

## Relating Star Reading® and Star Math® to the Missouri Assessment Program (MAP) Grade-Level Tests



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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 Missouri Assessment Program (MAP) tests in English Language Arts (ELA) and mathematics in grades 3 through 8.<sup>2</sup>

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 MAP 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 MAP 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 MAP tests in ELA and mathematics, we began by linking the score scales for each assessment.

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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).

## Data collection

Using a secure data-matching procedure compliant with the federal Family Educational Rights and Privacy Act (FERPA), staff from 4 districts (103 schools) provided Renaissance with MAP test scores for students who had taken Star Reading or Star Math during the 2017–2018 school year. Each record included a student’s MAP scores and was matched with all Star scores for that year.

## Sample characteristics

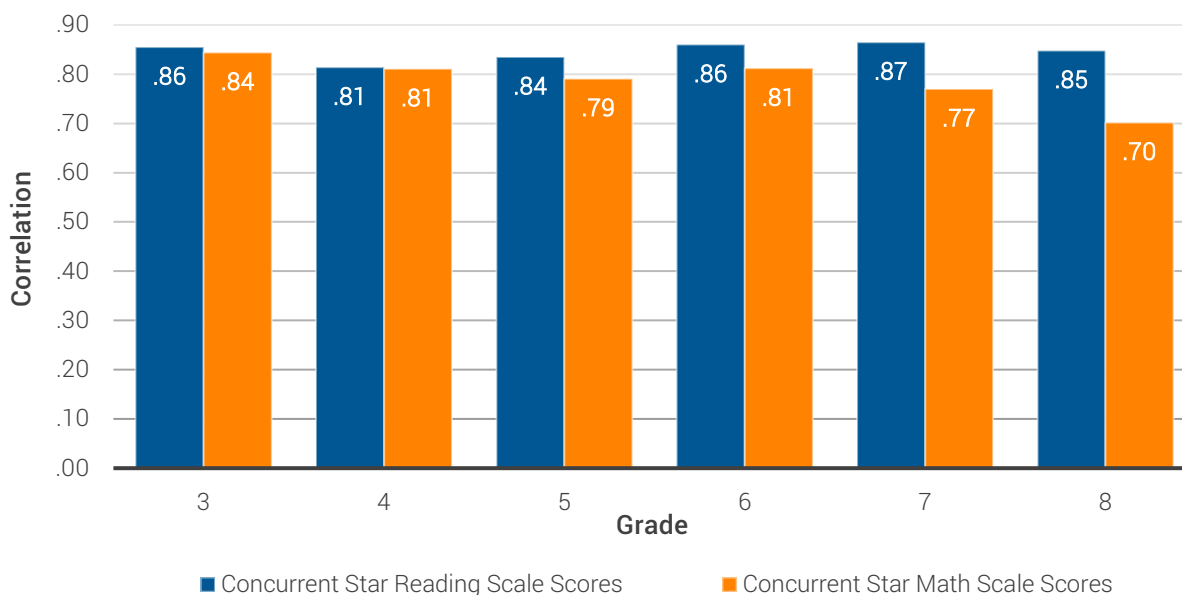
Renaissance divided the data into two samples. The **concurrent** sample included students’ scores for all Star tests taken within 30 days before or after the MAP administration. This sample numbered 28,878 records in grades 3–8 with matched MAP and Star Reading scores and 24,678 records in those grades with matched MAP and Star Math scores. In each grade, we then set aside scores from a subset of these students—10%—as a **holdout sample** to use only to evaluate the scale linkage.

The linking analysis revealed that Star Reading and Star Math are accurate predictors of the MAP tests.

## Correlations

Before linking Star tests with the MAP, we ensured there was a strong relationship between the test scales. As seen in figure 1, the correlations were strong, averaging .85 and .79 between MAP and Star Reading and Star Math, respectively.

