

Relating Star Reading® and Star Math® to the ACT Aspire®



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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 ACT Aspire® tests in reading and mathematics in grades 3 through 10.²

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Main Findings

Results from the linking analysis revealed that Star Reading and Star Math are accurate predictors of the ACT Aspire 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 ACT Aspire 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 ACT Aspire tests in reading 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.

Data collection

Using a secure data-matching procedure compliant with the federal Family Educational Rights and Privacy Act (FERPA), staff from seven districts in Alabama, South Carolina, and Wisconsin provided Renaissance with state summative test scores for students who had taken Star Reading or Star Math during the 2013–2014, 2014–2015, or 2015–2016 school years. Each record included a student’s ACT Aspire 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 ACT Aspire administration.³ This sample numbered 42,171 tests from students in grades 3–10 with matched ACT Aspire and Star Reading scores and 35,116 tests from students in those grades with matched ACT Aspire 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.

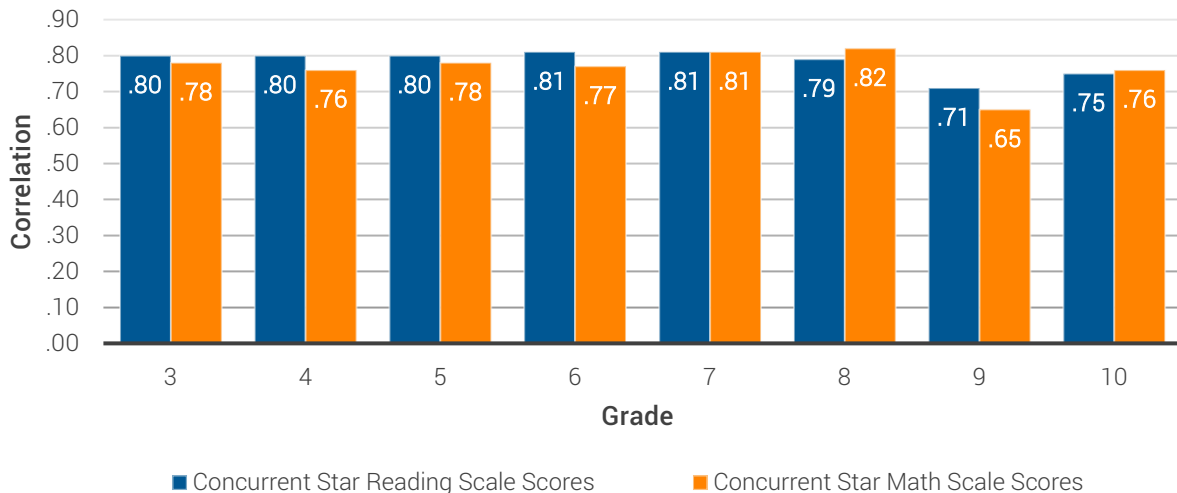
The linking analysis revealed that Star Reading and Star Math are accurate predictors of the ACT Aspire tests.

The **predictive** sample, which included 44,877 students for reading and 37,581 students for math, included Star scores for tests taken more than 30 days before the ACT Aspire administration.

Correlations

Before linking Star tests with the ACT Aspire, we ensured there was a strong relationship between the test scales. As seen in figure 1, the correlations were positive, averaging .78 and .77 between ACT Aspire and Star Reading and Star Math, respectively.

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



³ Two districts did not provide ACT Aspire administration dates in the data file. For these districts, the mid-date of the state testing window was used as the ACT Aspire administration date.

Scale linkage

Renaissance then linked the score scales for the Star Reading/Star Math and the ACT Aspire in reading and mathematics by applying equipercntile linking analysis (Kolen & Brennan, 2004) in grades 3–10. 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 ACT Aspire administration date), and the result was a table of ACT Aspire 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 ACT Aspire with Star data from earlier in the school year. To do so, we took students' Star scores from tests taken more than 30 days prior to the ACT Aspire administration date and used national growth norms (Renaissance Learning, 2016a, 2016b) to project what their Star scores would be at the date of the ACT Aspire administration. 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 ACT Aspire scale.

