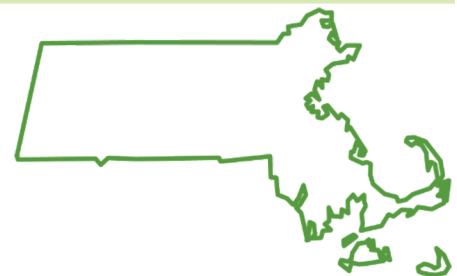


Pathway to Proficiency: Linking Star Reading® and Star Math® to the Next-Generation Massachusetts Comprehensive Assessment System (MCAS) Tests



Contents

3	Introduction
3	Main Findings
3	Study
5	Results
8	Appendix A: About Star Reading and Star Math
8	Appendix B: MCAS achievement levels
9	References

Figures

6	Figure 1. Star Reading and Star Math highly correlate with MCAS scores
---	--

Tables

4	Table 1. Performance characteristics of reading and math samples
5	Table 2. Star Reading and Star Math score equivalents for each MCAS achievement level range
7	Table 3. Proficiency forecasting using Star Reading and Star Math scores yields accurate results
8	Table B1. MCAS achievement level score ranges

Initial publication August 1, 2018

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 Next-Generation Massachusetts Comprehensive Assessment System (MCAS) tests in English Language Arts (ELA) 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 MCAS 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 MCAS 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 MCAS tests in ELA 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 MCAS and Star Assessments, we began by gathering all Star Reading and Star Math test records from 2016–2017 for Massachusetts. 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 MCAS data from the same school year by district and school name. To do this, performance level distribution data from the MCAS was obtained from the public data provided by the Massachusetts Department of Education. The file included the number of students tested in each grade and the percentage of students who were *Not Meeting Expectations*, *Partially Meeting Expectations*, *Meeting Expectations*, and *Exceeding Expectations*.

Sample characteristics

Once we determined how many students in each grade at a school were tested on the MCAS ELA 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 MCAS 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 MCAS 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 23,373 Star Reading students from 101 schools. The math sample included 20,830 Star Math students from 93 schools. Table 1 displays by-grade test summaries for the reading and math samples. It also includes percentages of students in the *Not Meeting Expectations*, *Partially Meeting Expectations*, *Meeting Expectations*, and *Exceeding 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	MCAS ELA students	Not Meeting Expectations		Partially Meeting Expectations		Meeting Expectations		Exceeding Expectations	
			Sample	State	Sample	State	Sample	State	Sample	State
3	3,174	3,119	9%	10%	40%	42%	43%	39%	8%	8%
4	3,928	3,862	8%	10%	42%	42%	43%	41%	7%	7%
5	4,535	4,468	8%	10%	42%	42%	45%	43%	5%	6%
6	4,433	4,351	10%	10%	40%	39%	45%	43%	5%	7%
7	3,839	3,735	8%	11%	43%	39%	45%	44%	4%	6%
8	3,464	3,391	6%	11%	41%	39%	45%	41%	8%	8%
Star Math® sample performance										
Grade	Star Math® students	MCAS Math students	Not Meeting Expectations		Partially Meeting		Meeting Expectations		Exceeding Expectations	
			Sample	State	Sample	State	Sample	State	Sample	State
3	2,773	2,711	14%	13%	37%	38%	41%	42%	8%	7%
4	3,587	3,513	11%	13%	39%	39%	44%	43%	6%	6%
5	3,818	3,740	9%	10%	43%	44%	41%	39%	7%	7%
6	3,494	3,412	9%	11%	41%	39%	44%	42%	6%	7%
7	2,914	2,836	6%	12%	42%	42%	43%	38%	9%	9%
8	4,244	4,145	9%	11%	41%	42%	40%	39%	10%	9%

Results

Scale linkage

Renaissance linked the Star test scale to the MCAS by applying equipercentile linking analysis (Kolen & Brennan, 2004). First, we aggregated the sample of schools to calculate the percentage of students performing *Minimally Proficient*, *Partially Proficient*, *Proficient*, and *Highly Proficient* 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 MCAS level. For example, as shown in Table 1, 9% of students in our third-grade reading sample were classified as *Not Meeting Expectations*, 40% *Partially Meeting Expectations*, 43% *Meeting Expectations*, and 8% *Exceeding Expectations*. Therefore, the cutscores for proficiency levels in the third grade are at the 9th percentile for *Partially Meeting Expectations*, the 49th percentile for *Meeting Expectations*, and the 92nd percentile for *Exceeding Expectations*.

MCAS cut scores and corresponding Star score equivalents

MCAS results are reported in scaled scores that are split into four achievement levels: *Not Meeting Expectations*, *Partially Meeting Expectations*, *Meeting Expectations*, and *Exceeding Expectations*. The main purpose in linking Star Reading and Star Math to the MCAS was to identify Star scores at the time of the state test that are approximately equivalent to the cut-off scores that separate the MCAS levels. Table 2 displays these equivalent Star scores at the time of the state test for grades 3-8.³ The corresponding MCAS cut scores can be found in Appendix B.

