Linking Study Report: Predicting Performance on the Virginia Standards of Learning (SOL) Mathematics Assessments based on NWEA MAP Growth Scores

July 2020

NWEA Psychometric Solutions

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Suggested citation: NWEA. (2020). *Linking study report: Predicting performance on the Virginia Standards of Learning (SOL) mathematics assessments based on NWEA MAP Growth scores*. Portland, OR: Author.

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Executive Summary

To predict student achievement on the Virginia Standards of Learning (SOL) assessments in Grades 3–8 Mathematics, NWEA® conducted a linking study using Spring 2019 data to derive Rasch Unit (RIT) cut scores on the MAP® Growth™ assessments that correspond to the Virginia SOL performance levels.[1] 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 March 2016 to incorporate the new 2020 NWEA MAP Growth norms (Thum & Kuhfeld, 2020).

Table E.1 presents the Virginia SOL *Proficient* 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 *Proficient* cut score on the Virginia SOL Grade 3 Mathematics test is 400. A Grade 3 student with a MAP Growth Mathematics RIT score of 181 in the fall is likely to meet proficiency on the Virginia SOL Mathematics test in the spring, whereas a Grade 3 student with a Mathematics RIT score lower than 181 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 Virginia SOL 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 Virginia SOL Mathematics Proficiency

Assessment		*Proficient* Cut Scores by Grade						
		2	3	4	5	6	7	8
Virginia SOL Spring		–	400	400	400	400	400	400
MAP Growth Mathematics	Fall	167	181	191	203	207	215	218
	Winter	176	189	198	209	212	218	221
	Spring	182	194	202	213	215	221	223

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 Virginia SOL Grades 3–8 Mathematics summative tests are aligned to the Virginia Standards of Learning. Based on their test scores, students are placed into one of four performance levels: *Below Basic*, *Basic*, *Proficient*, and *Advanced*. These tests are used to provide evidence of student achievement in Mathematics for various test score uses such as providing accountability information for school, school division, and state levels. The *Proficient* 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.

[1] Reading is not included in this linking study report but will be once data are available based on the new standards.

E.2. Linking Methods

Based on scores from the Spring 2019 test administration, the equipercentile linking method was used to identify the spring MAP Growth scores that correspond to the spring Virginia SOL 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 Virginia SOL 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 Virginia SOL Mathematics assessments in Spring 2019 were included in the study sample. Table E.2 presents the weighted number of Virginia students from 13 districts and 104 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.

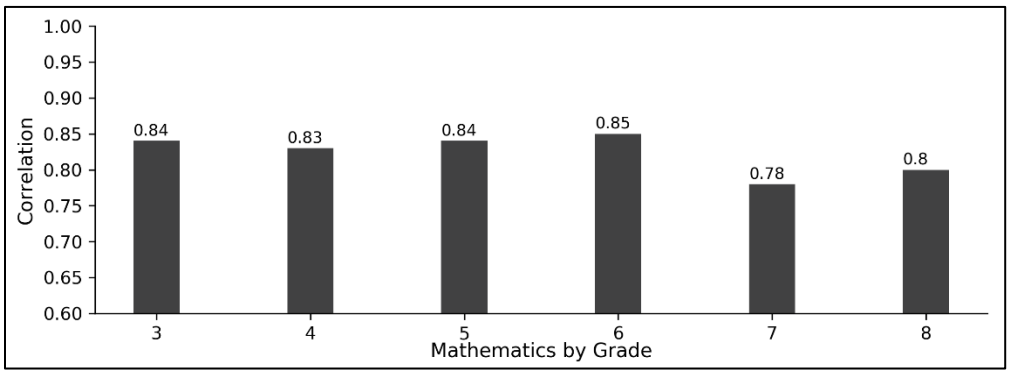
Table E.2. Linking Study Sample

Grade	#Students
3	4,078
4	3,542
5	3,599
6	4,171
7	3,406
8	1,492

E.4. Test Score Relationships

Correlations between MAP Growth RIT scores and Virginia SOL scores range from 0.78 to 0.85, 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 Virginia SOL assessments.

