	0.76	0.90
3	3,518	204	750	0.84	0.16	0.17	0.83	0.84	0.78	0.92
4	4,671	210	750	0.85	0.15	0.16	0.84	0.85	0.83	0.93
5	4,427	215	750	0.82	0.17	0.19	0.81	0.83	0.81	0.90
6	4,436	220	750	0.84	0.14	0.18	0.82	0.86	0.81	0.92
7	4,144	222	750	0.83	0.18	0.17	0.83	0.82	0.80	0.91
8	3,152	226	750	0.82	0.18	0.18	0.82	0.82	0.78	0.90
Mathematics										
2	3,115	197	750	0.83	0.16	0.20	0.80	0.84	0.78	0.91
3	4,528	208	750	0.86	0.12	0.18	0.82	0.88	0.82	0.93
4	4,636	221	750	0.88	0.08	0.19	0.81	0.92	0.83	0.95
5	4,767	228	750	0.89	0.09	0.16	0.84	0.91	0.84	0.95
6	4,743	234	750	0.91	0.07	0.14	0.86	0.93	0.84	0.97
7	4,293	240	750	0.90	0.08	0.16	0.84	0.92	0.82	0.96
8	3,484	242	750	0.89	0.08	0.18	0.82	0.92	0.80	0.95

*Class. Accuracy = overall classification accuracy rate. FP = false positives. FN = false negatives. AUC = area under the ROC curve.

3.5. Proficiency Projection

Table 3.8 and Table 3.9 present the estimated probability of achieving *Met Expectations* performance on the CMAS test based on RIT scores from fall, winter, or spring. For example, a Grade 3 student who obtained a MAP Growth Reading score of 204 in the fall has an 86% chance of reaching *Met Expectations* proficiency or higher on the CMAS test. “Prob.” indicates the probability of obtaining proficient status on the CMAS test in the spring.

Table 3.8. Proficiency Projection based on RIT Scores—ELA/Reading

ELA/Reading												
			Fall			Winter			Spring			
				Projected Proficiency			Projected Proficiency			Projected Proficiency		
Grade	Start %ile	Spring Cut	Fall RIT	*Met*	Prob.	Winter RIT	*Met*	Prob.	Spring RIT	*Met*	Prob.	
2	5	194	147	No	<0.01	156	No	<0.01	160	No	<0.01	
	10	194	153	No	<0.01	162	No	<0.01	166	No	<0.01	
	15	194	157	No	<0.01	166	No	<0.01	170	No	<0.01	
	20	194	160	No	0.01	169	No	<0.01	173	No	<0.01	
	25	194	162	No	0.01	171	No	<0.01	175	No	<0.01	
	30	194	164	No	0.02	173	No	<0.01	177	No	<0.01	
	35	194	166	No	0.03	175	No	<0.01	180	No	<0.01	
	40	194	168	No	0.06	177	No	0.01	182	No	<0.01	
	45	194	170	No	0.07	179	No	0.02	184	No	<0.01	
	50	194	172	No	0.12	181	No	0.05	186	No	0.01	
	55	194	174	No	0.18	183	No	0.10	188	No	0.03	
	60	194	176	No	0.25	185	No	0.17	189	No	0.06	
	65	194	178	No	0.35	187	No	0.29	192	No	0.27	
	70	194	180	No	0.40	189	No	0.43	194	Yes	0.50	
	75	194	183	Yes	0.55	191	Yes	0.57	196	Yes	0.73	
	80	194	185	Yes	0.65	194	Yes	0.77	199	Yes	0.94	
	85	194	188	Yes	0.75	197	Yes	0.90	202	Yes	0.99	
	90	194	192	Yes	0.88	200	Yes	0.97	205	Yes	>0.99	
	95	194	197	Yes	0.96	206	Yes	>0.99	211	Yes	>0.99	

