

## Pathway to Proficiency: Linking Star Reading® and Star Math® to the Michigan Student Test of Educational Progress (M-STEP)



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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,<sup>1</sup> 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 M-STEP tests in English Language Arts (ELA) and Mathematics in grades 3 through 8.<sup>2</sup>

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## Main Findings

Results from the linking analysis revealed that Star Reading and Star Math are accurate predictors of the M-STEP, 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 M-STEP 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 M-STEP tests in ELA and mathematics, we began by linking the score scales for each assessment.

### School-Level Data collection

To find a sample of students who were assessed by both the M-STEP and Star Assessments, we began by gathering all Star Reading and Star Math test records from 2017–2018 for Michigan. Then, each school's

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<sup>1</sup> **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.

<sup>2</sup> Technical manuals are available for Star Reading and Star Math by request to [research@renaissance.com](mailto:research@renaissance.com).

Star Reading and Star Math data were aggregated by grade and subject area. The next step was to match Star data with the M-STEP data from the same school year by district and school name. To do this, performance level distribution data from the M-STEP was obtained from the public data provided by the Michigan Department of Education. The file included the number of students tested in each grade and the percentage of students who were *Level 1: Not Proficient*, *Level 2: Partially Proficient*, *Level 3: Proficient*, or *Level 4: Advanced*.

## Sample characteristics

Once we determined how many students in each grade at a school were tested on the M-STEP 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 M-STEP 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 M-STEP 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 31,423 Star Reading students from 125 schools. The math sample included 20,457 Star Math students from 80 schools. Table 1 displays by-grade test summaries for the reading and math samples. It also includes percentages of students in the *Level 1: Not Proficient*, *Level 2: Partially Proficient*, *Level 3: Proficient*, and *Level 4: Advanced* 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	M-STEP ELA students	Level 1: Not Proficient		Level 2: Partially Proficient		Level 3: Proficient		Level 4: Advanced	
			Sample	State	Sample	State	Sample	State	Sample	State
3	4,622	4,512	22%	31%	26%	25%	26%	22%	26%	22%
4	5,640	5,526	25%	34%	22%	21%	25%	22%	28%	24%
5	5,219	5,078	25%	32%	21%	21%	33%	29%	21%	18%
6	5,281	5,134	23%	31%	28%	27%	34%	28%	15%	13%
7	5,583	5,423	19%	29%	27%	27%	38%	31%	16%	13%
8	4,940	4,808	18%	30%	28%	27%	39%	31%	15%	12%
Star Math® sample performance										
Grade	Star Math® students	M-STEP Math students	Level 1: Not Proficient		Level 2: Partially Proficient		Level 3: Proficient		Level 4: Advanced	
			Sample	State	Sample	State	Sample	State	Sample	State
3	2,602	2,538	22%	28%	28%	26%	32%	27%	18%	19%
4	2,758	2,682	18%	25%	36%	33%	30%	26%	16%	16%
5	3,542	3,441	28%	37%	32%	29%	20%	18%	20%	17%
6	3,330	3,228	21%	35%	34%	31%	24%	19%	21%	16%
7	3,963	3,842	23%	36%	32%	28%	26%	19%	19%	16%
8	4,262	4,168	28%	41%	31%	26%	19%	15%	22%	18%

# Results

## Scale linkage

Renaissance linked the Star test scale to the M-STEP by applying equipercentile linking analysis (Kolen & Brennan, 2004). First, we aggregated the sample of schools to calculate the percentage of students categorized as *Level 1: Not Proficient*, *Level 2: Partially Proficient*, *Level 3: Proficient*, and *Level 4: Advanced* 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 M-STEP level. For example, as shown in Table 1, 22% of students in the third-grade reading sample were classified as *Level 1: Not Proficient*, 26% were classified as *Level 2: Partially Proficient*, 26% were classified as *Level 3: Proficient*, and 26% were classified as *Level 4: Advanced*. Therefore, the cut score was at the 22<sup>nd</sup> percentile for *Level 2: Partially Proficient*, the 48<sup>th</sup> percentile for *Level 3: Proficient*, and the 74<sup>th</sup> percentile for *Level 4: Advanced*.