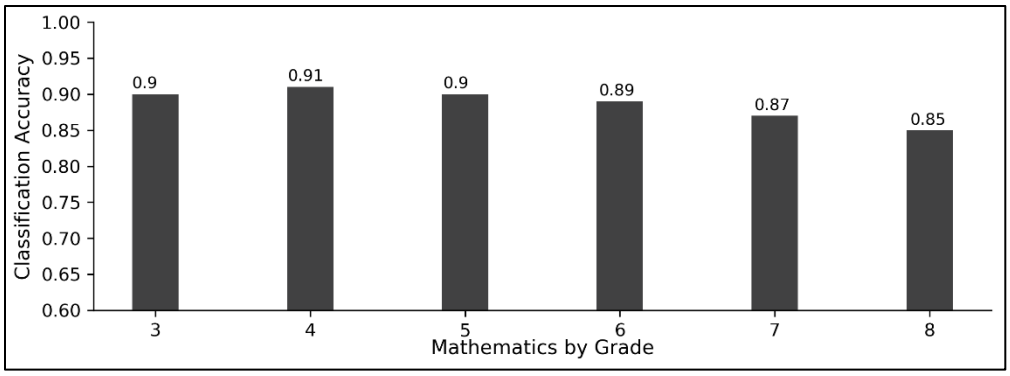
Figure E.1. Correlations between MAP Growth and Virginia SOL



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 Virginia SOL tests. For example, the MAP Growth Mathematics Grade 3 *Proficient* cut score has a 0.90 accuracy rate, meaning it accurately classified student achievement on the state test for 90% of the sample. The results range from 0.85 to 0.91, indicating that RIT scores have a high accuracy rate of identifying student proficiency on the Virginia SOL 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 Virginia Standards of Learning (SOL) Grades 3–8 Mathematics assessments with Rasch Unit (RIT) scores from the MAP Growth Mathematics assessments taken during the Spring 2019 term. The linking study has been updated since the previous version published in March 2016 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 Virginia SOL test by Grade 3. This report presents the following results:

1. Student sample demographics
2. Descriptive statistics of test scores
3. MAP Growth cut scores that correspond to the Virginia SOL 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 Virginia SOL tests
5. The probability of achieving grade-level proficiency on the Virginia SOL assessment based on MAP Growth RIT scores from fall, winter, and spring using the 2020 norms

1.2. Assessment Overview

The Virginia SOL Grades 3–8 Mathematics summative assessments are aligned to the Virginia Standards of Learning. Each assessment has three 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: *Below Basic*, *Basic*, *Proficient*, and *Advanced*. The *Proficient* 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 2019 administrations of the MAP Growth and Virginia SOL assessments. NWEA recruited Virginia 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 Virginia 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 Virginia SOL assessments in Spring 2019 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 MAP Growth RIT scores that correspond to the spring Virginia SOL 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 Virginia SOL 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 Virginia SOL 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., Virginia SOL). 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:

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

where $e_y(x)$ is the equipercentile equivalent of score x on Virginia SOL on the scale of MAP Growth, $P(x)$ is the percentile rank of a given score on Virginia SOL, 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:

$$RIT_{PredSpring} = RIT_{previous} + g \quad (2)$$

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 from 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 was used). 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 Virginia SOL tests can be described using classification accuracy statistics based on the MAP Growth spring RIT cut scores that show the proportion of students correctly classified by their RIT scores as proficient (*Proficient* or *Advanced*) or not proficient (*Below Basic* or *Basic*). Table 2.1 describes the classification accuracy statistics provided in this report (Pommerich, Hanson, Harris, & Sconing, 2004). The results are based on the Spring 2019 MAP Growth and Virginia SOL data for the *Proficient* cut score.

