

Linking Study Report: Predicting Performance on the North Carolina End-of-Grade (NC EOG) Mathematics Assessments based on NWEA MAP Growth Scores

December 2020

NWEA Psychometric Solutions



© 2020 NWEA. NWEA and MAP Growth are registered trademarks of NWEA in the U.S. and in other countries. All rights reserved. No part of this document may be modified or further distributed without written permission from NWEA.

Suggested citation: NWEA. (2020). *Linking study report: Predicting performance on the North Carolina End-of-Grade (NC EOG) mathematics assessments based on NWEA MAP Growth scores.*

Table of Contents

Executive Summary	4
1. Introduction	7
1.1. Purpose of the Study	7
1.2. Assessment Overview	7
2. Methods	8
2.1. Data Collection	8
2.2. Post-Stratification Weighting	8
2.3. MAP Growth Cut Scores	8
2.4. Classification Accuracy	9
2.5. Proficiency Projection	10
3. Results	11
3.1. Study Sample	11
3.2. Descriptive Statistics	13
3.3. MAP Growth Cut Scores	13
3.4. Classification Accuracy	15
3.5. Proficiency Projection	15
4. References	20

List of Tables

Table 2.1. Description of Classification Accuracy Summary Statistics	10
Table 3.1. Linking Study Sample Demographics (Unweighted)	11
Table 3.2. Spring 2019 NC EOG Student Population Demographics	12
Table 3.3. Linking Study Sample Demographics (Weighted)	12
Table 3.4. Descriptive Statistics of Test Scores	13
Table 3.5. MAP Growth Cut Scores	14
Table 3.6. Classification Accuracy Results	15
Table 3.7. Proficiency Projection based on RIT Scores	16

Executive Summary

To predict student achievement on the North Carolina End-of-Grade (NC EOG) Mathematics assessments in Grades 3–8, 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 NC EOG achievement 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 March 2016 to incorporate the new 2020 NWEA MAP Growth norms (Thum & Kuhfeld, 2020) and generate MAP Growth cut scores for the updated NC EOG Mathematics assessment based on new standards.¹

Table E.1 presents the NC EOG *Level 3* achievement 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 *Level 3* cut score on the NC EOG Grade 3 Mathematics test is 545. A Grade 3 student with a MAP Growth Mathematics RIT score of 185 in the fall is likely to meet proficiency on the NC EOG Mathematics test in the spring, whereas a Grade 3 student with a MAP Growth Mathematics RIT score lower than 185 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 NC EOG Mathematics 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 (e.g., Grades 2 to 3).

Table E.1. MAP Growth Cut Scores for NC EOG Mathematics Proficiency

Assessment		Level 3 Cut Scores						
		2	3	4	5	6	7	8
NC EOG Spring		–	545	547	546	546	546	543
MAP Growth Mathematics	Fall	171	185	201	209	214	221	229
	Winter	181	193	208	215	219	225	232
	Spring	186	198	212	219	222	228	234

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 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 the specific instructional weeks set by partners.

¹ A linking study will be conducted for the NC EOG English Language Arts (ELA) assessment once it has been administered with the new standards.

E.1. Assessment Overview

The NC EOG Mathematics Grades 3–8 tests are North Carolina’s state summative assessments aligned to the North Carolina Standard Course of Study (NCSCOS) that were first implemented in Spring 2019 for mathematics. Based on their test scores, students are placed into one of four achievement levels: *Not Proficient*, *Level 3*, *Level 4*, and *Level 5*. These tests are used to provide evidence of student achievement in mathematics for various test score uses such as meeting the requirements of the state’s accountability program. The *Level 3* 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 2019 test administration, the equipercentile linking method was used to identify the spring MAP Growth scores that correspond to the spring NC EOG achievement 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 NC EOG Mathematics 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 NC EOG Mathematics assessments in Spring 2019 were included in the study sample. Table E.2 presents the weighted number of North Carolina students from nine districts and 203 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 achievement 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.

