

Linking Study Report: Predicting Performance on the Missouri Assessment Program (MAP) based on MAP[®] Growth[™] Scores

February 2020

NWEA Psychometric Solutions

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Executive Summary

To predict student achievement on the Missouri Assessment Program (MAP) English Language Arts (ELA) and Mathematics Grades 3–8 tests¹ based on MAP® Growth™ Rasch Unit (RIT) scores, NWEA® conducted a linking study to derive cut scores on the MAP Growth assessments that correspond to the Missouri 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.

Table E.1 presents the Proficient performance level cut scores and the corresponding 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 Missouri Grade 3 ELA test is 364. A Grade 3 student with a MAP Growth Reading RIT score of 191 in the fall is likely to meet proficiency on the state summative test in the spring, whereas a Grade 3 student with a Reading RIT score lower than 191 in the fall is in jeopardy of not meeting proficiency.

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 from winter-to-spring. The typical growth scores 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.

Table E.1. MAP Growth Cut Score Predictions for State Summative Proficiency

Assessment		Proficient Cut Scores by Grade					
		3	4	5	6	7	8
ELA/Reading							
Missouri MAP		364	388	403	413	435	443
MAP Growth	Fall	191	199	209	214	220	222
	Winter	198	205	213	217	222	223
	Spring	201	207	215	218	223	224
Mathematics							
Missouri MAP		362	387	410	417	435	468
MAP Growth	Fall	190	200	213	218	225	234
	Winter	198	207	219	223	229	236
	Spring	203	212	223	226	231	238

E.1. Assessment Overview

The MAP ELA and Mathematics tests are Missouri’s state summative tests aligned to the Missouri Learning Standards and administered to students in Grades 3–8. Based on their state test scores, students are placed into one of four performance levels: Below Basic, Basic, Proficient, and Advanced. The Proficient cut score demarks the minimum level of achievement considered to be proficient. MAP Growth tests from NWEA are adaptive interim assessments aligned to the Missouri Learning Standards and administered in the fall, winter, and spring. RIT scores are reported on the RIT vertical scale with a range of 100–350.

¹ To avoid confusion, the MAP tests are referred to as the Missouri state tests throughout this report.

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 Missouri performance level cut scores by grade and content area. MAP Growth fall and winter cut scores that predict proficiency on the spring Missouri state tests were then projected using the 2015 NWEA growth norms that provide expected score gains across test administrations.

E.3. Student Sample

Only students who took both the MAP Growth and Missouri state tests in Spring 2018 were included in this study sample. Table E.2 presents the weighted number of Missouri students from 12 districts and 66 schools who were included in the linking study sample. Student scores were weighted to ensure that the sample was representative of the state population. All analyses in this study were conducted based on the weighted sample.

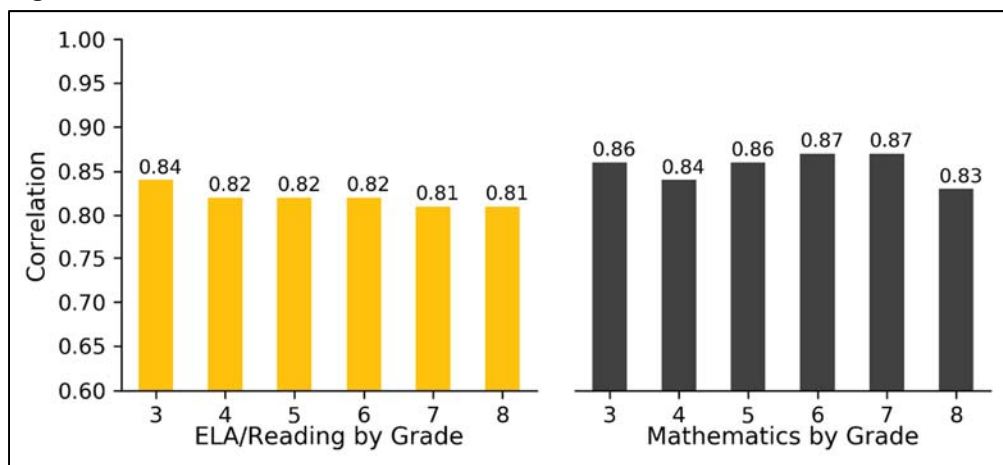
Table E.2. Linking Study Sample

Grade	#Students	
	ELA/Reading	Mathematics
3	2,692	2,742
4	2,692	2,765
5	2,462	2,645
6	2,539	2,783
7	2,273	2,553
8	1,765	1,828

E.4. Test Score Relationships

Correlations between MAP Growth RIT scores and Missouri state test scores range from 0.81 to 0.87, as shown in Figure E.1. These values indicate a strong relationship among the scores, which provides evidence that the two tests measure similar constructs.

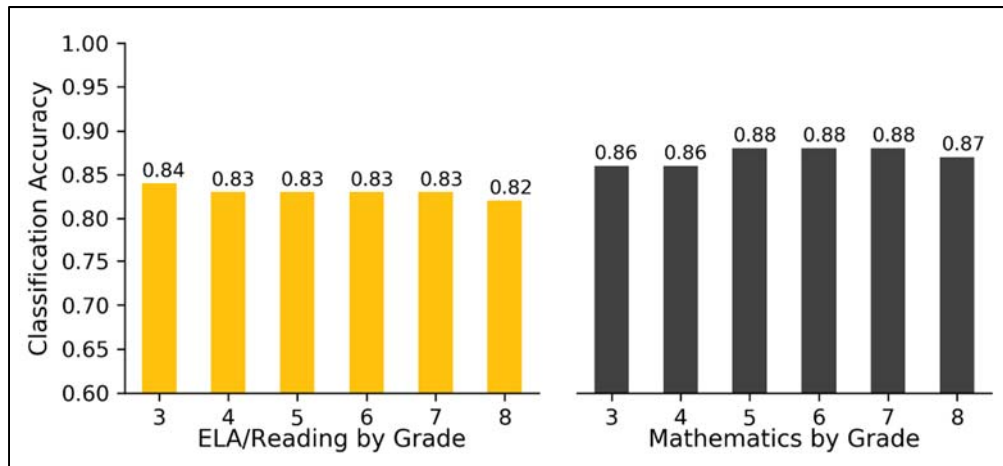
Figure E.1. Correlations between MAP Growth and Missouri State Tests