ACT Aspire cut scores and corresponding Star score equivalents

ACT Aspire results are reported in scaled scores that describe each student's location on an achievement continuum ranging from approximately 400 to 460, divided into four achievement levels: *In Need of Support*, *Close*, *Ready*, and *Exceeding*. A main purpose in linking Star Reading and Star Math to the ACT Aspire was to identify Star scores approximately equivalent to the cut-off scores that separate the ACT Aspire achievement levels. Table 1 displays these equivalent Star scores for grades 3–10. The corresponding ACT Aspire cut scores can be found in Appendix B.

Table 1. Star Reading® and Star Math® score equivalents for each ACT Aspire achievement level range

Star Reading® cut-score equivalents				
Grade	In Need of Support	Close	Ready	Exceeding
3	< 392	392 – 492	493 – 607	≥ 608
4	< 428	428 – 571	572 – 724	≥ 725
5	< 526	526 – 695	696 – 899	≥ 900
6	< 553	553 – 725	726 – 952	≥ 953
7	< 618	618 – 889	890 – 1242	≥ 1243
8	< 637	637 – 890	891 – 1251	≥ 1252
9	< 766	766 – 992	993 – 1252	≥ 1253
10	< 922	922 – 1185	1186 – 1342	≥ 1343
Star Math® cut-score equivalents				
Grade	In Need of Support	Close	Ready	Exceeding
3	< 505	505 – 595	596 – 678	≥ 679
4	< 523	523 – 675	676 – 773	≥ 774
5	< 568	568 – 739	740 – 827	≥ 828
6	< 621	621 – 764	765 – 845	≥ 846
7	< 719	719 – 818	819 – 878	≥ 879
8	< 777	777 – 848	849 – 899	≥ 900
9	< 840	840 – 883	884 – 920	≥ 921
10	< 878	878 – 918	919 – 965	≥ 966

Results

Accuracy of scale linkage confirmed

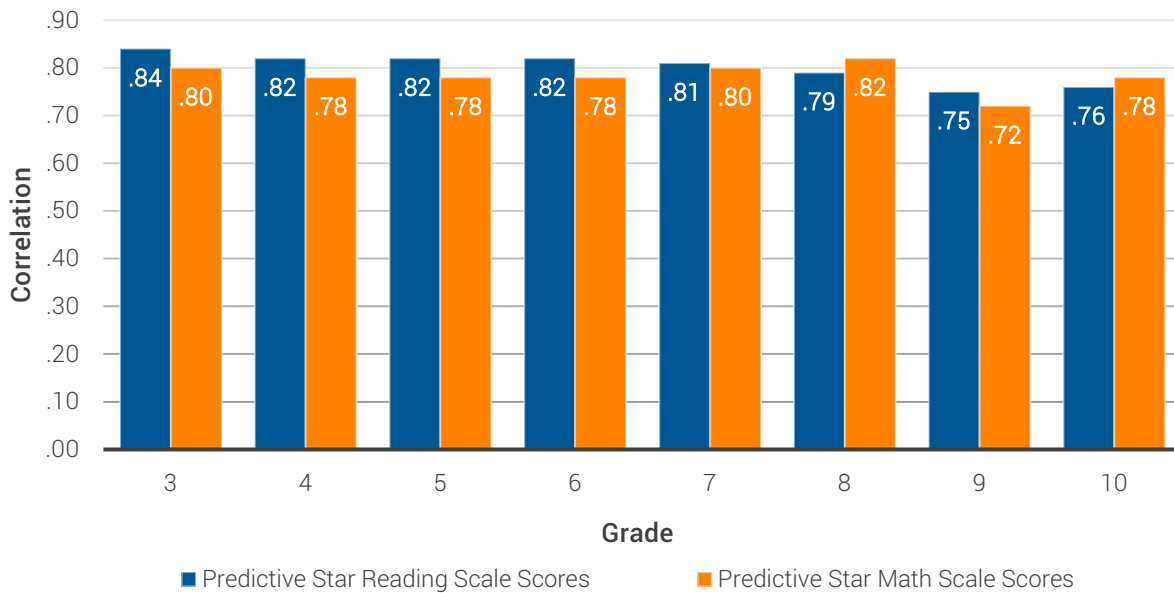
In evaluating the accuracy of the scale linkage, we used two methods to examine the differences between students' observed (actual) ACT Aspire scores and our Star equivalents: (1) computing the RMSEL (the root mean squared errors of linking) using the scores from the linking study, and (2) applying the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