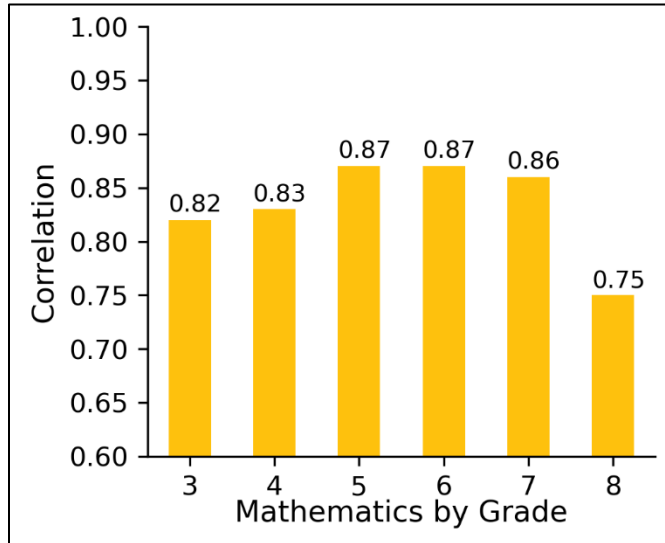
Table E.2. Linking Study Sample

Grade	#Students
3	15,269
4	15,873
5	15,825
6	14,973
7	14,255
8	9,011

E.4. Test Score Relationships

Correlations between MAP Growth RIT scores and NC EOG scores range from 0.75 to 0.87, 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 NC EOG Mathematics assessments.

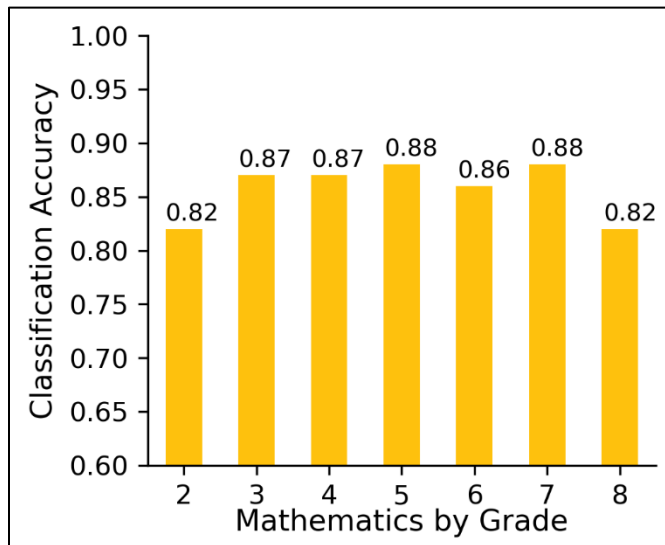
Figure E.1. Correlations between MAP Growth and NC EOG Mathematics Test Scores



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 NC EOG Mathematics tests. For example, the MAP Growth Mathematics Grade 3 *Level/3* cut score has a 0.87 accuracy rate, meaning it accurately classified student achievement on the state test for 87% of the sample. The results range from 0.82 to 0.88, indicating that RIT scores have a high accuracy rate of identifying student proficiency on the NC EOG Mathematics 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 December 2020 to statistically connect the scores of the North Carolina End-of-Grade (NC EOG) Mathematics assessments in Grades 3–8 with Rasch Unit (RIT) scores from the MAP Growth 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) and the cut scores for the NC EOG Mathematics assessment have been updated based on new standards. 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 NC EOG 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 NC EOG achievement 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 NC EOG tests
5. The probability of achieving grade-level proficiency on the NC EOG assessment based on MAP Growth RIT scores from fall, winter, and spring using the 2020 norms