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 Missouri state tests. For example, the MAP Growth Reading Grade 3 Proficient 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 0.88, indicating that RIT scores have a high accuracy rate of identifying student proficiency on the Missouri state 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 the MAP® Growth™ test scores. An 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 February 2020 to statistically connect the scores of the Missouri Assessment Program (MAP) English Language Arts (ELA) and Mathematics Grades 3–8 assessments with Rasch Unit (RIT) scores from the MAP Growth assessments taken during the Spring 2018 term. Specifically, this report presents the following results:

1. Student sample demographics
2. Descriptive statistics of test scores from both assessments
3. MAP Growth Reading and Mathematics RIT cut scores that correspond to the cut scores on the Missouri state tests using the equipercntile linking procedure for the MAP Growth spring results and the 2015 norms (Thum & Hauser, 2015) for the MAP Growth fall and winter results.
4. Classification accuracy statistics to determine the degree to which MAP Growth tests accurately predict student proficiency status on the state summative tests.
5. The probability of meeting or exceeding grade-level proficiency (i.e., achieving Proficient or above performance) on the Missouri state assessment based on MAP Growth scores from fall, winter, and spring using the 2015 norms.

1.2. Assessment Overview

Missouri's MAP ELA and Mathematics summative assessments are aligned to the Missouri Learning Standards and are administered to students in Grades 3–8. Each assessment has three cut scores that distinguish between the following performance levels: Below Basic, Basic, Proficient, and Advanced. A cut score is the minimum score a student must get on a test to be placed in a certain achievement level. The Proficient cut score that distinguishes between Basic and Proficient performance 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 the Missouri Learning Standards. Scores are reported on the RIT vertical scale with a range of 100–350. Each content area has its own scale. To aid interpretation of MAP Growth scores, NWEA periodically conducts norming studies of student and school performance on MAP Growth. The most recent norming study employed multi-level growth models on nearly 500,000 longitudinal test scores from over 100,000 students that were weighted to create large, nationally representative norms.

2. Methods

2.1. Data Collection

This linking study is based on data from the Spring 2018 administrations of MAP Growth and the Missouri state assessments. NWEA recruited Missouri school 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 NWEA's in-house database. Once Missouri state score information was received by participating districts, 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 interim and state summative 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 study sample represented the state population in terms of race, gender, and performance level. These variables were selected because they were correlated with a student's academic achievement within this study, and these data are often provided for the state population. When weighted, the 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, gender, and performance level for the sample and population.
- Calculate post-stratification weights with the rake function from the survey package in R.
- 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. Equipercentile Linking Procedure

The equipercentile procedure (Kolen & Brennan, 2004) was used to link the spring Missouri state summative test scores and the spring RIT scores, and the 2015 MAP Growth norms were used to predict performance on the spring Missouri state test based on RIT scores in the fall and winter. The MAP Growth spring cut scores could be calculated using the equipercentile linking method because that data is directly connected to the spring state test 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). Consider the linked scores between two tests. Let x represent a score on Test X (e.g., Missouri MAP). 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 Test X on the scale of MAP Growth, $P(x)$ is the percentile rank of a given score on Test X , 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.

2.4. Classification Accuracy

The degree to which MAP Growth predicts student proficiency status on the state summative tests can be described using classification accuracy statistics that show the proportion of students correctly classified by their MAP Growth scores as proficient (i.e., Proficient or Advanced) or not proficient (i.e., Below Basic or Basic) on the Missouri state tests. Table 2.1 describes the classification accuracy statistics provided in this report. The results are based on the Spring 2018 MAP Growth and Missouri state test data for the Proficient cut score.

Table 2.1. Description of Classification Accuracy Summary Statistics

Statistic	Description*	Interpretation
Overall Classification Accuracy Rate	$(TP + TN) / (\text{total sample size})$	The proportion of students in the study sample whose proficiency classification on the state test was correctly predicted by MAP Growth cut scores (Pommerich, Hanson, Harris, & Scoring, 2004).
Sensitivity	$TP / (TP + FN)$	The proportion of proficient students who were correctly identified on the MAP Growth test as such.
Specificity	$TN / (TN + FP)$	The proportion of below-proficient students who were correctly identified on the MAP Growth test as such.
False Negative Rate	$FN / (FN + TP)$	The proportion of proficient students who were incorrectly predicted by MAP Growth test to be below proficiency.
False Positive Rate	$FP / (FP + TN)$	The proportion of below-proficient students who were incorrectly predicted by MAP Growth test to be proficient.
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.

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

2.5. Proficiency Projection

MAP Growth conditional growth norms provide students’ expected score gains across testing seasons. This information was used to estimate the previous fall and winter MAP Growth scores that would meet the MAP Growth spring cut by adding the fall or winter RIT score with the growth score and comparing the sum to the spring cuts to determine a student’s projected performance. Equation 2 was used to determine the fall or winter 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 fall or winter RIT score.
- g is the expected growth from fall or winter to spring corresponding to $RIT_{previous}$.

The MAP Growth conditional growth norms data were also used to calculate the probability of reaching proficiency on the Missouri state 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 proficiency based on their fall or winter RIT score:

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

where:

- Φ is a standardized normal cumulative distribution.
- $RIT_{previous}$ is the student's RIT score in fall or winter.
- g is the expected growth from fall or winter to spring corresponding to that previous RIT.
- $RIT_{SpringCut}$ is the MAP Growth Proficient cut score for spring.
- SD is the conditional standard deviation of growth from fall or winter to spring.