ELA/Reading											
			Fall			Winter			Spring		
Grade	Start %ile	Spring Cut	Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Met	Prob.		*Met*	Prob.		*Met*	Prob.
3	5	204	159	No	<0.01	167	No	<0.01	170	No	<0.01
	10	204	165	No	<0.01	173	No	<0.01	176	No	<0.01
	15	204	169	No	<0.01	177	No	<0.01	180	No	<0.01
	20	204	173	No	0.01	180	No	<0.01	183	No	<0.01
	25	204	175	No	0.01	183	No	<0.01	186	No	<0.01
	30	204	178	No	0.03	185	No	<0.01	189	No	<0.01
	35	204	180	No	0.04	188	No	0.01	191	No	<0.01
	40	204	182	No	0.07	190	No	0.02	193	No	<0.01
	45	204	185	No	0.14	192	No	0.05	195	No	<0.01
	50	204	187	No	0.17	194	No	0.09	197	No	0.01
	55	204	189	No	0.25	196	No	0.17	199	No	0.06
	60	204	191	No	0.34	198	No	0.29	201	No	0.17
	65	204	193	No	0.45	200	No	0.43	203	No	0.38
	70	204	195	Yes	0.50	202	Yes	0.57	206	Yes	0.73
	75	204	198	Yes	0.66	205	Yes	0.77	208	Yes	0.89
	80	204	201	Yes	0.79	207	Yes	0.87	211	Yes	0.99
	85	204	204	Yes	0.86	211	Yes	0.95	214	Yes	>0.99
	90	204	208	Yes	0.95	215	Yes	0.99	218	Yes	>0.99
	95	204	214	Yes	0.99	220	Yes	>0.99	224	Yes	>0.99
4	5	210	169	No	<0.01	176	No	<0.01	178	No	<0.01
	10	210	175	No	<0.01	182	No	<0.01	184	No	<0.01
	15	210	179	No	<0.01	186	No	<0.01	188	No	<0.01
	20	210	183	No	0.01	189	No	<0.01	191	No	<0.01
	25	210	185	No	0.02	192	No	<0.01	194	No	<0.01
	30	210	188	No	0.04	194	No	0.01	196	No	<0.01
	35	210	190	No	0.06	196	No	0.02	199	No	<0.01
	40	210	192	No	0.11	198	No	0.04	201	No	<0.01
	45	210	195	No	0.17	200	No	0.06	203	No	0.01
	50	210	197	No	0.24	202	No	0.13	205	No	0.06
	55	210	199	No	0.34	205	No	0.28	207	No	0.17
	60	210	201	No	0.44	207	No	0.42	209	No	0.38
	65	210	203	Yes	0.50	209	Yes	0.58	211	Yes	0.62
	70	210	205	Yes	0.61	211	Yes	0.72	213	Yes	0.83
	75	210	208	Yes	0.76	213	Yes	0.83	216	Yes	0.97
	80	210	211	Yes	0.83	216	Yes	0.94	219	Yes	>0.99
	85	210	214	Yes	0.92	219	Yes	0.98	222	Yes	>0.99
	90	210	218	Yes	0.96	223	Yes	>0.99	226	Yes	>0.99
	95	210	224	Yes	>0.99	229	Yes	>0.99	232	Yes	>0.99

ELA/Reading											
			Fall			Winter			Spring		
	Start	Spring	Fall	Projected Proficiency		Winter	Projected Proficiency		Spring	Projected Proficiency	
Grade	%ile	Cut	RIT	*Met*	Prob.	RIT	*Met*	Prob.	RIT	*Met*	Prob.
5	5	215	178	No	<0.01	183	No	<0.01	185	No	<0.01
	10	215	183	No	<0.01	189	No	<0.01	191	No	<0.01
	15	215	187	No	<0.01	193	No	<0.01	194	No	<0.01
	20	215	191	No	0.01	196	No	<0.01	198	No	<0.01
	25	215	193	No	0.03	198	No	<0.01	200	No	<0.01
	30	215	196	No	0.06	201	No	0.01	203	No	<0.01
	35	215	198	No	0.08	203	No	0.03	205	No	<0.01
	40	215	200	No	0.13	205	No	0.06	207	No	0.01
	45	215	202	No	0.20	207	No	0.13	209	No	0.03
	50	215	204	No	0.29	209	No	0.22	211	No	0.11
	55	215	207	No	0.39	211	No	0.35	213	No	0.27
	60	215	209	Yes	0.50	213	Yes	0.50	215	Yes	0.50
	65	215	211	Yes	0.61	215	Yes	0.65	217	Yes	0.73
	70	215	213	Yes	0.66	217	Yes	0.72	219	Yes	0.89
	75	215	216	Yes	0.80	220	Yes	0.87	222	Yes	0.99
	80	215	218	Yes	0.87	222	Yes	0.94	224	Yes	>0.99
	85	215	221	Yes	0.92	226	Yes	0.99	228	Yes	>0.99
	90	215	225	Yes	0.97	229	Yes	>0.99	231	Yes	>0.99
	95	215	231	Yes	>0.99	235	Yes	>0.99	237	Yes	>0.99
6	5	220	183	No	<0.01	188	No	<0.01	189	No	<0.01
	10	220	189	No	<0.01	193	No	<0.01	195	No	<0.01
	15	220	193	No	<0.01	197	No	<0.01	199	No	<0.01
	20	220	196	No	0.01	200	No	<0.01	202	No	<0.01
	25	220	199	No	0.02	203	No	<0.01	205	No	<0.01
	30	220	202	No	0.04	205	No	0.01	207	No	<0.01
	35	220	204	No	0.08	208	No	0.03	209	No	<0.01
	40	220	206	No	0.13	210	No	0.06	211	No	<0.01
	45	220	208	No	0.16	212	No	0.12	213	No	0.01
	50	220	210	No	0.24	214	No	0.22	215	No	0.06
	55	220	212	No	0.33	216	No	0.28	217	No	0.17
	60	220	214	No	0.44	218	No	0.42	219	No	0.38
	65	220	217	Yes	0.56	220	Yes	0.58	222	Yes	0.73
	70	220	219	Yes	0.67	222	Yes	0.72	224	Yes	0.89
	75	220	221	Yes	0.76	225	Yes	0.88	226	Yes	0.97
	80	220	224	Yes	0.84	227	Yes	0.94	229	Yes	>0.99
	85	220	227	Yes	0.92	230	Yes	0.98	232	Yes	>0.99
	90	220	231	Yes	0.98	234	Yes	>0.99	236	Yes	>0.99
	95	220	237	Yes	>0.99	240	Yes	>0.99	242	Yes	>0.99