1.2. Assessment Overview

The NC EOG Grades 3–8 Mathematics summative assessments are aligned to the North Carolina Standard Course of Study (NCSCOS) that were first implemented in Spring 2019 for mathematics. Each assessment has three cut scores (i.e., the minimum score a student must get on a test to be placed in a certain achievement level) that distinguish between the following achievement levels: *Not Proficient*, *Level 3*, *Level 4*, and *Level 5*. The *Level 3* 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 NG EOG Mathematics assessments. NWEA recruited North Carolina 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 North Carolina 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 NC EOG Mathematics 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 achievement 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 achievement 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 equipercntile linking method (Kolen & Brennan, 2004) was used to identify the spring MAP Growth RIT scores that correspond to the spring NC EOG achievement 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 NC EOG 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 compared to peers nationwide and (2) the relative rigor of a state's achievement level designations for its summative assessment.

The MAP Growth spring cut scores for Grades 3–8 could be calculated using the equipercntile linking method because that data are directly connected to the NC EOG spring data used in the study. The equipercntile 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., NC EOG). Its equipercntile 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 NC EOG on the scale of MAP Growth, $P(x)$ is the percentile rank of a given score on NC EOG, 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 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 NC EOG Mathematics 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 (*Level 3, Level 4, or Level 5*) or not proficient. Table 2.1 describes the classification accuracy statistics provided in this report (Pommerich, Hanson, Harris, & Scoring, 2004). The results are based on the Spring 2019 MAP Growth and NC EOG Mathematics data for the *Level 3* cut score.

Since North Carolina students do not begin taking the NC EOG assessment until Grade 3, longitudinal data were collected for the Grade 3 cohort in order to link the NC EOG Mathematics assessment to MAP Growth for Grade 2 to calculate the classification accuracy statistics. To accomplish this, 2018–2019 NC EOG 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	$(TP + TN) / (\text{total sample size})$	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 NC EOG 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 *Level 3* proficiency on the NC EOG test based on their fall or winter RIT score:

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

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 *Level 3* 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 *Level 3* proficiency on the NC EOG test based on their spring RIT score (RIT_{Spring}):

$$Pr(\text{Achieving Level 3 in spring} | \text{spring RIT}) = \Phi \left(\frac{RIT_{Spring} - RIT_{SpringCut}}{SE} \right) \quad (4)$$

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 NC EOG Mathematics assessments in Spring 2019 were included in the study sample. Data used in this study were collected from nine districts and 203 schools in North Carolina. Table 3.1 presents the demographic distributions of race, sex, and achievement level in the original unweighted study sample. Table 3.2 presents the distributions of the student population that took the Spring 2019 NC EOG Mathematics tests. Since the unweighted data are different from the general NC EOG 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 NC EOG 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
Total N		15,269	15,857	15,825	14,958	14,255	9,011
Race	American Indian	0.3	0.3	0.3	0.3	0.2	0.4
	Asian	6.0	5.9	5.1	5.0	5.1	2.3
	Black	30.6	31.0	31.8	31.1	30.6	38.1
	Hispanic	24.8	25.9	25.6	25.2	24.0	27.3
	Multi-Race	0.2	0.1	0.2	0.1	0.1	0.1
	Native Hawaiian/Pacific Islander	3.4	2.9	2.7	3.1	3.0	2.8
	White	34.7	33.9	34.4	35.2	36.9	29.0
Sex	Female	49.2	48.7	49.4	49.0	49.0	48.4
	Male	50.8	51.3	50.6	51.0	51.0	51.6
Achievement Level	<i>Not Proficient</i>	32.3	38.7	35.9	38.2	38.4	64.7
	<i>Level 3</i>	19.0	17.6	17.7	16.7	13.2	15.1
	<i>Level 4</i>	32.4	27.1	31.6	30.1	31.7	14.3
	<i>Level 5</i>	16.3	16.6	14.8	15.0	16.8	5.8

