RENAISSANCE®

TECHNICAL PAPER | 2019–2020 School Year

Relating Star Reading® and Star Math® to the Wisconsin Forward Exam

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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 Wisconsin Forward Exam in English language arts 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 Wisconsin Forward Exam, meaning as a Wisconsin 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 Forward Exam 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 Wisconsin Forward Exam in English language arts and mathematics, we began by linking the score scales for each assessment.

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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.

Data collection

Using a secure data-matching procedure compliant with the federal Family Educational Rights and Privacy Act (FERPA) and Wisconsin Department of Public Instruction policies, staff from five large Wisconsin districts provided Renaissance with state summative test scores for students who had taken Star Reading or Star Math during the 2015–2016 school year. Each record included a student's Forward Exam scores and was matched with all Star scores for that year.

Sample characteristics

Renaissance divided the Wisconsin data into two samples. The **concurrent** sample included students' scores for all Star tests taken within 30 days before or after the mid-date of the Forward Exam administration window. This sample numbered 48,532 students in grades 3–8 with matched Forward Exam and Star Reading scores and 45,174 students in those grades with matched Forward Exam 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.

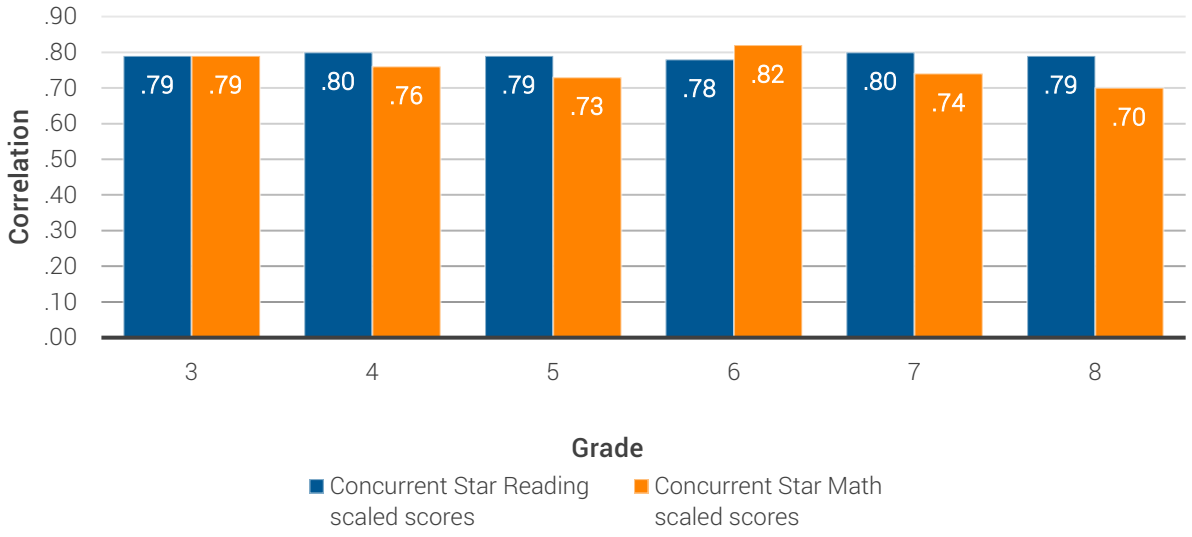
> The linking analysis revealed that Star Reading and Star Math are accurate predictors of the Wisconsin Forward Exam.

The **predictive** sample, which included 39,605 students for reading and 39,812 students for math, included Star scores for tests taken more than 30 days on either side of the mid-date in the Forward Exam testing window.

Correlations

Before linking Star tests with the Forward Exam we ensured there was a strong relationship between the test scales. As seen in figure 1, the correlations were positive, averaging .79 and .76 between Forward Exam and Star Reading and Star Math, respectively.

Figure 1. Star Reading® and Star Math® scores highly correlate with Wisconsin Forward Exam



Scale linkage

Renaissance then linked the score scales for the Star Reading/Star Math and the Forward Exam in English language arts and mathematics by applying equipercentile 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 Forward Exam testing mid-date), and the result was a table of Forward Exam scores for each possible Star score.

The predictive sample was then used to evaluate if the linking results could accurately predict student performance on the Forward Exam with Star data from earlier in the school year. To do so, we took students' Star scores from tests taken more than 30 days on either side of the mid-date in the Forward Exam testing window and used national growth norms (Renaissance, 2016a, 2016b) to project what their Star scores would be at the mid-date. Then the scale linkage table was used to look up the projected Star scores (or the average of the projected scores for students with multiple Star scores in the predictive sample) to see how they translated to the Forward Exam scale.

Wisconsin cut scores and corresponding Star score equivalents

Forward Exam results are reported in scaled scores that describe each student's location on an achievement continuum ranging from approximately 330 to 970 and using four achievement levels: *Below Basic*, *Basic*, *Proficient*, and *Advanced*.

A main purpose in linking Star Reading and Star Math to the Forward Exam was to identify Star scores approximately equivalent to the cut-off scores that separate the Wisconsin achievement levels. Table 1 displays these equivalent Star scores for grades 3–8. The corresponding Forward Exam cut scores can be found in the Appendix B.[3]

3 The linking sample came from five school districts, so cut scores should be considered approximations to be updated with greater precision as more data become available.