ELA/Reading												
			Fall			Winter			Spring			
				Projected Proficiency			Projected Proficiency			Projected Proficiency		
Grade	Start %ile	Spring Cut	Fall RIT	*Met*	Prob.	Winter RIT	*Met*	Prob.	Spring RIT	*Met*	Prob.
7	5	222	187	No	<0.01	190	No	<0.01	191	No	<0.01
	10	222	193	No	<0.01	196	No	<0.01	197	No	<0.01
	15	222	197	No	<0.01	200	No	<0.01	201	No	<0.01
	20	222	200	No	0.01	203	No	<0.01	205	No	<0.01
	25	222	203	No	0.02	206	No	<0.01	207	No	<0.01
	30	222	206	No	0.06	209	No	0.02	210	No	<0.01
	35	222	208	No	0.10	211	No	0.04	212	No	<0.01
	40	222	210	No	0.16	213	No	0.06	214	No	0.01
	45	222	212	No	0.19	215	No	0.12	216	No	0.03
	50	222	214	No	0.28	217	No	0.22	218	No	0.11
	55	222	216	No	0.39	219	No	0.35	220	No	0.27
	60	222	218	Yes	0.50	221	Yes	0.50	223	Yes	0.62
	65	222	221	Yes	0.61	223	Yes	0.65	225	Yes	0.83
	70	222	223	Yes	0.72	226	Yes	0.83	227	Yes	0.94
	75	222	225	Yes	0.81	228	Yes	0.91	229	Yes	0.99
	80	222	228	Yes	0.90	231	Yes	0.97	232	Yes	>0.99
	85	222	231	Yes	0.94	234	Yes	0.99	235	Yes	>0.99
	90	222	235	Yes	0.98	238	Yes	>0.99	239	Yes	>0.99
	95	222	241	Yes	>0.99	244	Yes	>0.99	245	Yes	>0.99
8	5	226	190	No	<0.01	193	No	<0.01	194	No	<0.01
	10	226	196	No	<0.01	199	No	<0.01	200	No	<0.01
	15	226	200	No	<0.01	203	No	<0.01	204	No	<0.01
	20	226	204	No	0.01	206	No	<0.01	207	No	<0.01
	25	226	207	No	0.03	209	No	<0.01	210	No	<0.01
	30	226	209	No	0.05	212	No	0.01	213	No	<0.01
	35	226	211	No	0.06	214	No	0.02	215	No	<0.01
	40	226	214	No	0.13	216	No	0.04	217	No	<0.01
	45	226	216	No	0.20	218	No	0.09	220	No	0.03
	50	226	218	No	0.29	221	No	0.22	222	No	0.11
	55	226	220	No	0.34	223	No	0.35	224	No	0.27
	60	226	222	No	0.45	225	Yes	0.50	226	Yes	0.50
	65	226	225	Yes	0.61	227	Yes	0.65	228	Yes	0.73
	70	226	227	Yes	0.71	229	Yes	0.78	231	Yes	0.94
	75	226	230	Yes	0.80	232	Yes	0.91	233	Yes	0.99
	80	226	232	Yes	0.87	235	Yes	0.97	236	Yes	>0.99
	85	226	236	Yes	0.95	238	Yes	0.99	239	Yes	>0.99
	90	226	240	Yes	0.99	242	Yes	>0.99	243	Yes	>0.99
	95	226	246	Yes	>0.99	248	Yes	>0.99	249	Yes	>0.99

