

Pathway to Proficiency: Linking Star Reading[®] and Star Math[®] to the Maine Educational Assessment (MEA)



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Introduction

At Renaissance, we know that as an educator, chief among your responsibilities is making decisions about how to allocate limited resources to best serve diverse student needs. A good assessment system supports your efforts, by providing timely, relevant information to help address key questions about which students are on track to meet important standards and who may need additional assistance.

Assessments that identify early any students at risk of missing academic standards are especially useful, as they inform instructional decisions to improve student performance and reduce gaps in achievement. Assessments that do this while taking little time away from instruction are particularly valuable. *Interim assessments*, one of three broad categories of educational assessment,¹ indicate which students are on track to meet later expectations (Perie, Marion, Gong, & Wurtzel, 2007).

This linking study applied results from two interim assessments, Renaissance Star Reading® and Renaissance Star Math®, to help you predict whether individual students are on track or need more assistance to succeed on the year-end summative Maine Educational Assessment (MEA) tests in English Language Arts/Literacy (ELA/Literacy) and Mathematics in grades 3 through 8.²

Assessments that identify early any students at risk of missing academic standards are especially useful.

Main Findings

Results from the linking analysis revealed that Star Reading and Star Math are accurate predictors of the MEA tests, meaning as an educator you can use Star scores to:

1. Identify early in the year students likely to miss reading and math yearly progress goals in time to make meaningful adjustments to instruction well before the year-end test.
2. Forecast the percent of students at each MEA performance level to serve as an early warning system for building and district administrators and allow redirection of resources as needed.

Study

To determine if Star Reading and Star Math can predict student achievement on the end-of-year MEA tests in ELA/Literacy and mathematics, we began by linking the score scales for each assessment.

¹ **Formative assessments** are short and frequent processes, embedded in instruction, that support learning and provide specific feedback on what students know and can do versus where gaps in knowledge exist. **Summative assessments** evaluate whether students have met a set of standards, and serve most commonly as year-end state-mandated tests. **Interim assessments** represent the middle ground, in terms of duration and frequency and can serve purposes including informing instruction, evaluating curriculum and student responsiveness to intervention, and forecasting performance on high-stakes summative year-end tests.

² Technical manuals are available for Star Reading and Star Math by request to research@renaissance.com.

School-Level Data collection

To find a sample of students who were assessed by both the MEA and Star Assessments, we began by gathering all Star Reading and Star Math test records from 2015–2016 for Maine. Then, each school’s Star Reading and Star Math data were aggregated by grade and subject area. The next step was to match Star data with the MEA data from the same school year by district and school name. To do this, performance level distribution data from the MEA was obtained from the Maine Assessment and Accountability Reporting System. The file included the number of students tested in each grade and the percentage of students who were *Well Below or Below State Expectations* and *At or Above State Expectations*.

Sample characteristics

Once we determined how many students in each grade at a school were tested on the MEA ELA/Literacy and took a Star Reading assessment, we calculated the percentage of students assessed on both tests. Then we repeated this exercise for the math assessments. In each grade at each school, if between 95% and 105% of the students who tested on the MEA had taken a Star assessment, that grade was included in the sample. This method of sample selection ensured that our sample consisted of cases in which all or nearly all the enrolled students who took the MEA also took a Star test within the specified window of time. If a total of approximately 1,000 or more students per grade met the sample criteria, that grade’s sample was considered sufficiently large for analysis.

The reading sample included 7,475 Star Reading students from 32 schools. The math sample included 7,064 Star Math students from 30 schools. Table 1 displays by-grade test summaries for the reading and math samples. It also includes percentages of students in the *Well Below or Below State Expectations* and *At or Above State Expectations* performance levels, both for the sample and statewide.

Table 1. Performance characteristics of reading and math samples

Star Reading® sample performance						
Grade	Star Reading® students	MEA ELA /Literacy students	Well Below or Below State Expectations		At or Above Expectations	
			Sample	State	Sample	State
3	1,042	1,016	44%	52%	56%	48%
4	1,165	1,145	39%	48%	61%	52%
5	1,183	1,156	38%	48%	62%	52%
6	1,479	1,441	52%	54%	48%	46%
7	1,176	1,129	47%	52%	53%	48%
8	1,430	1,389	48%	52%	52%	48%
Star Math® sample performance						
Grade	Star Math® students	MEA Mathematics students	Well Below or Below State Expectations		At or Above Expectations	
			Sample	State	Sample	State
3	1,104	1,078	47%	51%	53%	49%
4	1,065	1,039	50%	60%	50%	40%
5	1,131	1,105	54%	64%	46%	36%
6	1,495	1,456	64%	67%	36%	33%
7	1,013	974	51%	60%	49%	40%
8	1,256	1,215	65%	65%	35%	35%