Since Virginia students do not begin taking the Virginia SOL assessment until Grade 3, longitudinal data were collected for the 2018–2019 Grade 3 cohort in order to link the Virginia SOL assessment to MAP Growth for Grade 2 to calculate the classification accuracy statistics. To accomplish this, 2018–2019 Virginia SOL Grade 3 results were linked to MAP Growth data from Grade 3 students in 2018–2019 and Grade 2 students in 2017–2018. 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 Virginia SOL 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 *Proficient* on the Virginia SOL test based on their fall or winter RIT score:

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

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 *Proficient* 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 *Proficient* on the Virginia SOL test based on their spring RIT score (RIT_{Spring}):

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

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 Virginia SOL Mathematics assessments in Spring 2019 were included in the study sample. Data used in this study were collected from 13 districts and 104 schools in Virginia. Table 3.1 presents the demographic distributions of race, sex, and performance level in the original unweighted study sample. Table 3.2 presents the distributions of the student population that took the Spring 2019 Virginia SOL tests (VDOE, 2019). Since the unweighted data are different from the general Virginia SOL 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 Virginia SOL 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)							
		%Students by Grade					
Demographic Subgroup		3	4	5	6	7	8
Total N		4,078	3,542	3,599	4,167	3,406	1,492
Race	Asian	2.2	1.8	1.7	2.2	1.5	1.1
	Black	19.5	23.6	24.3	20.7	22.9	27.3
	Hispanic	6.7	6.4	6.5	7.3	7.6	9.3
	Multi-Race	0.5	0.5	0.3	0.4	0.3	0.1
	Other	16.9	20.1	20.1	16.5	19.0	26.8
	White	54.2	47.6	47.1	52.9	48.7	35.4
Sex	Female	48.5	49.2	50.5	49.3	49.6	45.7
	Male	51.5	50.8	49.5	50.7	50.4	54.3
Performance Level	*Below Basic*	3.2	2.7	4.4	6.1	4.5	7.0
	Basic	16.3	16.6	16.9	16.6	21.7	27.7
	Proficient	61.8	61.2	63.5	62.0	62.9	58.6
	Advanced	18.7	19.5	15.3	15.3	10.9	6.7

Table 3.2. Spring 2019 Virginia SOL Student Population Demographics

Spring 2019 Virginia SOL Mathematics Population							
		%Students by Grade					
Demographic Subgroup		3	4	5	6	7	8
Total N		92,898	94,931	90,365	77,826	57,725	44,839
Race	Asian	7.4	7.2	6.2	4.4	4.2	3.2
	Black	22.0	21.9	23.2	25.5	24.2	27.8
	Hispanic	16.4	16.9	17.2	18.5	19.2	19.3
	Multi-Race	6.4	6.1	5.9	5.5	5.3	5.2
	Other	0.4	0.5	0.4	0.4	0.4	0.4
	White	47.3	47.4	47.2	45.7	46.8	44.1
Sex	Female	48.9	49.0	49.5	49.5	48.7	46.0
	Male	51.1	51.0	50.5	50.5	51.3	54.0
Performance Level*	*Below Basic* / *Basic*	17.8	16.8	19.0	24.7	27.5	32.4
	Proficient	63.7	63.8	64.7	65.0	66.3	65.1
	Advanced	18.5	19.4	16.	10.4	6.2	2.5

**Below Basic* and *Basic* data are combined in the state database.

Table 3.3. Linking Study Sample Demographics (Weighted)