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

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

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 Missouri state summative assessments in Spring 2018 were included in the study sample. Data used in this study were collected from 12 districts and 66 schools in Missouri. Table 3.1 presents the unweighted demographics of the linking study sample, and Table 3.1 presents student demographic information of the Spring 2018 general Missouri student population (DESE, 2018). Since the unweighted data are different from the Missouri population, post-stratification weights were applied to the linking study sample to improve its representativeness. Table 3.3 presents the sample percentages after weighting, which are almost identical to the Missouri student population distributions. The differences are no more than 1%. The analyses in this study were therefore conducted based on the weighted sample.

Table 3.1. Linking Study Sample Demographics (Unweighted)

Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
ELA/Reading							
Total N		2,697	2,663	2,467	2,547	2,280	1,770
Race	White	81.1	80.5	78.2	77.3	79.7	76.4
	Black	5.5	6.6	7.5	6.4	5.6	7.3
	Hispanic	6.8	5.9	7.4	7.8	7.2	9.4
	Asian/PI	1.6	1.7	1.4	2.1	2.2	1.6
	Other*	5.1	5.3	5.6	6.4	5.3	5.4
Gender	Female	49.6	49.7	48.3	50.5	50.3	49.5
	Male	50.4	50.3	51.7	49.5	49.7	50.5
Performance Level	Below Basic	18.8	7.3	7.3	9.5	11.0	10.9
	Basic	26.7	33.9	37.3	34.0	39.0	40.4
	Proficient	28.8	33.8	30.3	28.3	21.1	31.9
	Advanced	25.7	24.9	25.1	28.3	28.9	16.8
Mathematics							
Total N		2,742	2,765	2,645	2,783	2,556	1,832
Race	White	78.9	78.3	74.5	76.1	78.2	76.6
	Black	6.5	7.2	8.7	7.2	6.4	8.3
	Hispanic	6.6	6.1	7.9	7.3	7.1	8.7
	Asian/PI	2.4	2.4	2.3	2.9	2.7	1.3
	Other*	5.7	6.0	6.6	6.5	5.6	5.1
Gender	Female	48.8	49.8	47.9	50.6	50.6	48.9
	Male	51.2	50.2	52.1	49.4	49.4	51.1
Performance Level	Below Basic	20.4	21.0	20.0	22.7	18.7	31.3
	Basic	25.5	25.6	30.9	29.9	35.6	41.3
	Proficient	26.6	27.9	27.0	21.0	23.9	22.4
	Advanced	27.5	25.5	22.2	26.4	21.8	5.0

*Other = American Indian, Pacific Islander, and Not Specified.

Table 3.2. Spring 2018 Missouri Population Demographics

Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
ELA/Reading							
Total N		67,932	69,593	69,835	67,941	66,833	66,276
Race	White	69.7	69.9	70.2	71.1	71.8	72.4
	Black	16.6	16.4	16.3	16.0	15.4	15.6
	Hispanic	6.5	6.6	6.6	6.5	6.5	6.1
	Asian	2.2	2.2	2.1	2.2	2.2	2.3
	Other*	5.0	4.9	4.7	4.2	4.1	3.7
Gender	Female	48.6	49.0	49.0	48.8	48.9	48.9
	Male	51.4	51.0	51.0	51.2	51.1	51.1
Performance Level	Below Basic	23.3	12.1	11.4	14.3	15.5	13.2
	Basic	27.9	37.5	40.4	37.1	40.5	37.5
	Proficient	27.0	29.9	26.2	26.3	19.9	30.0
	Advanced	21.6	20.2	21.8	22.0	23.8	19.0
Mathematics							
Total N		68,080	69,719	69,919	67,968	66,041	54,518
Race	White	69.6	69.8	70.1	71.0	71.6	71.3
	Black	16.5	16.4	16.3	16.0	15.6	16.9
	Hispanic	6.5	6.6	6.6	6.6	6.6	6.3
	Asian	2.3	2.2	2.2	2.2	2.1	1.8
	Other*	5.0	4.9	4.7	4.2	4.1	3.7
Gender	Female	48.6	49.0	49.0	48.8	49.0	48.1
	Male	51.4	51.0	51.0	51.2	51.0	51.9
Performance Level	Below Basic	25.1	27.3	24.2	27.7	25.2	32.9
	Basic	27.7	26.6	34.6	30.8	36.5	37.1
	Proficient	25.3	25.2	24.1	21.9	22.2	20.8
	Advanced	21.9	20.9	17.1	19.6	16.0	9.0

*Other = American Indian, Pacific Islander, and Not Specified.

Table 3.3. Linking Study Sample Demographics (Weighted)

Demographic Subgroup		%Students by Grade					
		3	4	5	6	7	8
ELA/Reading							
Total N		2,692	2,655	2,462	2,539	2,273	1,765
Race	White	69.7	69.9	70.3	71.1	71.8	72.3
	Black	16.6	16.4	16.3	16.0	15.4	15.6
	Hispanic	6.5	6.6	6.6	6.5	6.5	6.1
	Asian/PI	2.2	2.2	2.1	2.2	2.2	2.3
	Other*	5.0	4.9	4.7	4.2	4.1	3.7
Gender	Female	48.6	49.0	49.0	48.8	48.9	48.9
	Male	51.4	51.0	51.0	51.2	51.1	51.1
Performance Level	Below Basic	23.3	12.1	11.4	14.3	15.5	13.2
	Basic	28.0	37.6	40.5	37.2	40.6	37.6
	Proficient	27.1	30.0	26.3	26.4	20.0	30.1
	Advanced	21.6	20.3	21.8	22.1	23.9	19.1
Mathematics							
Total N		2,742	2,765	2,645	2,783	2,553	1,828
Race	White	69.7	69.9	70.2	71.0	71.6	71.3
	Black	16.5	16.4	16.3	16.0	15.6	16.9
	Hispanic	6.5	6.6	6.6	6.6	6.6	6.3
	Asian/PI	2.3	2.2	2.2	2.2	2.1	1.8
	Other*	5.0	4.9	4.7	4.2	4.1	3.7
Gender	Female	48.6	49.0	49.0	48.8	49.0	48.1
	Male	51.4	51.0	51.0	51.2	51.0	51.9
Performance Level	Below Basic	25.1	27.3	24.2	27.7	25.2	33.0
	Basic	27.7	26.6	34.6	30.8	36.5	37.2
	Proficient	25.3	25.2	24.1	21.9	22.2	20.8
	Advanced	21.9	20.9	17.1	19.6	16.0	9.0

*Other = American Indian, Pacific Islander, and Not Specified.