## M-STEP cut scores and corresponding Star score equivalents

M-STEP results are reported in scaled scores that are split into four achievement levels: *Level 1: Not Proficient*, *Level 2: Partially Proficient*, *Level 3: Proficient*, and *Level 4: Advanced*. The main purpose in linking Star Reading and Star Math to the M-STEP was to identify Star scores at the time of the state test that are approximately equivalent to the cut-off scores that separate the M-STEP levels. Table 2 displays these equivalent Star scores at the time of the state test for grades 3-8.<sup>3</sup> The corresponding M-STEP cut scores can be found in Appendix B.

**Table 2. Star Reading<sup>®</sup> and Star Math<sup>®</sup> score equivalents for each M-STEP achievement level range**

Star Reading <sup>®</sup> cut-score equivalents				
Grade	Level 1: Not Proficient	Level 2: Partially Proficient	Level 3: Proficient	Level 4: Advanced
3	< 353	353 – 461	462 – 551	≥ 552
4	< 457	457 – 543	544 – 654	≥ 655
5	< 517	517 – 616	617 – 821	≥ 820
6	< 569	569 – 730	731 – 992	≥ 993
7	< 614	614 – 813	814 – 1122	≥ 1123
8	< 688	688 – 909	910 – 1238	≥ 1239
Star Math <sup>®</sup> cut-score equivalents				
Grade	Level 1: Not Proficient	Level 2: Partially Proficient	Level 3: Proficient	Level 4: Advanced
3	< 569	569 – 624	625 – 675	≥ 676
4	< 619	619 – 702	703 – 760	≥ 761
5	< 689	689 – 789	790 – 809	≥ 810
6	< 719	719 – 803	804 – 847	≥ 848
7	< 754	754 – 831	832 – 876	≥ 877
8	< 784	784 – 850	851 – 885	≥ 886

<sup>3</sup> 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

Three schools in Michigan shared student level M-STEP scores to explore the accuracy of using Star Reading and Star Math for forecasting M-STEP performance. The Star Reading sample consisted of 1,602 students and the Star Math sample consisted of 1,261 students. We took students' Star scores from tests taken within 30 days of the mid-date of the M-STEP administration to examine the accuracy of the linkage to the M-STEP scale.

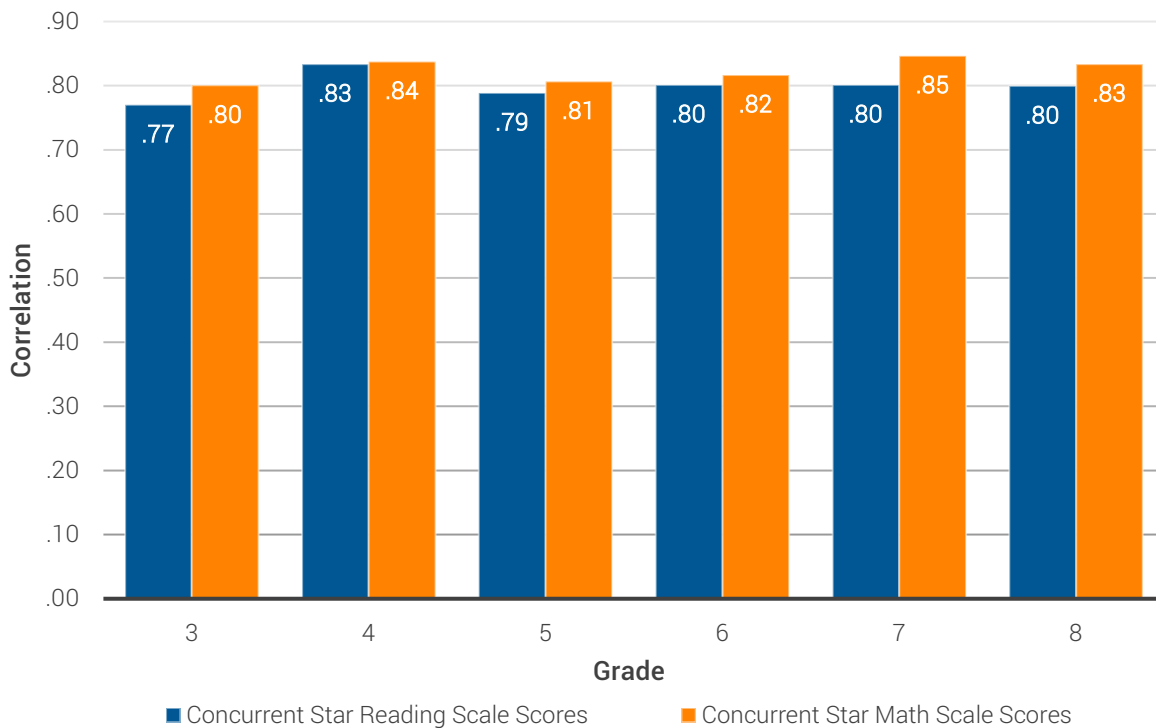
Classification diagnostics were derived from counts of correct and incorrect classifications when using Star scores to predict whether a student would achieve proficiency on the M-STEP. The results indicate that Star Assessments provide an effective means of estimating end-of-year achievement on the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