Table 3.2. Spring 2019 NC EOG Student Population Demographics

Spring 2019 NC EOG Mathematics Population							
Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
Total N		116,059	120,320	121,935	121,613	118,471	80,897
Race	American Indian	1.1	1.2	1.1	1.2	1.1	1.3
	Asian	3.8	3.6	3.4	3.4	3.4	1.7
	Black	25.1	25.6	25.3	25.0	25.0	29.0
	Hispanic	19.3	19.2	19.2	19.4	18.8	20.6
	Multi-Race	4.7	4.5	4.7	4.6	4.5	4.4
	Native Hawaiian/Pacific Islander	0.2	0.2	0.1	0.1	0.1	0.1
	White	45.8	45.8	46.1	46.4	47.1	42.9
Sex	Female	48.9	48.6	48.9	48.7	48.9	47.7
	Male	51.1	51.4	51.1	51.3	51.1	52.3
Achievement Level	<i>Not Proficient</i>	35.5	42.5	39.5	41.0	41.5	64.3
	<i>Level 3</i>	20.0	17.6	18.2	17.2	13.9	16.0
	<i>Level 4</i>	30.7	25.4	30.8	29.8	31.5	14.0
	<i>Level 5</i>	13.8	14.6	11.5	12.1	13.1	5.7

Table 3.3. Linking Study Sample Demographics (Weighted)

Linking Study Sample (Weighted)							
Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
Total N		15,269	15,873	15,825	14,973	14,255	9,011
Race	American Indian	1.1	1.2	1.1	1.2	1.1	1.3
	Asian	3.8	3.6	3.4	3.4	3.4	1.7
	Black	25.1	25.6	25.3	25.0	25.0	29.0
	Hispanic	19.3	19.2	19.2	19.4	18.8	20.6
	Multi-Race	4.7	4.5	4.7	4.6	4.5	4.4
	Native Hawaiian/Pacific Islander	0.2	0.2	0.1	0.1	0.1	0.1
	White	45.8	45.8	46.1	46.4	47.1	42.9
Sex	Female	48.9	48.6	48.9	48.7	48.9	47.7
	Male	51.1	51.4	51.1	51.3	51.1	52.3
Achievement Level	<i>Not Proficient</i>	35.5	42.5	39.5	41.0	41.5	64.3
	<i>Level 3</i>	20.0	17.6	18.2	17.2	13.9	16.0
	<i>Level 4</i>	30.7	25.4	30.8	29.8	31.5	14.0
	<i>Level 5</i>	13.8	14.6	11.5	12.1	13.1	5.7

3.2. Descriptive Statistics

Table 3.4 presents descriptive statistics of the MAP Growth and NC EOG Mathematics test scores from Spring 2019, including the correlation coefficient (r) between them. The correlation coefficients between the scores range from 0.75 to 0.87. 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 NC EOG Mathematics assessments.

Table 3.4. Descriptive Statistics of Test Scores

Grade	N	r	NC EOG Mathematics*				MAP Growth Mathematics*			
			Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
3	15,269	0.82	548.5	10.2	448	570	202.0	14.2	132	296
4	15,873	0.83	548.4	10.1	449	570	212.8	15.3	132	285
5	15,825	0.87	548.0	10.2	445	570	221.4	17.1	138	297
6	14,973	0.87	548.4	9.8	456	573	224.1	17.0	149	295
7	14,255	0.86	548.3	9.9	452	573	230.3	19.2	147	317
8	9,011	0.75	538.7	9.5	418	570	226.2	17.1	152	289

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

3.3. MAP Growth Cut Scores

Table 3.5 presents the NC EOG Mathematics scale score ranges and the corresponding MAP Growth Mathematics RIT cut scores and percentile ranges by grade. These tables can be used to predict a student's likely achievement level on the NC EOG 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 185 in the fall is likely to reach *Level 3* proficiency on the NC EOG Mathematics test. A Grade 3 student who obtained a MAP Growth Mathematics RIT score of 198 in the spring is also likely to reach *Level 3* proficiency on the NC EOG assessment. 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 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 achievement level could be different from the generic projection presented in this document. Partners are therefore encouraged to use the projected achievement 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

