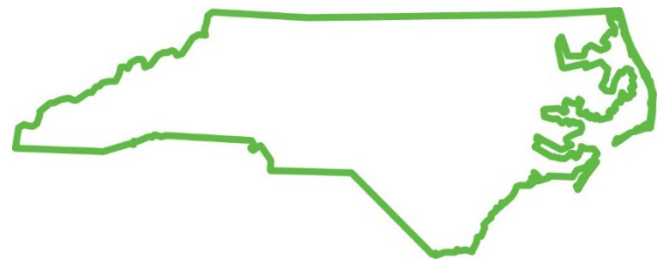


Relating Star Reading® and Star Math® to North Carolina End-of-Grade (EOG) Performance



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Initial publication February 16, 2015

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 North Carolina End-of-Grade (EOG) test in English language arts/reading 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 EOG 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 EOG 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 EOG tests in English language arts/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) and North Carolina Department of Instruction (NCDPI) policies, staff from North Carolina Education Research Data Center at Duke University provided Renaissance with state test scores for students who had taken Star Reading or Star Math during the 2013–2014 school year. Each record included a student’s EOG scores as well as scores on any Star tests taken during that year.

Sample characteristics

Renaissance divided the EOG 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 EOG administration window. This sample numbered 101,644 students in grades 3–8 with matched EOG English language arts/reading and Star Reading scores and 37,292 students in those grades 3–8 with matched EOG mathematics 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.

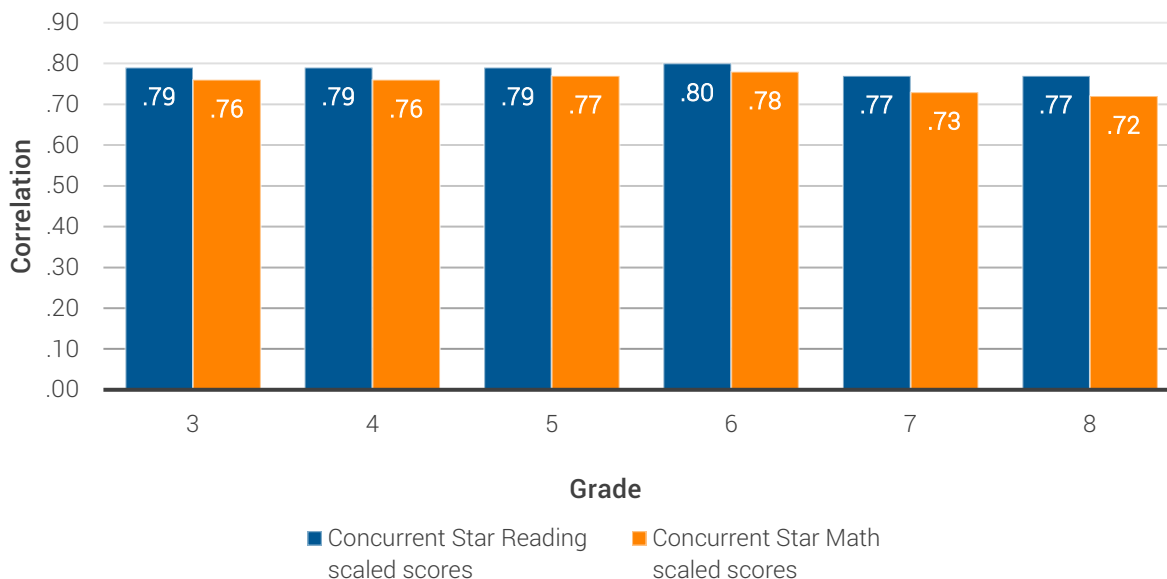
The linking analysis revealed that Star Reading and Star Math are accurate predictors of the EOG assessments.

The **predictive** sample, which included 396,075 students for reading and 125,932 students for math, included Star scores for tests taken more than 30 days before the mid-date in the EOG testing window.

Correlations

Before linking Star tests with the EOG assessments, we ensured there was a strong relationship between the test scales. As seen in figure 1, the correlations were positive, averaging .79 and .75 between EOG and Star Reading and Star Math, respectively.

Figure 1. Star Reading® and Star Math® scores highly correlate with NC EOG assessments



Scale linkage

Renaissance then linked the score scales for the Star Reading/Star Math and the EOG assessments in English language arts/reading and mathematics by applying equipercntile linking analysis (Kolen & Brennan, 2004) in grades 3–8 in reading and math. 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 EOG testing mid-date), and the result was a table of EOG 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 EOG assessment 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 EOG testing mid-date 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 EOG scale.

NC EOG cut scores and corresponding Star score equivalents

EOG results are reported in scaled scores that describe each student's location on an achievement continuum ranging from 406 to 487 and using five achievement levels: *Level 1*, *Level 2*, *Level 3*, *Level 4*, and *Level 5*. Level 5 denotes Superior Command of knowledge and skills, Level 4 denotes Solid Command, Level 3 denotes Sufficient Command, Level 2 denotes Partial Command, and Level 1 denotes Limited Command.