Scale linkage

Renaissance linked the Star test scale to the MEA by applying equipercentile linking analysis (Kolen & Brennan, 2004). First, we aggregated the sample of schools to calculate the percentage of students performing *Well Below or Below State Expectations* or *At or Above State Expectations* for each subject and grade. Then we analyzed the distribution of Star scores to determine the scaled score corresponding to the same percentile as specific MEA level. For example, as shown in Table 1, 44% of students in our third-grade reading sample were classified as *Well Below or Below State Expectations* and 56% were classified as *At or Above State Expectations*. Therefore, the cutscore for the *At or Above State Expectations* proficiency level in the third grade is at the 44th percentile.

MEA cut scores and corresponding Star score equivalents

MEA results are reported in scaled scores that are split into four achievement levels: *Well Below State Expectations*, *Below State Expectations*, *At State Expectations*, and *Above State Expectations*. The public data available on the Maine Assessment and Accountability Reporting System includes performance information for two levels only: the combined *Well Below or Below State Expectations* levels and the combined *At or Above State Expectations* Levels. The main purpose in linking Star Reading and Star Math to the MEA was to identify Star scores approximately equivalent to the cut-off scores that separate the MEA levels. Table 2 displays these equivalent Star scores. The corresponding MEA cut scores can be found in Appendix B.

Table 2. Star Reading® and Star Math® score equivalents for each MEA achievement level range

Star Reading® cut-score equivalents		
Grade	Well Below or Below State Expectations	At or Above State Expectations
3	< 437	≥ 437
4	< 524	≥ 524
5	< 613	≥ 613
6	< 779	≥ 779
7	< 855	≥ 855
8	< 924	≥ 924
Star Math® cut-score equivalents		
Grade	Well Below or Below State Expectations	At or Above State Expectations
3	< 610	≥ 610
4	< 698	≥ 698
5	< 764	≥ 764
6	< 818	≥ 818
7	< 829	≥ 829
8	< 862	≥ 862

Results

Accuracy of scale linkage confirmed

Three Maine schools shared student level MEA scores to explore the accuracy of using Star Reading and Star Math for forecasting MEA performance. The Star Reading sample consisted of 945 students and the Star Math sample consisted of 895 students. We took students' Star scores from tests taken prior to the mid-date of the MEA administration and used national growth norms (Renaissance Learning, 2016a, 2016b) to project what their Star scores would be at the date of the MEA administration. We used the projected Star scores (or the average of the projected scores for students with multiple Star scores prior to the mid-date of the MEA administration) to examine the accuracy of the linkage to the MEA scale.

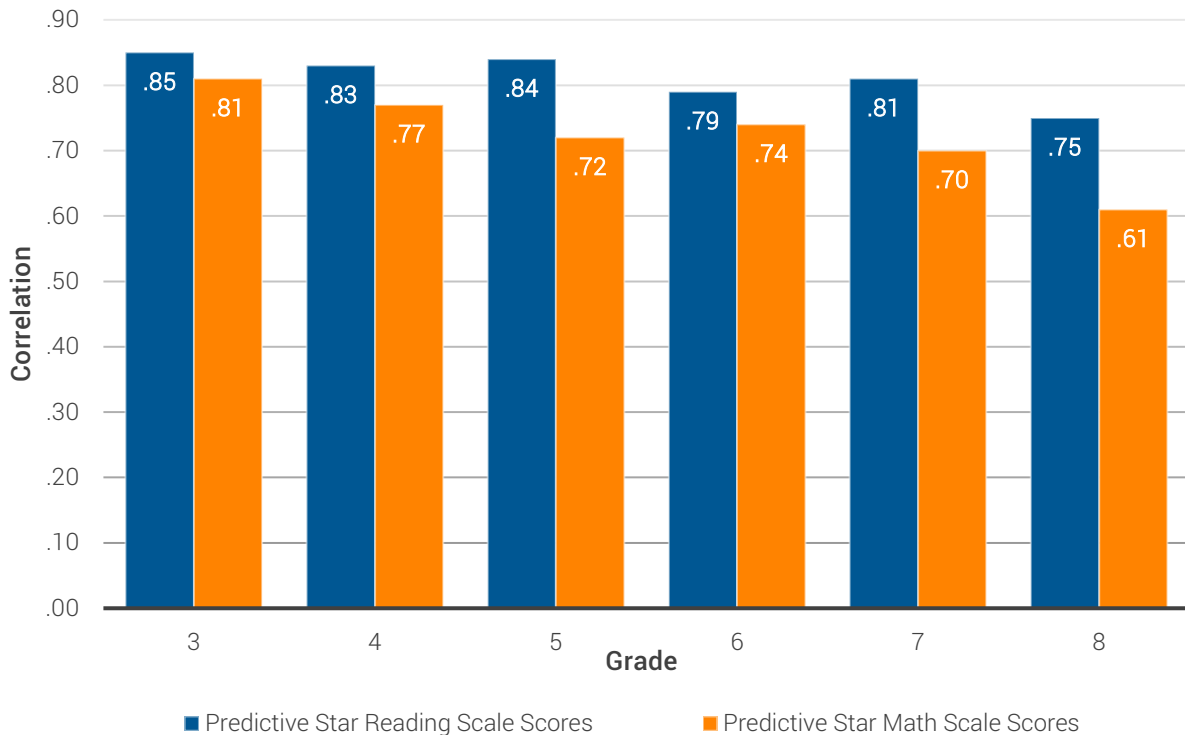
Classification diagnostics were derived from counts of correct and incorrect classifications when using Star scores to predict whether a student would achieve proficiency on the MEA. The results indicate that Star Assessments provide an effective means of estimating end-of-year achievement on the MEA.