Table 3.9. Proficiency Projection based on RIT Scores—Mathematics

Mathematics												
			Fall			Winter			Spring			
	Start	Spring	Fall	Projected Proficiency		Winter	Projected Proficiency		Spring	Projected Proficiency		
Grade	%ile	Cut	RIT	*Met*	Prob.	RIT	*Met*	Prob.	RIT	*Met*	Prob.
2	5	197	154	No	<0.01	163	No	<0.01	167	No	<0.01
	10	197	158	No	<0.01	167	No	<0.01	172	No	<0.01
	15	197	162	No	<0.01	171	No	<0.01	175	No	<0.01
	20	197	164	No	<0.01	173	No	<0.01	178	No	<0.01
	25	197	166	No	0.01	175	No	<0.01	180	No	<0.01
	30	197	168	No	0.01	177	No	<0.01	182	No	<0.01
	35	197	170	No	0.03	179	No	0.01	184	No	<0.01
	40	197	172	No	0.06	181	No	0.01	186	No	<0.01
	45	197	173	No	0.08	182	No	0.02	188	No	<0.01
	50	197	175	No	0.11	184	No	0.05	189	No	<0.01
	55	197	177	No	0.18	186	No	0.10	191	No	0.02
	60	197	178	No	0.22	187	No	0.15	193	No	0.08
	65	197	180	No	0.32	189	No	0.26	195	No	0.25
	70	197	182	No	0.44	191	No	0.42	196	No	0.37
	75	197	184	Yes	0.56	193	Yes	0.58	198	Yes	0.63
	80	197	186	Yes	0.62	195	Yes	0.74	201	Yes	0.92
	85	197	188	Yes	0.73	198	Yes	0.90	203	Yes	0.98
	90	197	192	Yes	0.89	201	Yes	0.97	207	Yes	>0.99
	95	197	196	Yes	0.96	205	Yes	>0.99	212	Yes	>0.99
3	5	208	166	No	<0.01	174	No	<0.01	178	No	<0.01
	10	208	171	No	<0.01	179	No	<0.01	183	No	<0.01
	15	208	175	No	<0.01	182	No	<0.01	186	No	<0.01
	20	208	177	No	<0.01	185	No	<0.01	189	No	<0.01
	25	208	179	No	<0.01	187	No	<0.01	192	No	<0.01
	30	208	181	No	0.01	189	No	<0.01	194	No	<0.01
	35	208	183	No	0.03	191	No	0.01	196	No	<0.01
	40	208	185	No	0.05	193	No	0.02	198	No	<0.01
	45	208	187	No	0.10	195	No	0.04	199	No	<0.01
	50	208	188	No	0.13	196	No	0.07	201	No	0.01
	55	208	190	No	0.21	198	No	0.14	203	No	0.04
	60	208	192	No	0.26	200	No	0.26	205	No	0.15
	65	208	194	No	0.37	201	No	0.33	207	No	0.37
	70	208	196	Yes	0.50	203	Yes	0.50	208	Yes	0.50
	75	208	198	Yes	0.63	205	Yes	0.67	211	Yes	0.85
	80	208	200	Yes	0.74	208	Yes	0.86	213	Yes	0.96
	85	208	202	Yes	0.83	210	Yes	0.93	216	Yes	>0.99
	90	208	206	Yes	0.95	214	Yes	0.98	219	Yes	>0.99
	95	208	211	Yes	0.99	219	Yes	>0.99	224	Yes	>0.99