NC EOG Mathematics								
Grade	Not Proficient		Level 3		Level 4		Level 5	
3	≤ 544		545–550		551–559		≥ 560	
4	≤ 546		547–551		552–559		≥ 560	
5	≤ 545		546–550		551–560		≥ 561	
6	≤ 545		546–550		551–560		≥ 561	
7	≤ 545		546–549		550–559		≥ 560	
8	≤ 542		543–547		548–554		≥ 555	
MAP Growth Mathematics*								
Grade	Not Proficient		Level 3		Level 4		Level 5	
	RIT	Percentile	RIT	Percentile	RIT	Percentile	RIT	Percentile
Fall								
2	100–170	1–37	171 –180	38–67	181–193	68–92	194–350	93–99
3	100–184	1–39	185 –193	40–65	194–204	66–88	205–350	89–99
4	100–200	1–53	201 –206	54–69	207–217	70–89	218–350	90–99
5	100–208	1–49	209 –216	50–69	217–230	70–92	231–350	93–99
6	100–213	1–47	214 –221	48–66	222–235	67–90	236–350	91–99
7	100–220	1–51	221 –227	52–66	228–243	67–90	244–350	91–99
8	100–228	1–58	229 –236	59–73	237–246	74–87	247–350	88–99
Winter								
2	100–180	1–40	181 –189	41–67	190–201	68–91	202–350	92–99
3	100–192	1–40	193 –200	41–63	201–212	64–88	213–350	89–99
4	100–207	1–54	208 –213	55–69	214–224	70–89	225–350	90–99
5	100–214	1–50	215 –222	51–69	223–236	70–91	237–350	92–99
6	100–218	1–48	219 –226	49–66	227–240	67–89	241–350	90–99
7	100–224	1–51	225 –231	52–66	232–247	67–90	248–350	91–99
8	100–231	1–57	232 –239	58–72	240–249	73–86	250–350	87–99
Spring								
2	100–185	1–39	186 –194	40–65	195–206	66–89	207–350	90–99
3	100–197	1–40	198 –205	41–63	206–216	64–86	217–350	87–99
4	100–211	1–53	212 –217	54–67	218–228	68–87	229–350	88–99
5	100–218	1–50	219 –226	51–68	227–240	69–90	241–350	91–99
6	100–221	1–47	222 –229	48–65	230–243	66–88	244–350	89–99
7	100–227	1–52	228 –234	53–66	235–250	67–89	251–350	90–99
8	100–233	1–56	234 –241	57–71	242–251	72–85	252–350	86–99

*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 NC EOG Mathematics tests, providing insight into the predictive validity of MAP Growth. The overall classification accuracy rate ranges from 0.82 to 0.88. These values suggest that the RIT cut scores are good at classifying students as proficient or not proficient on the NC EOG Mathematics assessment. For Grade 2, the classification accuracy rate refers to how well the MAP Growth cuts can predict students' proficiency status on NC EOG 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 NC EOG tests, there is a notable limitation to how these results should be used and interpreted. NC EOG 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	NC EOG		FP	FN				
2	10,813	186	545	0.82	0.21	0.17	0.83	0.79	0.91	0.90
3	15,269	198	545	0.87	0.24	0.07	0.93	0.76	0.88	0.93
4	15,873	212	547	0.87	0.18	0.10	0.90	0.82	0.87	0.94
5	15,825	219	546	0.88	0.15	0.10	0.90	0.85	0.90	0.95
6	14,973	222	546	0.86	0.18	0.11	0.89	0.82	0.88	0.94
7	14,255	228	546	0.88	0.14	0.10	0.90	0.86	0.90	0.95
8	9,011	234	543	0.82	0.14	0.25	0.75	0.86	0.74	0.90

*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 *Level 3* performance on the NC EOG Mathematics test based on RIT scores from fall, winter, or spring. "Prob." indicates the probability of obtaining proficient status on the NC EOG test in the spring. For example, a Grade 3 student who obtained a MAP Growth Mathematics score of 196 in the fall has a 95% chance of reaching *Level 3* proficiency or higher on the NC EOG test.