Linking Study Sample (Weighted)							
		%Students by Grade					
Demographic Subgroup		3	4	5	6	7	8
Total N		4,078	3,542	3,599	4,171	3,406	1,492
Race	Asian	7.4	7.2	6.2	4.4	4.2	3.2
	Black	22.0	21.9	23.2	25.5	24.2	27.8
	Hispanic	16.4	16.9	17.2	18.5	19.2	19.3
	Multi-Race	6.4	6.1	5.9	5.5	5.3	5.2
	Other	0.4	0.5	0.4	0.4	0.4	0.4
	White	47.3	47.4	47.2	45.7	46.8	44.1
Sex	Female	48.9	49.0	49.5	49.5	48.7	46.0
	Male	51.1	51.0	50.5	50.5	51.3	54.0
Performance Level	*Below Basic*	3.1	2.3	3.9	6.8	4.5	5.6
	Basic	14.7	14.5	15.1	17.8	23.0	26.8
	Proficient	63.7	63.8	64.7	64.9	66.3	65.1
	Advanced	18.5	19.4	16.3	10.4	6.2	2.5

3.2. Descriptive Statistics

Table 3.4 presents descriptive statistics of the MAP Growth and Virginia SOL Mathematics test scores from Spring 2019, including the correlation coefficient (*r*) between them. The correlation coefficients between the scores range from 0.78 to 0.85. 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 Virginia SOL Mathematics assessments.

Table 3.4. Descriptive Statistics of Test Scores

			Virginia SOL Mathematics*				MAP Growth Mathematics*			
Grade	N	*r*	Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
3	4,078	0.84	447.8	59.6	0	600	204.1	12.8	138	247
4	3,542	0.83	450.4	60.8	0	600	214.1	13.9	153	263
5	3,599	0.84	444.4	60.5	0	600	223.8	15.4	142	280
6	4,171	0.85	434.2	56.5	0	600	224.8	16.6	144	278
7	3,406	0.78	426.1	56.5	0	600	228.1	16.2	146	292
8	1,492	0.80	413.0	48.2	0	600	227.4	17.4	142	310

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

3.3. MAP Growth Cut Scores

Table 3.5 presents the Virginia SOL Mathematics scale score ranges and the corresponding MAP Growth Mathematics 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 Virginia SOL spring assessment when MAP Growth is taken in the fall, winter, or spring. For example, a Grade 3 student who obtained a MAP Growth Mathematics RIT score of 181 in the fall is likely to reach *Proficient* on the Virginia SOL Mathematics test. A Grade 3 student who obtained a MAP Growth Mathematics RIT score of 194 in the spring is also likely to reach *Proficient* on the Virginia SOL. 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

Virginia SOL Mathematics								
Grade	***Below Basic***		***Basic***		***Proficient***		***Advanced***	
3	0–330		331–399		**400**–499		500–600	
4	0–330		331–399		**400**–499		500–600	
5	0–335		336–399		**400**–499		500–600	
6	0–349		350–399		**400**–499		500–600	
7	0–328		329–399		**400**–499		500–600	
8	0–340		341–399		**400**–499		500–600	
MAP Growth Mathematics*								
	Below Basic		***Basic***		***Proficient***		***Advanced***	
Grade	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**	**RIT**	**Percentile**
Fall								
2	100–147	1–1	148–166	2–26	**167**–191	27–89	192–350	90–99
3	100–164	1–3	165–180	4–28	**181**–202	29–85	203–350	86–99
4	100–175	1–4	176–190	5–27	**191**–213	28–83	214–350	84–99
5	100–186	1–6	187–202	7–33	**203**–227	34–88	228–350	89–99
6	100–191	1–7	192–206	8–31	**207**–235	32–90	236–350	91–99
7	100–194	1–6	195–214	7–37	**215**–241	38–88	242-–350	89–99
8	100–194	1–5	195–217	6–35	**218**–252	36–92	253–350	93–99
Winter								
2	100–158	1–2	159–175	3–26	**176**–199	27–88	200–350	89–99
3	100–173	1–4	174–188	5–29	**189**–209	30–83	210–350	84–99
4	100–181	1–4	182–197	5–28	**198**–220	29–83	221–350	84–99
5	100–191	1–7	192–208	8–35	**209**–233	36–88	234–350	89–99
6	100–196	1–8	197–211	9–32	**212**–240	33–89	241–350	90–99
7	100–197	1–6	198–217	7–36	**218**–245	37–88	246–350	89–99
8	100–198	1–6	199–220	7–35	**221**–255	36–92	256–350	93–99
Spring								
2	100–164	1–2	165–181	3–28	**182**–204	29–87	205–350	88–99
3	100–178	1–5	179–193	6–30	**194**–214	31–83	215–350	84–99
4	100–186	1–6	187–201	7–28	**202**–224	29–81	225–350	82–99
5	100–195	1–8	196–212	9–36	**213**–237	37–87	238–350	88–99
6	100–199	1–9	200–214	10–32	**215**–243	33–88	244–350	89–99
7	100–200	1–7	201–220	8–37	**221**–248	38–87	249–350	88–99
8	100–200	1–6	201–222	7–35	**223**–257	36–91	258–350	92–99