To summarize the predictive power of Star Reading and Star Math, we calculated raw correlations between observed (actual) ACT Aspire 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 ACT Aspire scores. For reading, the correlations averaged .80 and for math, the associations were also high, averaging .78.

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

Figure 2. Projected scores from Star Reading® and Star Math® highly correlate with ACT Aspire scores



Star scores discriminate well between students who score proficient or not

Using the sample of actual ACT Aspire scores, we were able to compare how our projected Star scores aligned with the observed ACT Aspire scores. Table 2 displays classification diagnostics about whether students were correctly or incorrectly classified as proficient or not on the ACT Aspire using projected Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 84% of the time for reading and 85% of the time for math.

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

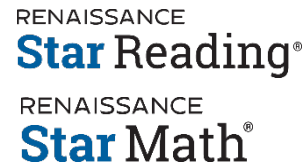
Star Reading®								
Measure	Grade							
	3	4	5	6	7	8	9	10
Overall classification accuracy (percentage of correct classifications)	84%	85%	83%	83%	82%	81%	87%	87%
Area Under the ROC Curve	0.92	0.93	0.91	0.92	0.90	0.90	0.92	0.92
Star Math®								
Measure	Grade							
	3	4	5	6	7	8	9	10
Overall classification accuracy (percentage of correct classifications)	83%	82%	81%	81%	84%	85%	91%	91%
Area Under the ROC Curve	0.91	0.90	0.90	0.89	0.93	0.93	0.95	0.95

Other diagnostic accuracy measures studied:

- ✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 81% and for Star Math averaged 81%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 84% and for Star Math averaged 80%.
- ✓ **Positive predictive values** indicate that when Star scores forecasted students to be proficient, they actually were proficient 78% of the time for Star Reading and 82% of the time for Star Math.
- ✓ **Negative predictive values** indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient 86% of the time for reading and 84% 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—as often as weekly—when used in progress monitoring programs.



Star Reading and Star Math are highly rated for progress monitoring by the National Center on Intensive Intervention, and received high ratings for screening and progress monitoring by the National Center on Response to Intervention.



Appendix B: ACT Aspire achievement levels

Table B1. ACT Aspire achievement level score ranges

ACT Aspire achievement level score ranges: Reading				
Grade	In Need of Support	Close	Ready	Exceeding
3	400 – 410	411 – 414	415 – 418	419 – 429
4	400 – 411	412 – 416	417 – 421	422 – 431
5	400 – 414	415 – 419	420 – 424	425 – 434
6	400 – 415	416 – 420	421 – 425	426 – 436
7	400 – 416	417 – 422	423 – 428	429 – 438
8	400 – 417	418 – 423	424 – 429	430 – 440
9	400 – 418	419 – 424	425 – 430	431 – 442
10	400 – 421	422 – 427	428 – 433	434 – 442
ACT Aspire achievement level score ranges: Mathematics				
Grade	In Need of Support	Close	Ready	Exceeding
3	400 – 408	409 – 412	413 – 416	417 – 434
4	400 – 410	411 – 415	416 – 420	421 – 440
5	400 – 411	412 – 417	418 – 423	424 – 446
6	400 – 413	414 – 419	420 – 425	426 – 451
7	400 – 415	416 – 421	422 – 427	428 – 453
8	400 – 418	419 – 424	425 – 430	431 – 456
9	400 – 421	422 – 427	428 – 433	434 – 460
10	400 – 425	426 – 431	432 – 437	438 – 460

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