Table 3.7. Proficiency Projection based on RIT Scores

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Level 3	Prob.		Level 3	Prob.		Level 3	Prob.
2	5	186	154	No	0.01	163	No	<0.01	167	No	<0.01
	10	186	158	No	0.03	167	No	<0.01	172	No	<0.01
	15	186	162	No	0.11	171	No	0.03	175	No	<0.01
	20	186	164	No	0.14	173	No	0.07	178	No	<0.01
	25	186	166	No	0.22	175	No	0.15	180	No	0.02
	30	186	168	No	0.32	177	No	0.26	182	No	0.08
	35	186	170	No	0.44	179	No	0.42	184	No	0.25
	40	186	172	Yes	0.56	181	Yes	0.50	186	Yes	0.50
	45	186	173	Yes	0.62	182	Yes	0.58	188	Yes	0.75
	50	186	175	Yes	0.68	184	Yes	0.74	189	Yes	0.85
	55	186	177	Yes	0.78	186	Yes	0.85	191	Yes	0.96
	60	186	178	Yes	0.82	187	Yes	0.90	193	Yes	0.99
	65	186	180	Yes	0.89	189	Yes	0.95	195	Yes	>0.99
	70	186	182	Yes	0.94	191	Yes	0.98	196	Yes	>0.99
	75	186	184	Yes	0.97	193	Yes	0.99	198	Yes	>0.99
	80	186	186	Yes	0.98	195	Yes	>0.99	201	Yes	>0.99
	85	186	188	Yes	0.99	198	Yes	>0.99	203	Yes	>0.99
90	186	192	Yes	>0.99	201	Yes	>0.99	207	Yes	>0.99	
95	186	196	Yes	>0.99	205	Yes	>0.99	212	Yes	>0.99	
3	5	198	166	No	<0.01	174	No	<0.01	178	No	<0.01
	10	198	171	No	0.02	179	No	<0.01	183	No	<0.01
	15	198	175	No	0.05	182	No	0.01	186	No	<0.01
	20	198	177	No	0.10	185	No	0.04	189	No	<0.01
	25	198	179	No	0.17	187	No	0.10	192	No	0.02
	30	198	181	No	0.26	189	No	0.20	194	No	0.08
	35	198	183	No	0.37	191	No	0.33	196	No	0.25
	40	198	185	Yes	0.50	193	Yes	0.50	198	Yes	0.50
	45	198	187	Yes	0.63	195	Yes	0.67	199	Yes	0.63
	50	198	188	Yes	0.69	196	Yes	0.74	201	Yes	0.85
	55	198	190	Yes	0.79	198	Yes	0.86	203	Yes	0.96
	60	198	192	Yes	0.83	200	Yes	0.93	205	Yes	0.99
	65	198	194	Yes	0.90	201	Yes	0.96	207	Yes	>0.99
	70	198	196	Yes	0.95	203	Yes	0.98	208	Yes	>0.99
	75	198	198	Yes	0.97	205	Yes	0.99	211	Yes	>0.99
	80	198	200	Yes	0.99	208	Yes	>0.99	213	Yes	>0.99
	85	198	202	Yes	>0.99	210	Yes	>0.99	216	Yes	>0.99
90	198	206	Yes	>0.99	214	Yes	>0.99	219	Yes	>0.99	
95	198	211	Yes	>0.99	219	Yes	>0.99	224	Yes	>0.99	