Table 2. Star Reading[®] and Star Math[®] score equivalents for each MCAS achievement level range

Star Reading [®] cut-score equivalents				
Grade	Not Meeting Expectations	Partially Meeting Expectations	Meeting Expectations	Exceeding Expectations
3	< 256	256 – 478	479 – 715	≥ 716
4	< 358	358 – 592	593 – 910	≥ 911
5	< 412	412 – 692	693 – 1113	≥ 1114
6	< 467	467 – 774	775 – 1226	≥ 1227
7	< 514	514 – 872	873 – 1305	≥ 1306
8	< 557	557 – 953	954 – 1319	≥ 1320
Star Math [®] cut-score equivalents				
Grade	Not Meeting Expectations	Partially Meeting Expectations	Meeting Expectations	Exceeding Expectations
3	< 545	545 – 635	636 – 716	≥ 717
4	< 607	607 – 710	711 – 808	≥ 809
5	< 627	627 – 779	780 – 863	≥ 864
6	< 670	670 – 806	807 – 898	≥ 899
7	< 689	689 – 842	843 – 923	≥ 924
8	< 700	700 – 855	856 – 933	≥ 934

³ The Star Reading and Star Math cut-score equivalents presented in Table 2 apply only to the time of the state test. Some Renaissance reports adjust the Star Reading and Star Math cut-score equivalents based on date.

Accuracy of scale linkage confirmed

Seven Massachusetts districts shared student level MCAS scores to explore the accuracy of using Star Reading and Star Math for forecasting MCAS performance. The Star Reading sample consisted of 10,000 students and the Star Math sample consisted of 11,346 students. We took students' Star scores from tests taken prior to the mid-date of the MCAS administration and used national growth norms (Renaissance Learning, 2018a, 2018b) to project what their Star scores would be at the date of the MCAS 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 MCAS administration) to examine the accuracy of the linkage to the MCAS scale.

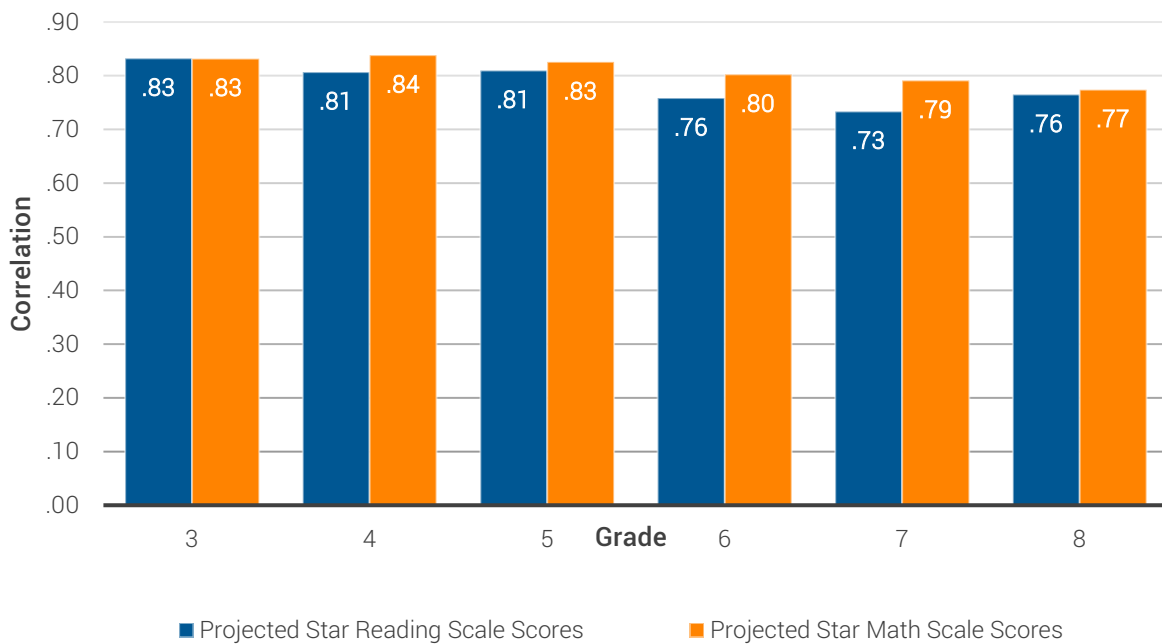
Classification diagnostics were derived from counts of correct and incorrect classifications when using Star scores to predict whether a student would achieve proficiency on the MCAS. The results indicate that Star Assessments provide an effective means of estimating end-of-year achievement on the MCAS.