3.2. Descriptive Statistics

Table 3.4 presents descriptive statistics of the MAP Growth and Missouri state test scores for Spring 2018, including the correlation coefficient (r) between the two scales. The correlation coefficients between the scores range from 0.81 to 0.84 for ELA and 0.83 to 0.87 for Mathematics. These values indicate a strong relationship among the scores, which provides evidence that the two tests measure similar constructs.

Table 3.4. Descriptive Statistics of Test Scores

Grade	N	r	Missouri MAP*				MAP Growth*			
			Mean	SD	Min.	Max.	Mean	SD	Min.	Max.
ELA/Reading										
3	2,692	0.84	361.3	42.3	160	560	198.3	15.5	148	238
4	2,655	0.82	386.0	40.5	170	570	205.8	14.6	150	251
5	2,462	0.82	401.1	40.0	286	600	211.7	15.4	151	256
6	2,539	0.82	410.9	35.7	302	583	215.8	14.7	158	253
7	2,273	0.81	427.1	39.1	304	630	218.3	15.3	154	260
8	1,765	0.81	438.9	40.4	284	586	221.7	14.7	159	253
Mathematics										
3	2,742	0.86	353.1	49.2	185	520	201.1	14.3	135	254
4	2,765	0.84	377.3	49.0	210	540	211.1	15.5	149	275
5	2,645	0.86	400.2	39.2	250	570	219.5	17.2	145	290
6	2,783	0.87	407.1	38.1	260	580	222.6	15.8	161	281
7	2,553	0.87	420.1	45.5	270	600	225.8	17.1	153	280
8	1,828	0.83	440.7	46.3	310	588	228.5	16.1	159	272

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

3.3. MAP Growth Cut Score Predictions

Table 3.5 and Table 3.6 present the Missouri scale score ranges for each performance level and the corresponding 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 spring Missouri state 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 191 in the fall is likely to reach Proficient proficiency on the state summative test. A Grade 3 student who obtained a MAP Growth Reading RIT score of 201 in the spring is also likely to reach Proficient proficiency. The spring cut score is higher than the fall cut score because growth is expected between fall and spring as students receive more instructions 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 from 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). 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 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 proficiency level in students' profile, classroom, and grade reports since they reflect the specific instructional weeks set by partners.

Table 3.5. MAP Growth Cut Score Predictions—ELA/Reading

Missouri MAP ELA*								
Grade	Below Basic		Basic		Proficient		Advanced	
3	160–330		331–363		364–394		395–560	
4	170–336		337–387		388–418		419–570	
5	210–350		351–402		403–430		431–600	
6	230–370		371–412		413–437		438–620	
7	240–383		384–434		435–455		456–630	
8	250–392		393–442		443–475		476–650	
MAP Growth Reading*								
Grade	Below Basic		Basic		Proficient		Advanced	
	RIT	Percentile	RIT	Percentile	RIT	Percentile	RIT	Percentile
Fall								
3	100–176	1–22	177–190	23–55	191–202	56–81	203–350	82–99
4	100–179	1–11	180–198	12–50	199–211	51–80	212–350	81–99
5	100–182	1–6	183–208	7–57	209–218	58–80	219–350	81–99
6	100–192	1–10	193–213	11–56	214–223	57–79	224–350	80–99
7	100–196	1–12	197–219	13–62	220–226	63–78	227–350	79–99
8	100–200	1–14	201–221	15–60	222–232	61–83	233–350	84–99
Winter								
3	100–184	1–23	185–197	24–54	198–208	55–80	209–350	81–99
4	100–186	1–12	187–204	13–52	205–215	53–78	216–350	79–99
5	100–188	1–7	189–212	8–57	213–221	58–78	222–350	79–99
6	100–196	1–11	197–216	12–56	217–225	57–78	226–350	79–99
7	100–200	1–13	201–221	14–62	222–227	63–76	228–350	77–99
8	100–203	1–15	204–222	16–58	223–233	59–82	234–350	83–99
Spring								
3	100–188	1–25	189–200	26–54	201–210	55–78	211–350	79–99
4	100–189	1–13	190–206	14–51	207–217	52–78	218–350	79–99
5	100–191	1–8	192–214	9–57	215–222	58–76	223–350	77–99
6	100–199	1–13	200–217	14–54	218–226	55–76	227–350	77–99
7	100–202	1–15	203–222	16–61	223–228	62–75	229–350	76–99
8	100–205	1–17	206–223	18–58	224–234	59–82	235–350	83–99