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Level 3	Prob.		Level 3	Prob.		Level 3	Prob.
4	5	212	176	No	<0.01	182	No	<0.01	185	No	<0.01
	10	212	181	No	<0.01	187	No	<0.01	191	No	<0.01
	15	212	185	No	0.01	191	No	<0.01	194	No	<0.01
	20	212	187	No	0.01	194	No	<0.01	197	No	<0.01
	25	212	190	No	0.04	196	No	0.01	200	No	<0.01
	30	212	192	No	0.07	198	No	0.02	202	No	<0.01
	35	212	194	No	0.13	200	No	0.04	205	No	0.01
	40	212	196	No	0.21	202	No	0.10	207	No	0.04
	45	212	198	No	0.32	204	No	0.20	209	No	0.15
	50	212	200	No	0.44	206	No	0.33	211	No	0.37
	55	212	201	Yes	0.50	208	Yes	0.50	212	Yes	0.50
	60	212	203	Yes	0.63	210	Yes	0.67	214	Yes	0.75
	65	212	205	Yes	0.74	212	Yes	0.80	217	Yes	0.96
	70	212	207	Yes	0.83	214	Yes	0.90	219	Yes	0.99
	75	212	209	Yes	0.90	216	Yes	0.96	221	Yes	>0.99
	80	212	212	Yes	0.96	219	Yes	0.99	224	Yes	>0.99
85	212	214	Yes	0.98	221	Yes	>0.99	227	Yes	>0.99	
90	212	218	Yes	>0.99	225	Yes	>0.99	230	Yes	>0.99	
95	212	223	Yes	>0.99	231	Yes	>0.99	236	Yes	>0.99	
5	5	219	184	No	<0.01	189	No	<0.01	191	No	<0.01
	10	219	190	No	<0.01	194	No	<0.01	197	No	<0.01
	15	219	193	No	<0.01	198	No	<0.01	201	No	<0.01
	20	219	196	No	0.02	201	No	<0.01	205	No	<0.01
	25	219	199	No	0.05	204	No	0.01	207	No	<0.01
	30	219	201	No	0.11	206	No	0.03	210	No	<0.01
	35	219	203	No	0.18	209	No	0.10	212	No	0.01
	40	219	205	No	0.27	211	No	0.20	215	No	0.08
	45	219	207	No	0.38	213	No	0.34	217	No	0.25
	50	219	209	Yes	0.50	215	Yes	0.50	219	Yes	0.50
	55	219	211	Yes	0.62	217	Yes	0.66	221	Yes	0.75
	60	219	213	Yes	0.73	219	Yes	0.80	223	Yes	0.92
	65	219	215	Yes	0.82	221	Yes	0.90	225	Yes	0.98
	70	219	217	Yes	0.89	223	Yes	0.95	228	Yes	>0.99
	75	219	219	Yes	0.94	225	Yes	0.98	230	Yes	>0.99
	80	219	222	Yes	0.98	228	Yes	>0.99	233	Yes	>0.99
85	219	225	Yes	0.99	231	Yes	>0.99	236	Yes	>0.99	
90	219	229	Yes	>0.99	235	Yes	>0.99	240	Yes	>0.99	
95	219	234	Yes	>0.99	241	Yes	>0.99	246	Yes	>0.99	

