

Pathway to Proficiency: Linking Star Reading® and Star Math® to the TNReady



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Initial publication December 10, 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 TNReady tests in English Language Arts (ELA) and Mathematics in grades 3 through 8.²

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Main Findings

Results from the linking analysis revealed that Star Reading and Star Math are accurate predictors of the TNReady, 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 TNReady 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 TNReady 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 TNReady and Star Assessments, we began by gathering all Star Reading and Star Math test records from 2016–2017 for Tennessee. 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 TNReady data from the same school year by district and school name. To do this, performance level distribution data from the TNReady was obtained from the public data provided by the Tennessee Department of Education. The file included the number of students tested in each grade and the percentage of students who were in the levels *Below*, *Approaching*, *On Track*, and *Mastered*.

Sample characteristics

Once we determined how many students in each grade at a school were tested on the TNReady 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 TNReady 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 TNReady 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 32,920 Star Reading students from 308 schools. The math sample included 25,759 Star Math students from 435 schools. Table 1 displays by-grade test summaries for the reading and math samples. It also includes percentages of students in the *Below*, *Approaching*, *On Track*, and *Mastered* 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	TNReady ELA students	Below		Approaching		On Track		Mastered	
			Sample	State	Sample	State	Sample	State	Sample	State
3	5,435	5,307	16%	27%	37%	39%	35%	27%	12%	7%
4	4,945	4,826	12%	19%	40%	44%	39%	32%	9%	5%
5	4,556	4,459	12%	25%	42%	44%	36%	26%	10%	5%
6	6,537	6,324	13%	19%	43%	47%	34%	28%	10%	6%
7	5,667	5,602	12%	21%	39%	43%	40%	31%	9%	5%
8	5,780	5,688	13%	18%	48%	51%	30%	25%	9%	6%
Star Math® sample performance										
Grade	Star Math® students	TNReady Math students	Below		Approaching		On Track		Mastered	
			Sample	State	Sample	State	Sample	State	Sample	State
3	5,076	4,947	16%	24%	34%	35%	32%	27%	18%	14%
4	4,045	3,952	16%	25%	33%	34%	39%	32%	12%	9%
5	4,007	3,905	16%	26%	35%	35%	34%	28%	15%	11%
6	5,830	5,623	14%	25%	31%	36%	43%	33%	12%	6%
7	4,724	4,667	14%	24%	40%	44%	37%	27%	9%	5%
8	2,077	2,010	24%	34%	34%	35%	30%	25%	12%	6%

Results

Scale linkage

Renaissance linked the Star test scale to the TNReady by applying equipercentile linking analysis (Kolen & Brennan, 2004). First, we aggregated the sample of schools to calculate the percentage of students categorized as *Below*, *Approaching*, *On Track*, *Proficient*, and *Mastered* 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 TNReady level. For example, as shown in Table 1, 16% of students in our third-grade reading sample were classified as *Below*, 37% *Approaching*, 35% *On Track*, and 12% *Mastered*. Therefore, the cutscores for proficiency levels in the third grade are at the 16th percentile for *Approaching*, the 53th percentile for *On Track*, and the 88th percentile for *Mastered*.

TNReady cut scores and corresponding Star score equivalents

TNReady results are reported in scaled scores that are split into four achievement levels: *Below*, *Approaching*, *On Track*, and *Mastered*. The main purpose in linking Star Reading and Star Math to the TNReady was to identify Star scores at the time of the state test that are approximately equivalent to the cut-off scores that separate the TNReady levels. Table 2 displays these equivalent Star scores at the time of the state test for grades 3-8.³ The corresponding TNReady cut scores can be found in Appendix B.

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

Star Reading [®] cut-score equivalents				
Grade	Below	Approaching	On Track	Mastered
3	< 349	349 - 504	505 - 676	≥ 677
4	< 382	382 - 584	585 - 877	≥ 878
5	< 480	480 - 724	725 - 1021	≥ 1022
6	< 507	507 - 820	821 - 1141	≥ 1142
7	< 572	572 - 910	911 - 1270	≥ 1271
8	< 613	613 - 1048	1049 - 1311	≥ 1312
Star Math [®] cut-score equivalents				
Grade	Below	Approaching	On Track	Mastered
3	< 564	564 - 640	641 - 691	≥ 692
4	< 625	625 - 705	706 - 780	≥ 781
5	< 674	674 - 771	772 - 834	≥ 835
6	< 691	691 - 789	790 - 877	≥ 878
7	< 713	713 - 839	840 - 913	≥ 914
8	< 761	761 - 840	841 - 915	≥ 916

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

A Tennessee district shared student level TNReady scores to explore the accuracy of using Star Reading and Star Math for forecasting TNReady performance. The Star Reading sample consisted of 8,679 students and the Star Math sample consisted of 7,671 students. We took students' Star scores from tests taken within 30 days of the mid-date of the TNReady administration to examine the accuracy of the linkage to the TNReady scale.