*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 3.6 presents the classification accuracy summary statistics, including the overall classification accuracy rate. These results indicate how well MAP Growth Mathematics spring RIT scores predict proficiency on the Virginia SOL Mathematics tests, providing insight into the predictive validity of MAP Growth. The overall classification accuracy rate ranges from 0.84 to 0.91. These values suggest that the RIT cut scores are good at classifying students as proficient or not proficient on the Virginia SOL Mathematics assessment. For Grade 2, the classification accuracy rate refers to how well the MAP Growth cuts can predict students' proficiency status on Virginia SOL 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 Virginia SOL tests, there is a notable limitation to how these results should be used and interpreted. Virginia SOL 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 3.6. Classification Accuracy Results

Grade	N	Mathematics Cut Score		Class. Accuracy*	Rate*		Sensitivity	Specificity	Precision	AUC*
		MAP Growth	Virginia SOL		FP	FN				
2	2,849	182	400	0.84	0.21	0.15	0.85	0.79	0.95	0.89
3	4,078	194	400	0.90	0.28	0.06	0.94	0.72	0.94	0.94
4	3,542	202	400	0.91	0.29	0.05	0.95	0.71	0.94	0.95
5	3,599	213	400	0.90	0.20	0.07	0.93	0.80	0.95	0.95
6	4,171	215	400	0.89	0.26	0.06	0.94	0.74	0.92	0.94
7	3,406	221	400	0.87	0.25	0.09	0.91	0.75	0.91	0.93
8	1,492	223	400	0.85	0.20	0.12	0.88	0.80	0.90	0.92

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

3.5. Proficiency Projection

Table 3.7 presents the estimated probability of achieving *Proficient* performance on the Virginia SOL Mathematics test based on RIT scores from fall, winter, or spring. For example, a Grade 3 student who obtained a MAP Growth Mathematics score of 194 in the fall has a 97% chance of reaching *Proficient* or higher on the Virginia SOL Mathematics test. "Prob." indicates the probability of obtaining proficient status on the Virginia SOL test in the spring.