Predictive Star scores correlate highly with actual MEA scores

To summarize the predictive power of Star Reading and Star Math, we calculated correlations between observed MEA scores and projected Star scores. As seen in figure 1, the correlations were strong, averaging .81 and .73 between MEA and Star Reading and Star Math, respectively.

Star scores have a strong relationship with end-of-year MEA scores.

Figure 1. Star Reading® and Star Math® scores highly correlate with MEA scores



Star scores discriminate well between students who score proficient or not

We compared actual MEA performance to students' estimated MEA performance based on projected Star scores and the estimated Star cut score equivalents. Table 3 displays classification diagnostics about whether students were correctly or incorrectly classified as proficient or not on the MEA using projected Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 83% of the time by Star Reading and 86% of the time by Star Math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, Star Reading averaged .93 and Star Math averaged .91 (also displayed in table 3). The AUCs met or exceeded the .85 standard set by the National Center on Response to Intervention to indicate convincing evidence that an assessment can accurately predict another assessment result or outcome.

Table 3. Proficiency forecasting using Star Reading® and Star Math® scores yields accurate results

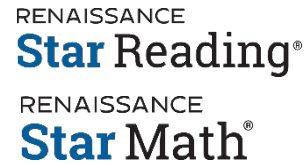
Star Reading®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	83%	85%	84%	83%	85%	80%
Area Under the ROC Curve	0.93	0.94	0.93	0.90	0.93	0.90
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	78%	92%	87%	89%	84%	87%
Area Under the ROC Curve	0.85	0.96	0.95	0.92	0.87	0.91

Other diagnostic accuracy measures studied:

- ✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 78% and for Star Math averaged 78%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 86% and for Star Math averaged 88%.
- ✓ **Positive predictive values**, which indicate that when Star scores forecasted students to be proficient, they actually were proficient, were 79% for Star Reading and 74% for Star Math.
- ✓ **Negative predictive values**, which indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient, were 85% for reading and 91% for math.
- ✓ **Proficiency status projection error**, the difference between actual and projected proficiency rates, indicates how well scores accurately predict proficiency within each grade. Star Reading averaged 1% and Star Math averaged 2% (negative scores indicate under-prediction while positive scores show over-prediction).

Appendix A: About Star Reading[®] and Star Math[®]

The computer-adaptive Star Reading and Star Math assessments serve multiple purposes including screening, progress monitoring, instructional planning, forecasting proficiency, standards mastery, and measuring growth. These highly reliable, valid, and efficient standards-based measures of student performance in reading and math provide valuable information regarding the acquisition of skills along a continuum of learning expectations. The assessments can be completed in about 20 minutes, and we recommend administering them two to five times a year for most purposes and more frequently when used for progress monitoring.



Star Reading and Star Math are highly rated for academic screening and academic progress monitoring by the National Center on Intensive Intervention.

National Center on
INTENSIVE INTERVENTION

at American Institutes for Research ■

Appendix B: MEA achievement levels

Table B1. MEA achievement level score ranges

MEA achievement level score ranges: ELA/Literacy		
Grade	Well Below or Below State Expectations	At or Above State Expectations
3	300 – 359	360 – 390
4	400 – 459	460 – 490
5	500 – 559	560 – 590
6	600 – 659	660 – 690
7	700 – 759	760 – 790
8	800 – 859	860 – 890
MEA achievement level score ranges: Mathematics		
Grade	Well Below or Below State Expectations	At or Above State Expectations
3	300 – 359	360 – 390
4	400 – 459	460 – 490
5	500 – 559	560 – 590
6	600 – 659	660 – 690
7	700 – 759	760 – 790
8	800 – 859	860 – 890

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