A main purpose in linking Star Reading and Star Math to the EOG assessments was to identify Star scores approximately equivalent to the cut-off scores that separate the EOG achievement levels. Table 1 displays these equivalent Star scores for grade 3–8 in reading and math. The corresponding EOG cut scores can be found in the Appendix B.

Table 1. Star Reading® and Star Math® score equivalents for each NC EOG achievement level range

Star Reading® cut-score equivalents					
Grade	Level 1	Level 2	Level 3	Level 4	Level 5
3	<= 319	320 – 400	401 – 455	456 – 641	≥ 642
4	<= 401	402 – 491	492 – 540	541 – 883	≥ 884
5	<= 467	468 – 580	581 – 655	656 – 973	≥ 974
6	<= 458	459 – 619	620 – 693	694 – 1037	≥ 1038
7	<= 492	493 – 690	691 – 783	784 – 1192	≥ 1193
8	<= 590	591 – 836	837 – 915	916 – 1293	≥ 1294
Star Math® cut-score equivalents					
Grade	Level 1	Level 2	Level 3	Level 4	Level 5
3	<= 530	531 – 608	609 – 635	636 – 711	≥ 712
4	<= 619	620 – 690	691 – 709	710 – 790	≥ 791
5	<= 662	663 – 744	745 – 762	763 – 837	≥ 838
6	<= 736	737 – 799	800 – 815	816 – 875	≥ 876
7	<= 764	765 – 828	829 – 841	842 – 907	≥ 908
8	<= 799	800 – 872	873 – 884	885 – 941	≥ 942

Results

Accuracy of scale linkage confirmed

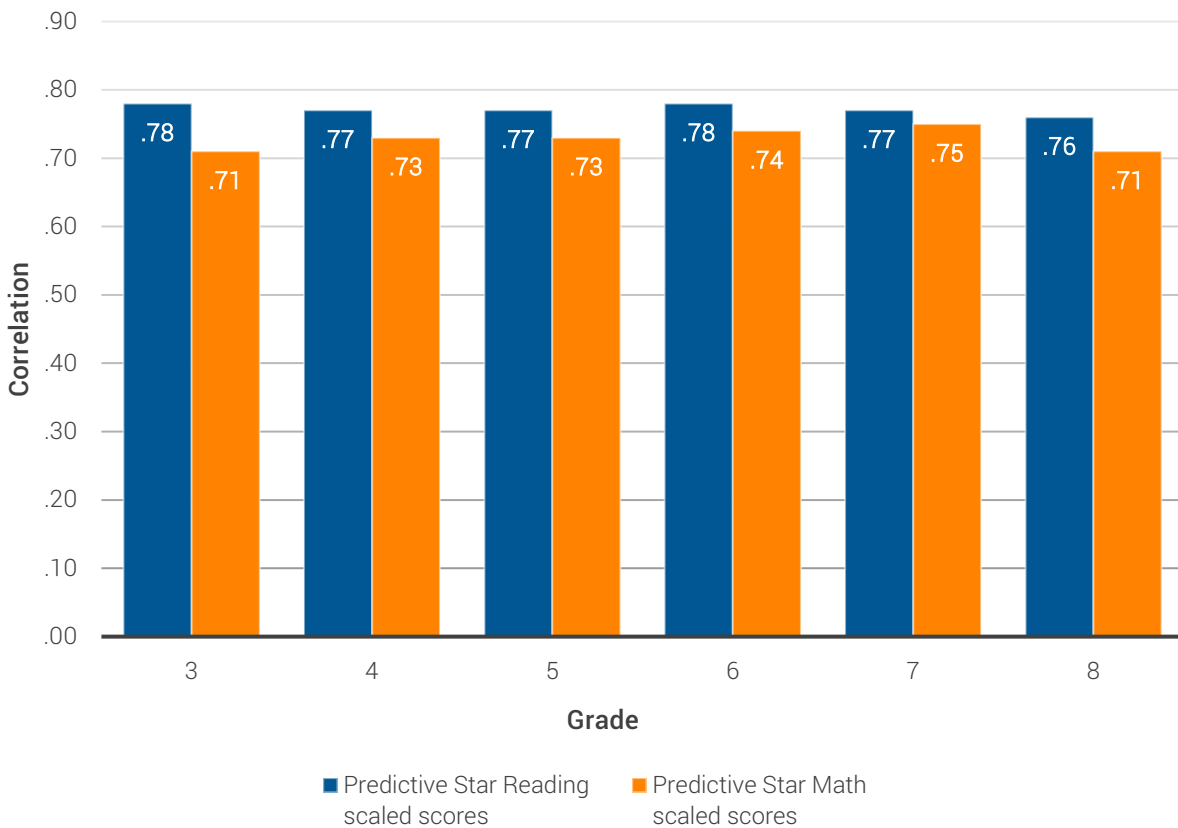
In evaluating the accuracy of the scale linkage, we used two methods to examine the differences between students' observed (actual) EOG scores and our Star equivalents: (1) computing the RMSEL (the root mean squared errors of linking) using the scores from the linking study, and (2) applying the holdout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

To summarize the predictive power of Star Reading and Star Math, we calculated raw correlations between observed (actual) EOG 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 EOG scores. For reading, the correlations averaged .77 and for math, the associations were also high, averaging .73.