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

Table 3.6. MAP Growth Cut Score Predictions—Mathematics

Missouri MAP Mathematics*								
Grade	Below Basic		Basic		Proficient		Advanced	
3	185–325		326–361		362–389		390–520	
4	210–357		358–386		387–412		413–540	
5	250–376		377–409		410–434		435–570	
6	260–387		388–416		417–437		438–580	
7	270–393		394–434		435–461		462–600	
8	310–419		420–467		468–505		506–660	
MAP Growth Mathematics*								
Grade	Below Basic		Basic		Proficient		Advanced	
	RIT	Percentile	RIT	Percentile	RIT	Percentile	RIT	Percentile
Fall								
3	100–177	1–16	178–189	17–47	190–199	48–75	200–350	76–99
4	100–189	1–18	190–199	19–42	200–211	43–75	212–350	76–99
5	100–197	1–17	198–212	18–52	213–224	53–81	225–350	82–99
6	100–205	1–21	206–217	22–49	218–227	50–73	228–350	74–99
7	100–209	1–21	210–224	22–54	225–235	55–78	236–350	79–99
8	100–216	1–29	217–233	30–65	234–246	66–87	247–350	88–99
Winter								
3	100–186	1–18	187–197	19–47	198–206	48–73	207–350	74–99
4	100–196	1–19	197–206	20–43	207–217	44–73	218–350	74–99
5	100–203	1–18	204–218	19–53	219–230	54–80	231–350	81–99
6	100–210	1–23	211–222	24–51	223–232	52–74	233–350	75–99
7	100–213	1–22	214–228	23–55	229–239	56–78	240–350	79–99
8	100–219	1–29	220–235	30–63	236–248	64–85	249–350	86–99
Spring								
3	100–191	1–19	192–202	20–47	203–211	48–72	212–350	73–99
4	100–201	1–21	202–211	22–44	212–222	45–72	223–350	73–99
5	100–207	1–19	208–222	20–52	223–234	53–79	235–350	80–99
6	100–213	1–23	214–225	24–50	226–235	51–72	236–350	73–99
7	100–215	1–22	216–230	23–54	231–241	55–76	242–350	77–99
8	100–221	1–31	222–237	32–63	238–250	64–84	251–350	85–99

*Cut scores for fall and winter are derived from the spring cuts and growth scores based on the typical instructional weeks. 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 Proficient proficiency on the Missouri state tests, providing insight into the predictive validity of MAP Growth. The overall classification accuracy rate ranges from 0.82 to 0.84 for ELA/Reading and 0.86 to 0.88 for Mathematics. These values suggest that the RIT cut scores are good at classifying students as Proficient on the Missouri state summative assessment.

Although the results show that MAP Growth scores can be used to accurately classify students as Proficient on the Missouri state tests, there is a notable limitation to how these results should be used and interpreted. Both 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

Grade	N	Cut Score		Class. Accuracy*	Rate		Sensitivity	Specificity	AUC*
		MAP Growth	Missouri		FP*	FN*			
ELA/Reading									
3	2,692	201	364	0.84	0.17	0.15	0.85	0.83	0.93
4	2,655	207	388	0.83	0.20	0.14	0.86	0.80	0.91
5	2,462	215	403	0.83	0.15	0.19	0.81	0.85	0.92
6	2,539	218	413	0.83	0.16	0.17	0.83	0.84	0.92
7	2,273	223	435	0.83	0.13	0.21	0.79	0.87	0.92
8	1,765	224	443	0.82	0.18	0.17	0.83	0.82	0.91
Mathematics									
3	2,742	203	362	0.86	0.15	0.12	0.88	0.85	0.94
4	2,765	212	387	0.86	0.17	0.10	0.90	0.83	0.95
5	2,645	223	410	0.88	0.11	0.13	0.87	0.89	0.95
6	2,783	226	417	0.88	0.13	0.09	0.91	0.87	0.96
7	2,553	231	435	0.88	0.11	0.12	0.88	0.89	0.96
8	1,828	238	468	0.87	0.09	0.22	0.78	0.91	0.94

*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 Proficient performance on the Missouri state summative assessment based on RIT scores from fall, winter, or spring. For example, a Grade 3 student who obtained a MAP Growth Reading RIT score of 202 in the fall has a 0.90 or 90% chance of reaching Proficient proficiency or higher on the Missouri state test.

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

ELA/Reading											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.*		Proficient	Prob.*		Proficient	Prob.*
3	5	201	162	No	<0.01	171	No	<0.01	174	No	<0.01
	10	201	168	No	<0.01	176	No	<0.01	179	No	<0.01
	15	201	172	No	0.01	180	No	<0.01	183	No	<0.01
	20	201	175	No	0.03	183	No	<0.01	186	No	<0.01
	25	201	178	No	0.06	185	No	0.01	188	No	<0.01
	30	201	180	No	0.10	188	No	0.04	191	No	<0.01
	35	201	182	No	0.13	190	No	0.06	193	No	0.01
	40	201	184	No	0.20	192	No	0.13	195	No	0.03
	45	201	186	No	0.29	194	No	0.22	197	No	0.11
	50	201	188	No	0.34	196	No	0.35	199	No	0.27
	55	201	190	No	0.44	198	Yes	0.50	201	Yes	0.50
	60	201	192	Yes	0.56	199	Yes	0.58	202	Yes	0.62
	65	201	194	Yes	0.61	201	Yes	0.72	204	Yes	0.83
	70	201	197	Yes	0.76	204	Yes	0.83	207	Yes	0.97
	75	201	199	Yes	0.84	206	Yes	0.91	209	Yes	0.99
	80	201	202	Yes	0.90	208	Yes	0.96	211	Yes	>0.99
	85	201	205	Yes	0.95	211	Yes	0.99	214	Yes	>0.99
90	201	209	Yes	0.98	215	Yes	>0.99	218	Yes	>0.99	
95	201	214	Yes	>0.99	221	Yes	>0.99	223	Yes	>0.99	
4	5	207	173	No	<0.01	179	No	<0.01	181	No	<0.01
	10	207	178	No	<0.01	184	No	<0.01	187	No	<0.01
	15	207	182	No	0.01	188	No	<0.01	190	No	<0.01
	20	207	185	No	0.04	191	No	0.01	193	No	<0.01
	25	207	188	No	0.07	194	No	0.02	196	No	<0.01
	30	207	190	No	0.12	196	No	0.06	198	No	<0.01
	35	207	192	No	0.19	198	No	0.12	200	No	0.01
	40	207	194	No	0.23	200	No	0.22	202	No	0.06
	45	207	196	No	0.33	202	No	0.28	204	No	0.17
	50	207	198	No	0.44	204	No	0.42	206	No	0.38
	55	207	200	Yes	0.56	205	Yes	0.50	208	Yes	0.62
	60	207	202	Yes	0.62	207	Yes	0.65	210	Yes	0.83
	65	207	204	Yes	0.72	209	Yes	0.78	212	Yes	0.94
	70	207	206	Yes	0.81	211	Yes	0.88	214	Yes	0.99
	75	207	209	Yes	0.88	214	Yes	0.96	216	Yes	>0.99
	80	207	211	Yes	0.93	216	Yes	0.98	218	Yes	>0.99
	85	207	214	Yes	0.97	219	Yes	0.99	221	Yes	>0.99
90	207	218	Yes	0.99	223	Yes	>0.99	225	Yes	>0.99	
95	207	224	Yes	>0.99	228	Yes	>0.99	230	Yes	>0.99	