Table 3.7. Proficiency Projection based on RIT Scores

Mathematics											
			Fall			Winter			Spring		
Grade	Start %ile	Spring Cut	Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.		*Proficient*	Prob.		*Proficient*	Prob.
2	5	182	154	No	0.03	163	No	<0.01	167	No	<0.01
	10	182	158	No	0.11	167	No	0.03	172	No	<0.01
	15	182	162	No	0.27	171	No	0.15	175	No	0.01
	20	182	164	No	0.32	173	No	0.26	178	No	0.08
	25	182	166	No	0.44	175	No	0.42	180	No	0.25
	30	182	168	Yes	0.56	177	Yes	0.58	182	Yes	0.50
	35	182	170	Yes	0.68	179	Yes	0.74	184	Yes	0.75
	40	182	172	Yes	0.78	181	Yes	0.80	186	Yes	0.92
	45	182	173	Yes	0.82	182	Yes	0.85	188	Yes	0.98
	50	182	175	Yes	0.86	184	Yes	0.93	189	Yes	0.99
	55	182	177	Yes	0.92	186	Yes	0.97	191	Yes	>0.99
	60	182	178	Yes	0.94	187	Yes	0.98	193	Yes	>0.99
	65	182	180	Yes	0.97	189	Yes	0.99	195	Yes	>0.99
	70	182	182	Yes	0.99	191	Yes	>0.99	196	Yes	>0.99
	75	182	184	Yes	0.99	193	Yes	>0.99	198	Yes	>0.99
	80	182	186	Yes	>0.99	195	Yes	>0.99	201	Yes	>0.99
	85	182	188	Yes	>0.99	198	Yes	>0.99	203	Yes	>0.99
	90	182	192	Yes	>0.99	201	Yes	>0.99	207	Yes	>0.99
	95	182	196	Yes	>0.99	205	Yes	>0.99	212	Yes	>0.99
3	5	194	166	No	0.01	174	No	<0.01	178	No	<0.01
	10	194	171	No	0.07	179	No	0.02	183	No	<0.01
	15	194	175	No	0.17	182	No	0.07	186	No	<0.01
	20	194	177	No	0.26	185	No	0.20	189	No	0.04
	25	194	179	No	0.37	187	No	0.33	192	No	0.25
	30	194	181	Yes	0.50	189	Yes	0.50	194	Yes	0.50
	35	194	183	Yes	0.63	191	Yes	0.67	196	Yes	0.75
	40	194	185	Yes	0.74	193	Yes	0.80	198	Yes	0.92
	45	194	187	Yes	0.83	195	Yes	0.90	199	Yes	0.96
	50	194	188	Yes	0.87	196	Yes	0.93	201	Yes	0.99
	55	194	190	Yes	0.93	198	Yes	0.97	203	Yes	>0.99
	60	194	192	Yes	0.95	200	Yes	0.99	205	Yes	>0.99
	65	194	194	Yes	0.97	201	Yes	0.99	207	Yes	>0.99
	70	194	196	Yes	0.99	203	Yes	>0.99	208	Yes	>0.99
	75	194	198	Yes	>0.99	205	Yes	>0.99	211	Yes	>0.99
	80	194	200	Yes	>0.99	208	Yes	>0.99	213	Yes	>0.99
	85	194	202	Yes	>0.99	210	Yes	>0.99	216	Yes	>0.99
	90	194	206	Yes	>0.99	214	Yes	>0.99	219	Yes	>0.99
	95	194	211	Yes	>0.99	219	Yes	>0.99	224	Yes	>0.99