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

Figure 2. Projected scores from Star Reading® and Star Math® highly correlate with NC EOG scores



Star scores discriminate well between students who score proficient or not

Using the sample of actual EOG scores, we were able to compare how our projected Star scores aligned with the observed EOG scores. Table 2 displays classification diagnostics about whether students were correctly or incorrectly classified as proficient or not on the EOG assessments using projected Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 81% of the time for reading and 81% of the time for math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, Star Reading and Star Math averaged .89 and .89, 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)	82%	81%	80%	81%	80%	80%
Area Under the ROC Curve	0.90	0.90	0.89	0.89	0.88	0.88
Star Math®						
Measure	Grade					
	3	4	5	6	7	8
Overall classification accuracy (percentage of correct classifications)	78%	80%	79%	82%	84%	82%
Area Under the ROC Curve	0.87	0.89	0.88	0.90	0.92	0.90

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 78%.
- ✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 78% and for Star Math averaged 82%.
- ✓ **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 79% of the time for Star Math.
- ✓ **Negative predictive values** indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient 81% of the time for reading and 83% 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 average 2% and Star Math averaged 0% (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: North Carolina EOG achievement levels

Table B1. North Carolina EOG achievement level score ranges

NC EOG achievement level score ranges: English language arts/reading					
Grade	Level 1	Level 2	Level 3	Level 4	Level 5
3	<= 431	432 – 438	439 – 441	442 – 451	≥ 452
4	<= 438	439 – 444	445 – 447	448 – 459	≥ 460
5	<= 442	443 – 449	450 – 452	453 – 463	≥ 464
6	<= 441	442 – 450	451 – 453	454 – 464	≥ 465
7	<= 444	445 – 453	454 – 456	457 – 468	≥ 469
8	<= 448	449 – 457	458 – 461	462 – 472	≥ 473
NC EOG achievement level score ranges: Mathematics					
Grade	Level 1	Level 2	Level 3	Level 4	Level 5
3	<= 439	440 – 447	448 – 450	451 – 459	≥ 460
4	<= 440	441 – 448	449 – 450	451 – 459	≥ 460
5	<= 440	441 – 448	449 – 450	451 – 459	≥ 460
6	<= 443	444 – 450	451 – 452	453 – 460	≥ 461
7	<= 443	444 – 450	451 – 452	453 – 460	≥ 461
8	<= 443	444 – 451	452 – 453	454 – 462	≥ 463

References

- Kolen, M. J., & Brennan, R. R. (2004). *Test equating scaling and linking: Methods and practices*. New York, NY: Springer Science+Business Media.
- Perie, M., Marion, S., Gong, B., & Wurtzel, J. (2007). *The role of interim assessments in a comprehensive assessment system*. Aspen, CO: Aspen Institute.
- Renaissance Learning. (2016a). *STAR Math: Technical manual*. Wisconsin Rapids, WI: Author. Available by request to research@renaissance.com
- Renaissance Learning. (2016b). *STAR Reading: Technical manual*. Wisconsin Rapids, WI: Author. Available by request to research@renaissance.com

Independent technical reviews of Star Reading® and Star Math®

- U.S. Department of Education: National Center on Intensive Intervention. (2018a). *Review of academic progress monitoring tools* [Review of Star Math]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/progress-monitoring>
- U.S. Department of Education: National Center on Intensive Intervention. (2018b). *Review of academic progress monitoring tools* [Review of Star Reading]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/progress-monitoring>
- U.S. Department of Education: National Center on Intensive Intervention. (2018c). *Review of academic screening tools* [Review of Star Math]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/academic-screening>
- U.S. Department of Education: National Center on Intensive Intervention. (2018d). *Review of academic screening tools* [Review of Star Reading]. Washington, DC: Author. Retrieved from <https://charts.intensiveintervention.org/chart/academic-screening>
- U.S. Department of Education: National Center on Response to Intervention. (2010a). *Review of progress monitoring tools* [Review of STAR Math]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20120813035500/http://www.rti4success.org/pdf/progressMonitoringGOM.pdf>
- U.S. Department of Education: National Center on Response to Intervention. (2010b). *Review of progress monitoring tools* [Review of STAR Reading]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20120813035500/http://www.rti4success.org/pdf/progressMonitoringGOM.pdf>
- U.S. Department of Education: National Center on Response to Intervention. (2011a). *Review of screening tools* [Review of STAR Math]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20171027185735/http://www.rti4success.org:80/resources/tools-charts/screening-tools-chart>
- U.S. Department of Education: National Center on Response to Intervention. (2011b). *Review of screening tools* [Review of STAR Reading]. Washington, DC: Author. Retrieved from <https://web.archive.org/web/20171027185735/http://www.rti4success.org:80/resources/tools-charts/screening-tools-chart>