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Level 3	Prob.		Level 3	Prob.		Level 3	Prob.
6	5	222	188	No	<0.01	192	No	<0.01	194	No	<0.01
	10	222	194	No	<0.01	198	No	<0.01	200	No	<0.01
	15	222	198	No	0.01	202	No	<0.01	205	No	<0.01
	20	222	201	No	0.02	205	No	<0.01	208	No	<0.01
	25	222	204	No	0.06	208	No	0.01	211	No	<0.01
	30	222	206	No	0.10	211	No	0.04	214	No	<0.01
	35	222	209	No	0.22	213	No	0.10	216	No	0.02
	40	222	211	No	0.32	215	No	0.20	218	No	0.08
	45	222	213	No	0.44	217	No	0.34	221	No	0.37
	50	222	215	Yes	0.56	220	Yes	0.58	223	Yes	0.63
	55	222	217	Yes	0.68	222	Yes	0.74	225	Yes	0.85
	60	222	219	Yes	0.78	224	Yes	0.86	227	Yes	0.96
	65	222	221	Yes	0.86	226	Yes	0.93	230	Yes	>0.99
	70	222	223	Yes	0.92	228	Yes	0.97	232	Yes	>0.99
	75	222	226	Yes	0.97	231	Yes	0.99	235	Yes	>0.99
	80	222	228	Yes	0.99	234	Yes	>0.99	238	Yes	>0.99
85	222	231	Yes	>0.99	237	Yes	>0.99	241	Yes	>0.99	
90	222	235	Yes	>0.99	241	Yes	>0.99	245	Yes	>0.99	
95	222	241	Yes	>0.99	247	Yes	>0.99	252	Yes	>0.99	
7	5	228	192	No	<0.01	194	No	<0.01	196	No	<0.01
	10	228	198	No	<0.01	201	No	<0.01	203	No	<0.01
	15	228	202	No	<0.01	205	No	<0.01	207	No	<0.01
	20	228	206	No	<0.01	209	No	<0.01	211	No	<0.01
	25	228	208	No	0.01	212	No	<0.01	214	No	<0.01
	30	228	211	No	0.04	215	No	0.02	217	No	<0.01
	35	228	213	No	0.07	217	No	0.04	220	No	<0.01
	40	228	216	No	0.17	219	No	0.10	222	No	0.02
	45	228	218	No	0.31	222	No	0.26	224	No	0.08
	50	228	220	No	0.44	224	No	0.42	227	No	0.37
	55	228	222	Yes	0.56	226	Yes	0.58	229	Yes	0.63
	60	228	225	Yes	0.74	229	Yes	0.80	231	Yes	0.85
	65	228	227	Yes	0.83	231	Yes	0.90	234	Yes	0.98
	70	228	229	Yes	0.90	233	Yes	0.96	236	Yes	>0.99
	75	228	232	Yes	0.96	236	Yes	0.99	239	Yes	>0.99
	80	228	235	Yes	0.99	239	Yes	>0.99	242	Yes	>0.99
85	228	238	Yes	>0.99	243	Yes	>0.99	246	Yes	>0.99	
90	228	243	Yes	>0.99	247	Yes	>0.99	251	Yes	>0.99	
95	228	249	Yes	>0.99	254	Yes	>0.99	257	Yes	>0.99	

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Level 3	Prob.		Level 3	Prob.		Level 3	Prob.
8	5	234	194	No	<0.01	196	No	<0.01	197	No	<0.01
	10	234	201	No	<0.01	203	No	<0.01	205	No	<0.01
	15	234	205	No	<0.01	208	No	<0.01	210	No	<0.01
	20	234	209	No	<0.01	212	No	<0.01	214	No	<0.01
	25	234	212	No	0.01	215	No	<0.01	217	No	<0.01
	30	234	215	No	0.03	218	No	<0.01	220	No	<0.01
	35	234	218	No	0.06	221	No	0.01	223	No	<0.01
	40	234	220	No	0.10	223	No	0.03	225	No	<0.01
	45	234	223	No	0.19	226	No	0.11	228	No	0.02
	50	234	225	No	0.28	228	No	0.20	230	No	0.08
	55	234	227	No	0.39	231	No	0.42	233	No	0.37
	60	234	230	Yes	0.56	233	Yes	0.58	235	Yes	0.63
	65	234	232	Yes	0.67	236	Yes	0.80	238	Yes	0.92
	70	234	235	Yes	0.81	238	Yes	0.89	241	Yes	0.99
	75	234	238	Yes	0.90	241	Yes	0.97	244	Yes	>0.99
	80	234	241	Yes	0.96	244	Yes	0.99	247	Yes	>0.99
	85	234	245	Yes	0.99	248	Yes	>0.99	251	Yes	>0.99
90	234	249	Yes	>0.99	253	Yes	>0.99	256	Yes	>0.99	
95	234	256	Yes	>0.99	260	Yes	>0.99	263	Yes	>0.99	

4. References

- Kolen, M. J., & Brennan, R. L. (2004). *Test equating, scaling, and linking*. Springer.
- Lumley, T. (2019). *Survey: Analysis of complex survey samples*. R package version 3.36. <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.