Table 1. Star Reading® and Star Math® score equivalents for each Forward Exam achievement level range

Star Reading® cut-score equivalents				
Grade	Below Basic	Basic	Proficient	Advanced
3	< 308	308–472	473–677	≥ 678
4	< 397	397–571	572–890	≥ 891
5	< 474	474–681	682–1037	≥ 1038
6	< 515	515–785	786–1170	≥ 1171
7	< 580	580–859	860–1261	≥ 1262
8	< 595	595–922	923–1295	≥ 1296
Star Math® cut-score equivalents				
Grade	Below Basic	Basic	Proficient	Advanced
3	< 542	542–634	635–732	≥ 733
4	< 614	614–715	716–814	≥ 815
5	< 682	682–785	786–864	≥ 865
6	< 722	722–813	814–918	≥ 919
7	< 767	767–845	846–957	≥ 958
8	< 777	777–874	875–958	≥ 959

Results

Accuracy of scale linkage confirmed

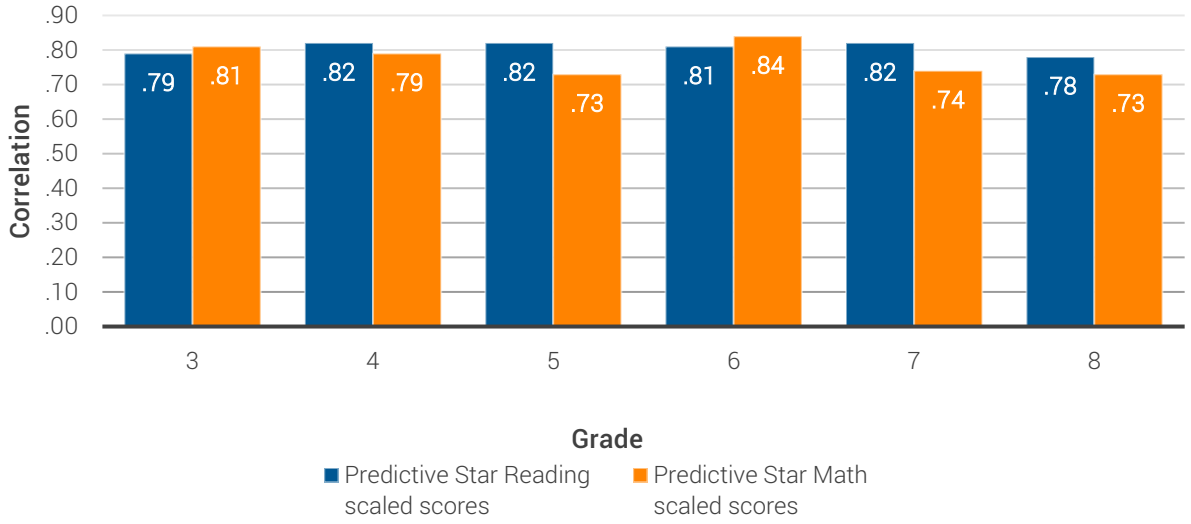
In evaluating the accuracy of the scale linkage, we used two methods to examine the differences between students' observed (actual) Forward Exam scores and our Star equivalents: (1) computing the RMSEL (the root mean squared errors of linking) using the scores from the linking study, and (2) applying 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.

Predictive Star scores correlate highly with actual Forward Exam scores

> Star scores have a strong relationship with end-of-year Forward Exam scores.

To summarize the predictive power of Star Reading and Star Math, we calculated raw correlations between observed (actual) Forward Exam scores and projected Star scores. As figure 2 shows, the predictive correlation showed a strong relationship between the assessments (similar to the correlations from the concurrent sample, see figure 1, p. 4), indicating that earlier Star scores have a strong relationship with end-of-year Forward Exam scores. For reading, the correlations averaged .81 and for math, the associations were also high, averaging .77.

Figure 2. Projected scores from Star Reading® and Star Math® highly correlate with Wisconsin Forward Exam scores



Star scores discriminate well between students who score proficient or not

Using the sample of actual Forward Exam scores, we were able to compare how our projected Star scores aligned with the observed Wisconsin scores. Table 2 displays classification diagnostics about whether students were correctly or incorrectly classified as proficient or not on the Forward Exam using projected Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 88% of the time for reading and 91% of the time for math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, Star Reading and Star Math averaged .94 and .96, respectively (also displayed in table 2). The AUCs far 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)	88%	90%	88%	90%	87%	88%
Area Under the ROC Curve	0.94	0.95	0.94	0.95	0.94	0.94
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	88%	91%	91%	91%	92%	93%
Area Under the ROC Curve	0.94	0.96	0.96	0.96	0.96	0.96

Other diagnostic accuracy measures studied:

- ✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 73% and for Star Math averaged 71%.

- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 93% and for Star Math averaged 96%.

- ✓ **Positive predictive values** indicate that when Star scores forecasted students to be proficient, they actually were proficient 76% of the time for Star Reading and 81% of the time for Star Math.

- ✓ **Negative predictive values** indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient 92% of the time for reading and 93% 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 -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.

RENAISSANCE Star Reading®

RENAISSANCE Star Math®

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: Wisconsin Forward Exam achievement levels

Table B1. Forward Exam achievement level score ranges

Forward Exam achievement level score ranges: English language arts				
Grade	Below Basic	Basic	Proficient	Advanced
3	330–521	522–569	570–623	624–900
4	340–545	546–591	592–649	650–930
5	350–563	564–609	610–669	670–940
6	360–571	572–621	622–670	671–950
7	370–584	585–637	638–696	697–960
8	380–591	592–651	652–707	708–970
Forward Exam achievement level score ranges: Mathematics				
Grade	Below Basic	Basic	Proficient	Advanced
3	360–516	517–559	560–610	611–760
4	405–535	536–587	588–632	633–800
5	430–573	574–610	611–657	658–830
6	440–581	582–625	626–687	688–870
7	450–605	606–646	647–711	712–880
8	470–619	620–666	667–717	718–890

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