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



## Scale linkage

Renaissance then linked the score scales for the Star Reading/Star Math and the MAP in ELA and mathematics by applying equipercntile linking analysis (Kolen & Brennan, 2004) in grades 3–8. The concurrent sample (sans the holdout sample) was used in the linking (scores from all Star tests taken

within 30 days before or after the MAP administration date), and the result was a table of MAP scores for each possible Star score.

## MAP cut scores and corresponding Star score equivalents

MAP results are reported in scaled scores that describe each student’s location on an achievement continuum ranging from approximately 160 to 660 and using four achievement levels: *Below Basic*, *Basic*, *Proficient*, and *Advanced*. A main purpose in linking Star Reading and Star Math to the MAP was to identify Star scores at the time of the state test that are approximately equivalent to the cut-off scores that separate the MAP achievement levels. Table 1 displays these equivalent Star scores at the time of the state test for grades 3–8.<sup>3</sup> The corresponding MAP cut scores can be found in Appendix B.

**Table 1. Star Reading® and Star Math® score equivalents at time of state test for each MAP achievement level range**

Star Reading® cut-score equivalents				
Grade	Below Basic	Basic	Proficient	Advanced
3	< 331	331-458	459-588	≥ 589
4	< 332	332-532	533-734	≥ 735
5	< 362	362-621	622-847	≥ 848
6	< 463	463-720	721-954	≥ 955
7	< 515	515-865	866-1070	≥ 1071
8	< 530	530-908	909-1250	≥ 1251
Star Math® cut-score equivalents				
Grade	Below Basic	Basic	Proficient	Advanced
3	< 558	558-627	628-684	≥ 685
4	< 626	626-700	701-772	≥ 773
5	< 650	650-761	762-828	≥ 829
6	< 711	711-795	796-851	≥ 852
7	< 725	725-824	825-878	≥ 879
8	< 758	758-852	853-905	≥ 906

## Results

### Accuracy of scale linkage confirmed

In evaluating the accuracy of the scale linkage, we used two methods to examine the differences between students’ observed (actual) MAP scores and our Star equivalents: (1) computing the RMSEL (the root mean squared errors of linking) using the scores from the linking study, and (2) applying the holdout sample, consisting of the subset of concurrent scores not used in the linking, to the linking results. Results showed that our linking computation performed as intended.

<sup>3</sup> The Star Reading and Star Math cut-score equivalents presented in Table 1 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.

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

Using the holdout sample, we were able to compare how concurrent Star scores aligned with the observed MAP scores. Table 2 displays classification diagnostics about whether students were correctly or incorrectly classified as proficient or not on the MAP using concurrent Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 87% of the time for reading and 88% of the time for math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, Star Reading averaged .94 and Star Math averaged .93 (also displayed in table 2). The AUCs exceed 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 2. Proficiency forecasting using Star Reading® and Star Math® scores yields accurate results**

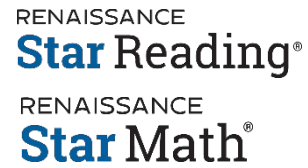
Star Reading®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	89%	87%	84%	85%	88%	87%
Area Under the ROC Curve	0.95	0.95	0.92	0.94	0.95	0.94
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	90%	88%	86%	85%	89%	90%
Area Under the ROC Curve	0.94	0.95	0.93	0.92	0.94	0.92

Other diagnostic accuracy measures studied:

- ✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 83% and for Star Math averaged 75%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which averaged 89% for Star Reading and 92% for Star Math.
- ✓ **Positive predictive values** indicate that when Star scores forecasted students to be proficient, they actually were proficient 81% of the time for Star Reading and 76% of the time for Star Math.
- ✓ **Negative predictive values** indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient 90% of the time for reading and 91% of the time 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 -1% (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: Missouri Assessment Program (MAP) Test achievement levels

**Table B1. MAP achievement level score ranges**

MAP achievement level score ranges: English language arts				
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 achievement level score ranges: 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

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