## Star scores correlate highly with actual M-STEP scores

To summarize the predictive power of Star Reading and Star Math, we calculated correlations between concurrent M-STEP scores and Star scores. As seen in figure 1, the correlations were strong, averaging .80 and .82 between M-STEP and Star Reading and Star Math, respectively.

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

Figure 1. Star Reading® and Star Math® scores highly correlate with M-STEP scores



## Star scores discriminate well between students who score proficient or not

We compared actual M-STEP performance to students' estimated M-STEP performance based on concurrent 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 M-STEP using Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 83% of the time by Star Reading and 83% 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 .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**

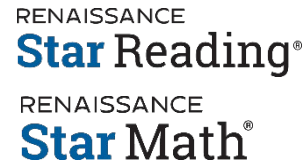
Star Reading®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	83%	82%	83%	83%	85%	80%
Area Under the ROC Curve	0.88	0.90	0.92	0.91	0.91	0.89
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	82%	84%	82%	81%	86%	82%
Area Under the ROC Curve	0.91	0.93	0.90	0.90	0.94	0.89

Other diagnostic accuracy measures studied:

- ✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 84% and for Star Math averaged 87%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 81% and Star Math averaged 77%.
- ✓ **Positive predictive values**, which indicate that when Star scores forecasted students to be proficient, they actually were proficient, were 88% for Star Reading and 81% for Star Math.
- ✓ **Negative predictive values**, which indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient, were 75% for reading and 85% 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 -3% and Star Math averaged 4% (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: M-STEP achievement levels

**Table B1. M-STEP achievement level score ranges**

M-STEP achievement level score ranges: ELA				
Grade	Level 1: Not Proficient	Level 2: Partially Proficient	Level 3: Proficient	Level 4: Advanced
3	1203 – 1279	1280 – 1299	1300 – 1316	1317 – 1357
4	1301 – 1382	1383 – 1399	1400 – 1416	1417 – 1454
5	1409 – 1480	1481 – 1499	1500 – 1523	1524 – 1560
6	1508 – 1577	1578 – 1599	1600 – 1623	1624 – 1655
7	1618 – 1678	1679 – 1699	1700 – 1725	1726 – 1753
8	1721 – 1776	1777 – 1799	1800 – 1827	1828 – 1857
M-STEP achievement level score ranges: Mathematics				
Grade	Level 1: Not Proficient	Level 2: Partially Proficient	Level 3: Proficient	Level 4: Advanced
3	1217 – 1280	1281 – 1299	1300 – 1320	1321 – 1361
4	1310 – 1375	1376 – 1399	1400 – 1419	1420 – 1455
5	1409 – 1477	1478 – 1499	1500 – 1514	1515 – 1550
6	1518 – 1578	1579 – 1599	1600 – 1613	1614 – 1650
7	1621 – 1678	1679 – 1699	1700 – 1715	1716 – 1752
8	1725 – 1779	1780 – 1799	1800 – 1814	1815 – 1850



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