ELA/Reading											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.*		Proficient	Prob.*		Proficient	Prob.*
5	5	215	181	No	<0.01	186	No	<0.01	188	No	<0.01
	10	215	186	No	<0.01	191	No	<0.01	193	No	<0.01
	15	215	190	No	0.01	195	No	<0.01	197	No	<0.01
	20	215	193	No	0.02	197	No	<0.01	199	No	<0.01
	25	215	195	No	0.04	200	No	0.01	202	No	<0.01
	30	215	198	No	0.07	202	No	0.02	204	No	<0.01
	35	215	200	No	0.12	204	No	0.04	206	No	<0.01
	40	215	202	No	0.19	206	No	0.09	208	No	0.01
	45	215	204	No	0.23	208	No	0.17	210	No	0.06
	50	215	206	No	0.33	210	No	0.28	212	No	0.17
	55	215	208	No	0.44	212	No	0.42	214	No	0.38
	60	215	210	Yes	0.56	214	Yes	0.58	216	Yes	0.62
	65	215	212	Yes	0.62	215	Yes	0.65	217	Yes	0.73
	70	215	214	Yes	0.72	218	Yes	0.78	220	Yes	0.94
	75	215	216	Yes	0.81	220	Yes	0.88	222	Yes	0.99
	80	215	218	Yes	0.85	222	Yes	0.94	224	Yes	>0.99
	85	215	221	Yes	0.93	225	Yes	0.98	227	Yes	>0.99
90	215	225	Yes	0.97	229	Yes	>0.99	231	Yes	>0.99	
95	215	231	Yes	>0.99	234	Yes	>0.99	236	Yes	>0.99	
6	5	218	186	No	<0.01	190	No	<0.01	192	No	<0.01
	10	218	192	No	<0.01	196	No	<0.01	197	No	<0.01
	15	218	196	No	0.01	199	No	<0.01	201	No	<0.01
	20	218	198	No	0.03	202	No	<0.01	203	No	<0.01
	25	218	201	No	0.06	204	No	0.01	206	No	<0.01
	30	218	203	No	0.10	207	No	0.04	208	No	<0.01
	35	218	205	No	0.16	209	No	0.09	210	No	0.01
	40	218	207	No	0.19	211	No	0.17	212	No	0.03
	45	218	209	No	0.28	212	No	0.22	214	No	0.11
	50	218	211	No	0.39	214	No	0.35	216	No	0.27
	55	218	213	No	0.44	216	No	0.42	218	Yes	0.50
	60	218	215	Yes	0.56	218	Yes	0.58	219	Yes	0.62
	65	218	217	Yes	0.67	220	Yes	0.72	221	Yes	0.83
	70	218	219	Yes	0.77	222	Yes	0.83	223	Yes	0.94
	75	218	221	Yes	0.81	224	Yes	0.91	226	Yes	0.99
	80	218	224	Yes	0.90	226	Yes	0.96	228	Yes	>0.99
	85	218	226	Yes	0.94	229	Yes	0.99	231	Yes	>0.99
90	218	230	Yes	0.98	233	Yes	>0.99	235	Yes	>0.99	
95	218	236	Yes	>0.99	238	Yes	>0.99	240	Yes	>0.99	

ELA/Reading											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.*		Proficient	Prob.*		Proficient	Prob.*
7	5	223	189	No	<0.01	192	No	<0.01	193	No	<0.01
	10	223	195	No	<0.01	198	No	<0.01	199	No	<0.01
	15	223	199	No	<0.01	201	No	<0.01	202	No	<0.01
	20	223	202	No	0.01	204	No	<0.01	205	No	<0.01
	25	223	204	No	0.02	207	No	<0.01	208	No	<0.01
	30	223	206	No	0.04	209	No	0.01	210	No	<0.01
	35	223	209	No	0.07	211	No	0.03	212	No	<0.01
	40	223	211	No	0.12	213	No	0.04	214	No	<0.01
	45	223	213	No	0.19	215	No	0.09	216	No	0.01
	50	223	214	No	0.23	217	No	0.17	218	No	0.06
	55	223	216	No	0.33	219	No	0.28	220	No	0.17
	60	223	218	No	0.39	221	No	0.42	222	No	0.38
	65	223	220	Yes	0.50	223	Yes	0.58	224	Yes	0.62
	70	223	222	Yes	0.61	225	Yes	0.72	226	Yes	0.83
	75	223	225	Yes	0.72	227	Yes	0.83	228	Yes	0.94
	80	223	227	Yes	0.81	230	Yes	0.94	231	Yes	0.99
85	223	230	Yes	0.90	232	Yes	0.97	234	Yes	>0.99	
90	223	234	Yes	0.97	236	Yes	>0.99	238	Yes	>0.99	
95	223	240	Yes	>0.99	242	Yes	>0.99	243	Yes	>0.99	
8	5	224	191	No	<0.01	194	No	<0.01	194	No	<0.01
	10	224	197	No	<0.01	199	No	<0.01	200	No	<0.01
	15	224	201	No	0.01	203	No	<0.01	204	No	<0.01
	20	224	204	No	0.03	206	No	<0.01	207	No	<0.01
	25	224	207	No	0.05	209	No	0.01	209	No	<0.01
	30	224	209	No	0.08	211	No	0.01	212	No	<0.01
	35	224	211	No	0.13	213	No	0.03	214	No	<0.01
	40	224	213	No	0.16	215	No	0.07	216	No	0.01
	45	224	215	No	0.22	217	No	0.14	218	No	0.03
	50	224	217	No	0.31	219	No	0.23	220	No	0.11
	55	224	219	No	0.40	221	No	0.36	222	No	0.27
	60	224	221	No	0.45	223	Yes	0.50	224	Yes	0.50
	65	224	223	Yes	0.55	225	Yes	0.64	226	Yes	0.73
	70	224	225	Yes	0.65	227	Yes	0.77	228	Yes	0.89
	75	224	228	Yes	0.78	229	Yes	0.86	231	Yes	0.99
	80	224	230	Yes	0.84	232	Yes	0.95	233	Yes	>0.99
85	224	234	Yes	0.94	235	Yes	0.99	236	Yes	>0.99	
90	224	237	Yes	0.97	239	Yes	>0.99	240	Yes	>0.99	
95	224	243	Yes	>0.99	244	Yes	>0.99	246	Yes	>0.99	