Mathematics												
			Fall			Winter			Spring			
Grade	Start %ile	Spring Cut	Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency		
				Proficient	Prob.		*Proficient*	Prob.		*Proficient*	Prob.	
4	5	202	176	No	0.01	182	No	<0.01	185	No	<0.01	
	10	202	181	No	0.05	187	No	0.02	191	No	<0.01	
	15	202	185	No	0.17	191	No	0.10	194	No	<0.01	
	20	202	187	No	0.26	194	No	0.26	197	No	0.04	
	25	202	190	No	0.44	196	No	0.33	200	No	0.25	
	30	202	192	Yes	0.56	198	Yes	0.50	202	Yes	0.50	
	35	202	194	Yes	0.68	200	Yes	0.67	205	Yes	0.85	
	40	202	196	Yes	0.79	202	Yes	0.80	207	Yes	0.96	
	45	202	198	Yes	0.87	204	Yes	0.90	209	Yes	0.99	
	50	202	200	Yes	0.93	206	Yes	0.96	211	Yes	>0.99	
	55	202	201	Yes	0.95	208	Yes	0.98	212	Yes	>0.99	
	60	202	203	Yes	0.97	210	Yes	0.99	214	Yes	>0.99	
	65	202	205	Yes	0.99	212	Yes	>0.99	217	Yes	>0.99	
	70	202	207	Yes	0.99	214	Yes	>0.99	219	Yes	>0.99	
	75	202	209	Yes	>0.99	216	Yes	>0.99	221	Yes	>0.99	
	80	202	212	Yes	>0.99	219	Yes	>0.99	224	Yes	>0.99	
	85	202	214	Yes	>0.99	221	Yes	>0.99	227	Yes	>0.99	
	90	202	218	Yes	>0.99	225	Yes	>0.99	230	Yes	>0.99	
	95	202	223	Yes	>0.99	231	Yes	>0.99	236	Yes	>0.99	
5	5	213	184	No	<0.01	189	No	<0.01	191	No	<0.01	
	10	213	190	No	0.02	194	No	<0.01	197	No	<0.01	
	15	213	193	No	0.05	198	No	0.01	201	No	<0.01	
	20	213	196	No	0.11	201	No	0.05	205	No	<0.01	
	25	213	199	No	0.22	204	No	0.15	207	No	0.02	
	30	213	201	No	0.38	206	No	0.26	210	No	0.15	
	35	213	203	Yes	0.50	209	Yes	0.50	212	No	0.37	
	40	213	205	Yes	0.62	211	Yes	0.66	215	Yes	0.75	
	45	213	207	Yes	0.73	213	Yes	0.80	217	Yes	0.92	
	50	213	209	Yes	0.82	215	Yes	0.90	219	Yes	0.98	
	55	213	211	Yes	0.89	217	Yes	0.95	221	Yes	>0.99	
	60	213	213	Yes	0.94	219	Yes	0.98	223	Yes	>0.99	
	65	213	215	Yes	0.97	221	Yes	0.99	225	Yes	>0.99	
	70	213	217	Yes	0.98	223	Yes	>0.99	228	Yes	>0.99	
	75	213	219	Yes	0.99	225	Yes	>0.99	230	Yes	>0.99	
	80	213	222	Yes	>0.99	228	Yes	>0.99	233	Yes	>0.99	
	85	213	225	Yes	>0.99	231	Yes	>0.99	236	Yes	>0.99	
	90	213	229	Yes	>0.99	235	Yes	>0.99	240	Yes	>0.99	
	95	213	234	Yes	>0.99	241	Yes	>0.99	246	Yes	>0.99	