Predictive Star scores correlate highly with actual MCAS scores

To summarize the predictive power of Star Reading and Star Math, we calculated correlations between observed MCAS scores and projected Star scores. As seen in figure 1, the correlations were strong, averaging .78 and .81 between MCAS and Star Reading and Star Math, respectively.

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

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



Star scores discriminate well between students who score proficient or not

We compared actual MCAS performance to students' estimated MCAS 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 MCAS using projected Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 83% of the time by Star Reading and 85% of the time by Star Math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, Star Reading averaged .90 and Star Math averaged .92 (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

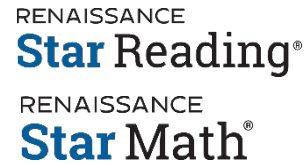
Star Reading®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	84%	83%	83%	85%	80%	83%
Area Under the ROC Curve	0.92	0.91	0.91	0.90	0.86	0.88
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	85%	84%	86%	85%	86%	85%
Area Under the ROC Curve	0.92	0.91	0.93	0.91	0.93	0.92

Other diagnostic accuracy measures studied:

- ✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 69% and for Star Math averaged 77%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading and Star Math averaged 89%.
- ✓ **Positive predictive values**, which indicate that when Star scores forecasted students to be proficient, they actually were proficient, were 74% for Star Reading and 76% for Star Math.
- ✓ **Negative predictive values**, which indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient, were 86% for reading and 89% 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 -2% and Star Math averaged 0% (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: MCAS achievement levels

Table B1. MCAS achievement level score ranges

MCAS achievement level score ranges: ELA				
Grade	Not Meeting Expectations	Partially Meeting Expectations	Meeting Expectations	Exceeding Expectations
3	440 – 469	470 – 499	500 – 529	530 – 560
4	440 – 469	470 – 499	500 – 529	530 – 560
5	440 – 469	470 – 499	500 – 529	530 – 560
6	440 – 469	470 – 499	500 – 529	530 – 560
7	440 – 469	470 – 499	500 – 529	530 – 560
8	440 – 469	470 – 499	500 – 529	530 – 560
MCAS achievement level score ranges: Mathematics				
Grade	Not Meeting Expectations	Partially Meeting Expectations	Meeting Expectations	Exceeding Expectations
3	440 – 469	470 – 499	500 – 529	530 – 560
4	440 – 469	470 – 499	500 – 529	530 – 560
5	440 – 469	470 – 499	500 – 529	530 – 560
6	440 – 469	470 – 499	500 – 529	530 – 560
7	440 – 469	470 – 499	500 – 529	530 – 560
8	440 – 469	470 – 499	500 – 529	530 – 560

References

- Kolen, M. J., & Brennan, R. R. (2004). *Test equating scaling and linking: Methods and practices*. New York, NY: Springer Science+Business Media.
- Perie, M., Marion, S., Gong, B., & Wurtzel, J. (2007). *The role of interim assessments in a comprehensive assessment system*. Aspen, CO: Aspen Institute.
- Renaissance Learning. (2018a). *Star Math technical manual*. Wisconsin Rapids, WI: Author. Available by request to research@renaissance.com
- Renaissance Learning. (2018b). *Star Reading technical manual*. Wisconsin Rapids, WI: Author. Available by request to research@renaissance.com

Independent technical reviews of Star Reading® and Star Math®

- U.S. Department of Education: National Center on Intensive Intervention. (2018a). *Review of academic progress monitoring tools* [Review of Star Math]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/progress-monitoring>
- U.S. Department of Education: National Center on Intensive Intervention. (2018b). *Review of academic progress monitoring tools* [Review of Star Reading]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/progress-monitoring>
- U.S. Department of Education: National Center on Intensive Intervention. (2018c). *Review of academic screening tools* [Review of Star Math]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/academic-screening>
- U.S. Department of Education: National Center on Intensive Intervention. (2018d). *Review of academic screening tools* [Review of Star Reading]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/academic-screening>
- U.S. Department of Education: National Center on Response to Intervention. (2010a). *Review of progress monitoring tools* [Review of STAR Math]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20120813035500/http://www.rti4success.org/pdf/progressMonitoringGOM.pdf>
- U.S. Department of Education: National Center on Response to Intervention. (2010b). *Review of progress monitoring tools* [Review of STAR Reading]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20120813035500/http://www.rti4success.org/pdf/progressMonitoringGOM.pdf>
- U.S. Department of Education: National Center on Response to Intervention. (2011a). *Review of screening tools* [Review of STAR Math]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20171027185735/http://www.rti4success.org:80/resources/tools-charts/screening-tools-chart>
- U.S. Department of Education: National Center on Response to Intervention. (2011b). *Review of screening tools* [Review of STAR Reading]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20171027185735/http://www.rti4success.org:80/resources/tools-charts/screening-tools-chart>