*Prob. = Probability of obtaining proficient status on the Missouri state summative test in the spring.

Table 3.9. Proficiency Projection based on RIT Scores—Mathematics

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.*		Proficient	Prob.*		Proficient	Prob.*
3	5	203	169	No	<0.01	176	No	<0.01	181	No	<0.01
	10	203	174	No	0.01	181	No	<0.01	186	No	<0.01
	15	203	177	No	0.03	184	No	<0.01	189	No	<0.01
	20	203	179	No	0.06	187	No	0.01	192	No	<0.01
	25	203	182	No	0.14	189	No	0.03	194	No	<0.01
	30	203	184	No	0.17	191	No	0.07	196	No	0.01
	35	203	185	No	0.22	193	No	0.14	198	No	0.04
	40	203	187	No	0.32	195	No	0.26	200	No	0.15
	45	203	189	No	0.44	197	No	0.42	202	No	0.37
	50	203	190	Yes	0.50	198	Yes	0.50	203	Yes	0.50
	55	203	192	Yes	0.62	200	Yes	0.66	205	Yes	0.75
	60	203	194	Yes	0.73	202	Yes	0.80	207	Yes	0.92
	65	203	195	Yes	0.78	203	Yes	0.86	209	Yes	0.98
	70	203	197	Yes	0.86	205	Yes	0.93	211	Yes	>0.99
	75	203	199	Yes	0.89	207	Yes	0.97	213	Yes	>0.99
	80	203	201	Yes	0.94	209	Yes	0.99	215	Yes	>0.99
	85	203	204	Yes	0.98	212	Yes	>0.99	218	Yes	>0.99
90	203	207	Yes	0.99	215	Yes	>0.99	221	Yes	>0.99	
95	203	212	Yes	>0.99	220	Yes	>0.99	226	Yes	>0.99	
4	5	212	179	No	<0.01	185	No	<0.01	189	No	<0.01
	10	212	184	No	0.01	190	No	<0.01	194	No	<0.01
	15	212	188	No	0.03	194	No	<0.01	198	No	<0.01
	20	212	190	No	0.06	197	No	0.02	201	No	<0.01
	25	212	193	No	0.14	199	No	0.04	203	No	<0.01
	30	212	195	No	0.22	201	No	0.10	206	No	0.02
	35	212	197	No	0.32	203	No	0.20	208	No	0.08
	40	212	198	No	0.38	205	No	0.34	210	No	0.25
	45	212	200	Yes	0.50	207	Yes	0.50	212	Yes	0.50
	50	212	202	Yes	0.62	209	Yes	0.66	213	Yes	0.63
	55	212	204	Yes	0.73	211	Yes	0.80	215	Yes	0.85
	60	212	205	Yes	0.73	212	Yes	0.86	217	Yes	0.96
	65	212	207	Yes	0.83	214	Yes	0.93	219	Yes	0.99
	70	212	209	Yes	0.89	216	Yes	0.97	221	Yes	>0.99
	75	212	211	Yes	0.94	218	Yes	0.99	224	Yes	>0.99
	80	212	214	Yes	0.98	221	Yes	>0.99	226	Yes	>0.99
	85	212	216	Yes	0.99	223	Yes	>0.99	229	Yes	>0.99
90	212	220	Yes	>0.99	227	Yes	>0.99	233	Yes	>0.99	
95	212	225	Yes	>0.99	232	Yes	>0.99	238	Yes	>0.99	