Mathematics												
			Fall			Winter			Spring			
				Projected Proficiency			Projected Proficiency			Projected Proficiency		
Grade	Start %ile	Spring Cut	Fall RIT	*Met*	Prob.	Winter RIT	*Met*	Prob.	Spring RIT	*Met*	Prob.	
4	5	221	176	No	<0.01	182	No	<0.01	185	No	<0.01	
	10	221	181	No	<0.01	187	No	<0.01	191	No	<0.01	
	15	221	185	No	<0.01	191	No	<0.01	194	No	<0.01	
	20	221	187	No	<0.01	194	No	<0.01	197	No	<0.01	
	25	221	190	No	<0.01	196	No	<0.01	200	No	<0.01	
	30	221	192	No	<0.01	198	No	<0.01	202	No	<0.01	
	35	221	194	No	0.01	200	No	<0.01	205	No	<0.01	
	40	221	196	No	0.01	202	No	<0.01	207	No	<0.01	
	45	221	198	No	0.03	204	No	<0.01	209	No	<0.01	
	50	221	200	No	0.05	206	No	0.01	211	No	<0.01	
	55	221	201	No	0.07	208	No	0.03	212	No	<0.01	
	60	221	203	No	0.13	210	No	0.07	214	No	0.01	
	65	221	205	No	0.21	212	No	0.14	217	No	0.08	
	70	221	207	No	0.32	214	No	0.26	219	No	0.25	
	75	221	209	No	0.44	216	No	0.42	221	Yes	0.50	
	80	221	212	Yes	0.63	219	Yes	0.67	224	Yes	0.85	
	85	221	214	Yes	0.74	221	Yes	0.80	227	Yes	0.98	
	90	221	218	Yes	0.90	225	Yes	0.96	230	Yes	>0.99	
	95	221	223	Yes	0.98	231	Yes	>0.99	236	Yes	>0.99	
5	5	228	184	No	<0.01	189	No	<0.01	191	No	<0.01	
	10	228	190	No	<0.01	194	No	<0.01	197	No	<0.01	
	15	228	193	No	<0.01	198	No	<0.01	201	No	<0.01	
	20	228	196	No	<0.01	201	No	<0.01	205	No	<0.01	
	25	228	199	No	<0.01	204	No	<0.01	207	No	<0.01	
	30	228	201	No	<0.01	206	No	<0.01	210	No	<0.01	
	35	228	203	No	0.01	209	No	<0.01	212	No	<0.01	
	40	228	205	No	0.02	211	No	<0.01	215	No	<0.01	
	45	228	207	No	0.05	213	No	0.01	217	No	<0.01	
	50	228	209	No	0.08	215	No	0.03	219	No	<0.01	
	55	228	211	No	0.14	217	No	0.07	221	No	0.01	
	60	228	213	No	0.22	219	No	0.15	223	No	0.04	
	65	228	215	No	0.32	221	No	0.26	225	No	0.15	
	70	228	217	No	0.44	223	No	0.42	228	Yes	0.50	
	75	228	219	Yes	0.56	225	Yes	0.58	230	Yes	0.75	
	80	228	222	Yes	0.73	228	Yes	0.80	233	Yes	0.96	
	85	228	225	Yes	0.86	231	Yes	0.93	236	Yes	>0.99	
	90	228	229	Yes	0.95	235	Yes	0.99	240	Yes	>0.99	
	95	228	234	Yes	0.99	241	Yes	>0.99	246	Yes	>0.99	