Mathematics												
			Fall			Winter			Spring			
Grade	Start %ile	Spring Cut	Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency		
				Proficient	Prob.		*Proficient*	Prob.		*Proficient*	Prob.	
6	5	215	188	No	<0.01	192	No	<0.01	194	No	<0.01	
	10	215	194	No	0.02	198	No	<0.01	200	No	<0.01	
	15	215	198	No	0.08	202	No	0.02	205	No	<0.01	
	20	215	201	No	0.17	205	No	0.07	208	No	0.01	
	25	215	204	No	0.32	208	No	0.20	211	No	0.08	
	30	215	206	No	0.44	211	No	0.42	214	No	0.37	
	35	215	209	Yes	0.62	213	Yes	0.58	216	Yes	0.63	
	40	215	211	Yes	0.73	215	Yes	0.74	218	Yes	0.85	
	45	215	213	Yes	0.83	217	Yes	0.86	221	Yes	0.98	
	50	215	215	Yes	0.90	220	Yes	0.96	223	Yes	>0.99	
	55	215	217	Yes	0.94	222	Yes	0.98	225	Yes	>0.99	
	60	215	219	Yes	0.97	224	Yes	0.99	227	Yes	>0.99	
	65	215	221	Yes	0.99	226	Yes	>0.99	230	Yes	>0.99	
	70	215	223	Yes	0.99	228	Yes	>0.99	232	Yes	>0.99	
	75	215	226	Yes	>0.99	231	Yes	>0.99	235	Yes	>0.99	
	80	215	228	Yes	>0.99	234	Yes	>0.99	238	Yes	>0.99	
	85	215	231	Yes	>0.99	237	Yes	>0.99	241	Yes	>0.99	
	90	215	235	Yes	>0.99	241	Yes	>0.99	245	Yes	>0.99	
	95	215	241	Yes	>0.99	247	Yes	>0.99	252	Yes	>0.99	
7	5	221	192	No	<0.01	194	No	<0.01	196	No	<0.01	
	10	221	198	No	<0.01	201	No	<0.01	203	No	<0.01	
	15	221	202	No	0.02	205	No	<0.01	207	No	<0.01	
	20	221	206	No	0.07	209	No	0.03	211	No	<0.01	
	25	221	208	No	0.13	212	No	0.10	214	No	0.01	
	30	221	211	No	0.26	215	No	0.26	217	No	0.08	
	35	221	213	No	0.37	217	No	0.42	220	No	0.37	
	40	221	216	Yes	0.56	219	Yes	0.58	222	Yes	0.63	
	45	221	218	Yes	0.74	222	Yes	0.80	224	Yes	0.85	
	50	221	220	Yes	0.83	224	Yes	0.90	227	Yes	0.98	
	55	221	222	Yes	0.90	226	Yes	0.96	229	Yes	>0.99	
	60	221	225	Yes	0.96	229	Yes	0.99	231	Yes	>0.99	
	65	221	227	Yes	0.98	231	Yes	>0.99	234	Yes	>0.99	
	70	221	229	Yes	0.99	233	Yes	>0.99	236	Yes	>0.99	
	75	221	232	Yes	>0.99	236	Yes	>0.99	239	Yes	>0.99	
	80	221	235	Yes	>0.99	239	Yes	>0.99	242	Yes	>0.99	
	85	221	238	Yes	>0.99	243	Yes	>0.99	246	Yes	>0.99	
	90	221	243	Yes	>0.99	247	Yes	>0.99	251	Yes	>0.99	
	95	221	249	Yes	>0.99	254	Yes	>0.99	257	Yes	>0.99	

Mathematics											
			Fall			Winter			Spring		
Grade	Start %ile	Spring Cut	Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.		*Proficient*	Prob.		*Proficient*	Prob.
8	5	223	194	No	<0.01	196	No	<0.01	197	No	<0.01
	10	223	201	No	0.01	203	No	<0.01	205	No	<0.01
	15	223	205	No	0.04	208	No	<0.01	210	No	<0.01
	20	223	209	No	0.12	212	No	0.03	214	No	<0.01
	25	223	212	No	0.24	215	No	0.11	217	No	0.02
	30	223	215	No	0.39	218	No	0.27	220	No	0.15
	35	223	218	Yes	0.50	221	Yes	0.50	223	Yes	0.50
	40	223	220	Yes	0.61	223	Yes	0.66	225	Yes	0.75
	45	223	223	Yes	0.76	226	Yes	0.85	228	Yes	0.96
	50	223	225	Yes	0.84	228	Yes	0.93	230	Yes	0.99
	55	223	227	Yes	0.90	231	Yes	0.98	233	Yes	>0.99
	60	223	230	Yes	0.96	233	Yes	0.99	235	Yes	>0.99
	65	223	232	Yes	0.98	236	Yes	>0.99	238	Yes	>0.99
	70	223	235	Yes	0.99	238	Yes	>0.99	241	Yes	>0.99
	75	223	238	Yes	>0.99	241	Yes	>0.99	244	Yes	>0.99
	80	223	241	Yes	>0.99	244	Yes	>0.99	247	Yes	>0.99
	85	223	245	Yes	>0.99	248	Yes	>0.99	251	Yes	>0.99
	90	223	249	Yes	>0.99	253	Yes	>0.99	256	Yes	>0.99
	95	223	256	Yes	>0.99	260	Yes	>0.99	263	Yes	>0.99

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