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.*		Proficient	Prob.*		Proficient	Prob.*
5	5	223	187	No	<0.01	192	No	<0.01	195	No	<0.01
	10	223	193	No	<0.01	198	No	<0.01	201	No	<0.01
	15	223	196	No	0.01	201	No	<0.01	205	No	<0.01
	20	223	199	No	0.02	204	No	<0.01	208	No	<0.01
	25	223	202	No	0.05	207	No	0.01	210	No	<0.01
	30	223	204	No	0.09	209	No	0.02	213	No	<0.01
	35	223	206	No	0.15	211	No	0.05	215	No	<0.01
	40	223	208	No	0.23	213	No	0.11	217	No	0.02
	45	223	210	No	0.33	215	No	0.20	219	No	0.08
	50	223	211	No	0.38	217	No	0.34	221	No	0.25
	55	223	213	Yes	0.50	219	Yes	0.50	223	Yes	0.50
	60	223	215	Yes	0.62	221	Yes	0.66	225	Yes	0.75
	65	223	217	Yes	0.72	223	Yes	0.80	228	Yes	0.96
	70	223	219	Yes	0.81	225	Yes	0.89	230	Yes	0.99
	75	223	221	Yes	0.88	228	Yes	0.97	232	Yes	>0.99
	80	223	224	Yes	0.95	230	Yes	0.99	235	Yes	>0.99
	85	223	227	Yes	0.98	233	Yes	>0.99	238	Yes	>0.99
90	223	230	Yes	0.99	237	Yes	>0.99	242	Yes	>0.99	
95	223	236	Yes	>0.99	242	Yes	>0.99	248	Yes	>0.99	
6	5	226	192	No	<0.01	196	No	<0.01	198	No	<0.01
	10	226	198	No	<0.01	202	No	<0.01	204	No	<0.01
	15	226	202	No	0.01	205	No	<0.01	208	No	<0.01
	20	226	205	No	0.03	209	No	<0.01	211	No	<0.01
	25	226	207	No	0.05	211	No	0.01	214	No	<0.01
	30	226	209	No	0.09	214	No	0.03	217	No	<0.01
	35	226	212	No	0.19	216	No	0.07	219	No	0.01
	40	226	214	No	0.28	218	No	0.15	221	No	0.04
	45	226	216	No	0.38	220	No	0.27	223	No	0.15
	50	226	218	Yes	0.50	222	No	0.42	225	No	0.37
	55	226	220	Yes	0.62	224	Yes	0.58	227	Yes	0.63
	60	226	222	Yes	0.72	226	Yes	0.73	230	Yes	0.92
	65	226	224	Yes	0.81	228	Yes	0.85	232	Yes	0.98
	70	226	226	Yes	0.88	230	Yes	0.93	234	Yes	>0.99
	75	226	228	Yes	0.93	233	Yes	0.98	237	Yes	>0.99
	80	226	231	Yes	0.96	236	Yes	>0.99	239	Yes	>0.99
	85	226	234	Yes	0.99	239	Yes	>0.99	243	Yes	>0.99
90	226	238	Yes	>0.99	243	Yes	>0.99	247	Yes	>0.99	
95	226	243	Yes	>0.99	248	Yes	>0.99	253	Yes	>0.99	

Mathematics											
Grade	Start %ile	Spring Cut	Fall			Winter			Spring		
			Fall RIT	Projected Proficiency		Winter RIT	Projected Proficiency		Spring RIT	Projected Proficiency	
				Proficient	Prob.*		Proficient	Prob.*		Proficient	Prob.*
7	5	231	195	No	<0.01	198	No	<0.01	199	No	<0.01
	10	231	201	No	<0.01	204	No	<0.01	206	No	<0.01
	15	231	205	No	<0.01	208	No	<0.01	210	No	<0.01
	20	231	209	No	0.01	212	No	<0.01	214	No	<0.01
	25	231	211	No	0.02	215	No	<0.01	217	No	<0.01
	30	231	214	No	0.05	217	No	0.01	219	No	<0.01
	35	231	216	No	0.08	220	No	0.03	222	No	<0.01
	40	231	218	No	0.14	222	No	0.07	224	No	0.01
	45	231	221	No	0.27	224	No	0.15	226	No	0.04
	50	231	223	No	0.38	226	No	0.26	229	No	0.25
	55	231	225	Yes	0.50	228	No	0.42	231	Yes	0.50
	60	231	227	Yes	0.62	230	Yes	0.58	233	Yes	0.75
	65	231	229	Yes	0.73	233	Yes	0.80	235	Yes	0.92
	70	231	231	Yes	0.82	235	Yes	0.90	238	Yes	0.99
	75	231	234	Yes	0.92	238	Yes	0.97	241	Yes	>0.99
	80	231	237	Yes	0.97	240	Yes	0.99	244	Yes	>0.99
	85	231	240	Yes	0.99	244	Yes	>0.99	247	Yes	>0.99
90	231	244	Yes	>0.99	248	Yes	>0.99	251	Yes	>0.99	
95	231	250	Yes	>0.99	254	Yes	>0.99	258	Yes	>0.99	
8	5	238	197	No	<0.01	199	No	<0.01	199	No	<0.01
	10	238	203	No	<0.01	206	No	<0.01	206	No	<0.01
	15	238	208	No	<0.01	210	No	<0.01	211	No	<0.01
	20	238	211	No	<0.01	214	No	<0.01	215	No	<0.01
	25	238	214	No	0.01	217	No	<0.01	218	No	<0.01
	30	238	217	No	0.02	220	No	<0.01	221	No	<0.01
	35	238	219	No	0.03	222	No	<0.01	224	No	<0.01
	40	238	222	No	0.08	225	No	0.01	226	No	<0.01
	45	238	224	No	0.12	227	No	0.04	229	No	<0.01
	50	238	226	No	0.18	229	No	0.08	231	No	0.01
	55	238	229	No	0.30	231	No	0.16	233	No	0.04
	60	238	231	No	0.40	234	No	0.35	236	No	0.25
	65	238	233	No	0.45	236	Yes	0.50	238	Yes	0.50
	70	238	236	Yes	0.60	239	Yes	0.72	241	Yes	0.85
	75	238	238	Yes	0.70	241	Yes	0.84	244	Yes	0.98
	80	238	241	Yes	0.82	245	Yes	0.96	247	Yes	>0.99
	85	238	245	Yes	0.92	248	Yes	0.99	251	Yes	>0.99
90	238	249	Yes	0.98	253	Yes	>0.99	255	Yes	>0.99	
95	238	256	Yes	>0.99	259	Yes	>0.99	262	Yes	>0.99	

*Prob. = Probability of obtaining proficient status on the Missouri state summative test in the spring.

4. References

- Kolen, M. J., & Brennan, R. L. (2004). *Test equating, scaling, and linking*. New York: Springer.
- Missouri Department of Elementary and Secondary Education (DESE). (2018, December). *Missouri assessment program grade-level assessments: English language arts and mathematics grades 3–8 and Science grades 5 and 8: Technical report 2018*. Retrieved from <https://dese.mo.gov/sites/default/files/asmt-gl-tech-report-2018.pdf>.
- 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., & Hauser, C. H. (2015). *NWEA 2015 MAP norms for student and school achievement status and growth*. NWEA Research Report. Portland, OR: NWEA.