Mathematics											
			Fall			Winter			Spring		
				Projected Proficiency			Projected Proficiency			Projected Proficiency	
Grade	Start %ile	Spring Cut	Fall RIT	*Met*	Prob.	Winter RIT	*Met*	Prob.	Spring RIT	*Met*	Prob.
6	5	234	188	No	<0.01	192	No	<0.01	194	No	<0.01
	10	234	194	No	<0.01	198	No	<0.01	200	No	<0.01
	15	234	198	No	<0.01	202	No	<0.01	205	No	<0.01
	20	234	201	No	<0.01	205	No	<0.01	208	No	<0.01
	25	234	204	No	<0.01	208	No	<0.01	211	No	<0.01
	30	234	206	No	<0.01	211	No	<0.01	214	No	<0.01
	35	234	209	No	<0.01	213	No	<0.01	216	No	<0.01
	40	234	211	No	0.01	215	No	<0.01	218	No	<0.01
	45	234	213	No	0.02	217	No	<0.01	221	No	<0.01
	50	234	215	No	0.04	220	No	0.01	223	No	<0.01
	55	234	217	No	0.08	222	No	0.03	225	No	<0.01
	60	234	219	No	0.14	224	No	0.07	227	No	0.01
	65	234	221	No	0.22	226	No	0.14	230	No	0.08
	70	234	223	No	0.32	228	No	0.26	232	No	0.25
	75	234	226	Yes	0.50	231	Yes	0.50	235	Yes	0.63
	80	234	228	Yes	0.62	234	Yes	0.74	238	Yes	0.92
	85	234	231	Yes	0.78	237	Yes	0.90	241	Yes	0.99
	90	234	235	Yes	0.92	241	Yes	0.98	245	Yes	>0.99
	95	234	241	Yes	0.99	247	Yes	>0.99	252	Yes	>0.99
7	5	240	192	No	<0.01	194	No	<0.01	196	No	<0.01
	10	240	198	No	<0.01	201	No	<0.01	203	No	<0.01
	15	240	202	No	<0.01	205	No	<0.01	207	No	<0.01
	20	240	206	No	<0.01	209	No	<0.01	211	No	<0.01
	25	240	208	No	<0.01	212	No	<0.01	214	No	<0.01
	30	240	211	No	<0.01	215	No	<0.01	217	No	<0.01
	35	240	213	No	<0.01	217	No	<0.01	220	No	<0.01
	40	240	216	No	<0.01	219	No	<0.01	222	No	<0.01
	45	240	218	No	0.01	222	No	<0.01	224	No	<0.01
	50	240	220	No	0.02	224	No	<0.01	227	No	<0.01
	55	240	222	No	0.04	226	No	0.01	229	No	<0.01
	60	240	225	No	0.10	229	No	0.04	231	No	<0.01
	65	240	227	No	0.17	231	No	0.10	234	No	0.02
	70	240	229	No	0.26	233	No	0.20	236	No	0.08
	75	240	232	No	0.44	236	No	0.42	239	No	0.37
	80	240	235	Yes	0.63	239	Yes	0.67	242	Yes	0.75
	85	240	238	Yes	0.79	243	Yes	0.90	246	Yes	0.98
	90	240	243	Yes	0.95	247	Yes	0.98	251	Yes	>0.99
	95	240	249	Yes	>0.99	254	Yes	>0.99	257	Yes	>0.99

Mathematics											
			Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
Grade	Start %ile	Spring Cut		***Met***	**Prob.**		***Met***	**Prob.**		***Met***	**Prob.**
	5	242	194	No	<0.01	196	No	<0.01	197	No	<0.01
	10	242	201	No	<0.01	203	No	<0.01	205	No	<0.01
	15	242	205	No	<0.01	208	No	<0.01	210	No	<0.01
	20	242	209	No	<0.01	212	No	<0.01	214	No	<0.01
	25	242	212	No	<0.01	215	No	<0.01	217	No	<0.01
	30	242	215	No	<0.01	218	No	<0.01	220	No	<0.01
	35	242	218	No	<0.01	221	No	<0.01	223	No	<0.01
	40	242	220	No	0.01	223	No	<0.01	225	No	<0.01
	45	242	223	No	0.02	226	No	<0.01	228	No	<0.01
8	50	242	225	No	0.04	228	No	0.01	230	No	<0.01
	55	242	227	No	0.07	231	No	0.03	233	No	<0.01
	60	242	230	No	0.16	233	No	0.07	235	No	0.01
	65	242	232	No	0.24	236	No	0.20	238	No	0.08
	70	242	235	No	0.39	238	No	0.34	241	No	0.37
	75	242	238	Yes	0.56	241	Yes	0.58	244	Yes	0.75
	80	242	241	Yes	0.72	244	Yes	0.80	247	Yes	0.96
	85	242	245	Yes	0.88	248	Yes	0.95	251	Yes	>0.99
	90	242	249	Yes	0.96	253	Yes	>0.99	256	Yes	>0.99
	95	242	256	Yes	>0.99	260	Yes	>0.99	263	Yes	>0.99

References

Colorado Department of Education (CDE). (2018). *2018 CMAS English language arts/literacy and mathematics state achievement results*. Retrieved from https://www.cde.state.co.us/assessment/2018_cmas_ela_math_state_summary_achievement_results.

Kolen, M. J., & Brennan, R. L. (2004). *Test equating, scaling, and linking*. New York: Springer.

Lumley, T. (2019). *Survey: Analysis of complex survey samples*. R package version 3.36. Retrieved from https://CRAN.R-project.org/package=survey.

Pommerich, M., Hanson, B., Harris, D., & Sconing, J. (2004). Issues in conducting linkage between distinct tests. *Applied Psychological Measurement*, *28*(4), 247–273.

Thum, Y. M., & Kuhfeld, M. (2020). *NWEA 2020 MAP Growth achievement status and growth norms for students and schools*. NWEA Research Report. Portland, OR: NWEA.