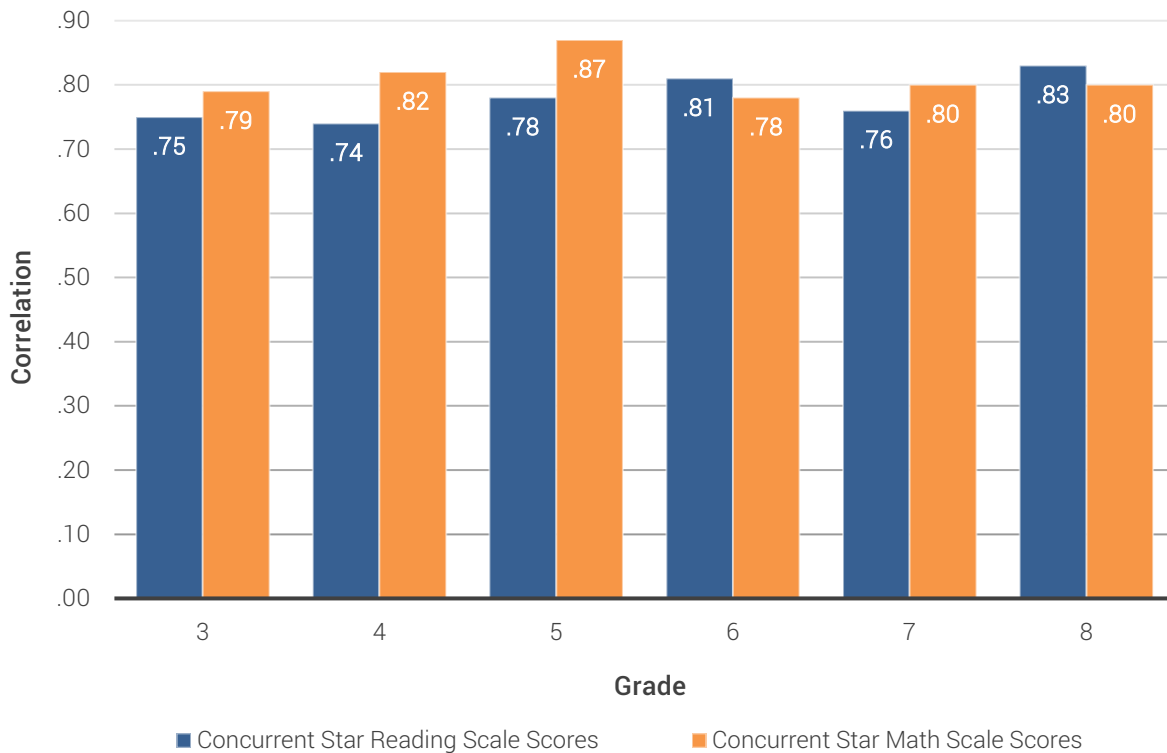
Classification diagnostics were derived from counts of correct and incorrect classifications when using Star scores to predict whether a student would achieve proficiency on the TNReady. The results indicate that Star Assessments provide an effective means of estimating end-of-year achievement on the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

Predictive Star scores correlate highly with actual TNReady scores

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

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

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



Star scores discriminate well between students who score proficient or not

We compared actual TNReady performance to students' estimated TNReady 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 TNReady using Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 82% of the time by Star Reading and 84% of the time by Star Math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, both Star Reading 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

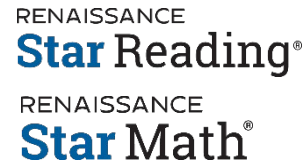
Star Reading®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	81%	82%	79%	83%	82%	87%
Area Under the ROC Curve	0.90	0.89	0.89	0.92	0.90	0.94
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	79%	87%	86%	82%	81%	88%
Area Under the ROC Curve	0.87	0.93	0.94	0.90	0.90	0.94

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 88%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 80% and Star Math averaged 77%.
- ✓ **Positive predictive values**, which indicate that when Star scores forecasted students to be proficient, they actually were proficient, were 84% for Star Reading and 87% for Star Math.
- ✓ **Negative predictive values**, which indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient, were 80% for reading and 78% 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 0% 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.



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Appendix B: TNReady achievement levels

Table B1. TNReady achievement level score ranges

TNReady achievement level score ranges: ELA				
Grade	Below	Approaching	On Track	Mastered
3	200 - 321	322 - 358	359 - 390	391 - 450
4	200 - 298	299 - 342	343 - 378	379 - 450
5	200 - 295	296 - 332	333 - 370	371 - 450
6	200 - 302	303 - 341	342 - 376	377 - 450
7	200 - 304	305 - 340	341 - 373	374 - 450
8	200 - 297	298 - 345	346 - 383	384 - 450
TNReady achievement level score ranges: Mathematics				
Grade	Below	Approaching	On Track	Mastered
3	200 - 304	305 - 340	341 - 370	371 - 450
4	200 - 294	295 - 329	330 - 372	373 - 450
5	200 - 299	300 - 338	339 - 373	374 - 450
6	200 - 306	307 - 339	340 - 381	382 - 450
7	200 - 294	295 - 338	339 - 378	379 - 450
8	200 - 295	296 - 329	330 - 366	367 - 450

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