# RENAISSANCE

# Relating Star Reading and Star Math to California Assessment of Student Performance and Progress (CAASPP) (Smarter Balanced)

# Contents

**Figures**

**Tables**

**Initial publication October 30, 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 et al., 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 Smarter Balanced assessments in English language arts/literacy and mathematics in grades 3 through 8.[2]

> **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 Smarter Balanced assessments, 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 Smarter Balanced performance level to serve as an early warning system for building and district administrators and allow redirection of resources as needed.

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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.

# Study

To determine if Star Reading and Star Math can predict student achievement on the end-of-year Smarter Balanced assessments in English language arts/literacy and mathematics, we began by linking the score scales for each assessment.

### Data collection

Using a secure data-matching procedure compliant with the federal Family Educational Rights and Privacy Act (FERPA), staff from eight large districts in four Smarter Balanced states (California, Oregon, Washington, and Connecticut) provided Renaissance with state summative test scores for students who had taken Star Reading or Star Math during the 2014–2015 school year. Each record included a student's Smarter Balanced scores and was matched with all Star scores for that year.

### Sample characteristics

Renaissance divided the Smarter Balanced 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 Smarter Balanced administration window. This sample numbered 54,777 students in grades 3–8 with matched Smarter Balanced English language arts/literacy and Star Reading scores and 50,752 students in those grades 3–8 with matched Smarter

> **The linking analysis revealed that Star Reading and Star Math are accurate predictors of the Smarter Balanced assessments.**

Balanced 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 **predictive** sample, which included 51,835 students for reading and 51,816 students for math, included Star scores for tests taken more than 30 days before the mid-date in the Smarter Balanced testing window.

### Correlations

Before linking Star tests with the Smarter Balanced assessments, we ensured there was a strong relationship between the test scales. As seen in figure 1, the correlations were positive, averaging .82 and .85 between Smarter Balanced and Star Reading and Star Math, respectively.

**Figure 1. Star Reading and Star Math scores highly correlate with Smarter Balanced assessments**



Legend: ■ Concurrent Star Reading scaled scores ■ Concurrent Star Math scaled scores
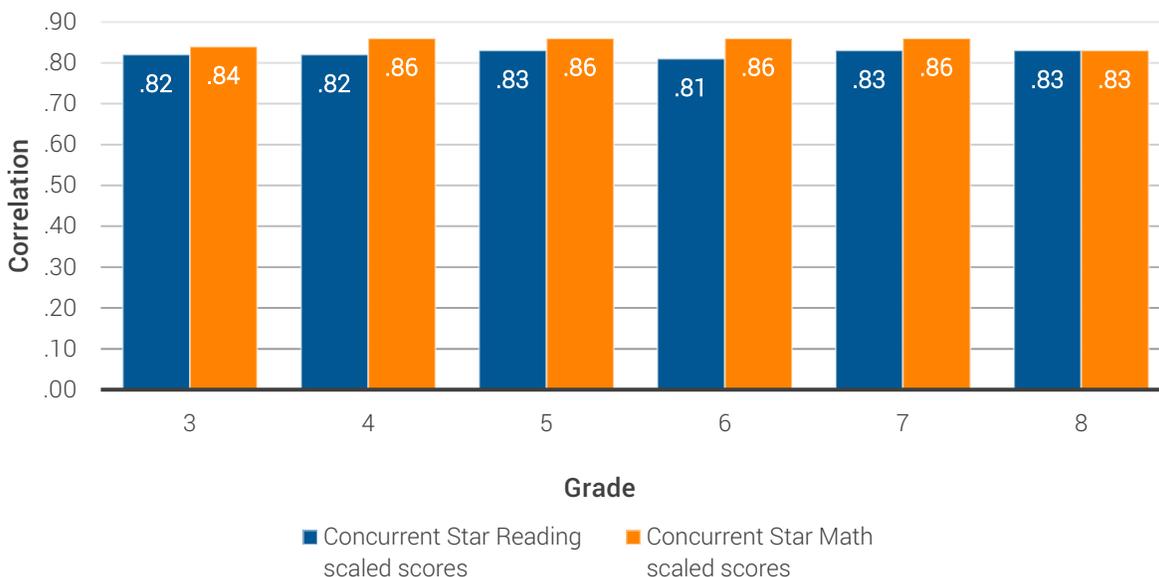
## Scale linkage

Renaissance then linked the score scales for the Star Reading/Star Math and the Smarter Balanced assessments in English language arts/literacy and mathematics by applying equipercentile 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 Smarter Balanced testing mid-date), and the result was a table of Smarter Balanced 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 Smarter Balanced 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 Smarter Balanced 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 Smarter Balanced scale.

## Smarter Balanced cut scores and corresponding Star score equivalents

Smarter Balanced results are reported in scaled scores that describe each student's location on an achievement continuum ranging from 2114 to 2769 for ELA/literacy and 2189 to 2802 for mathematics and using four achievement levels: *Level 1, Level 2, Level 3, and Level 4.*

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

**Table 1. Star Reading and Star Math Unified score equivalents for each Smarter Balanced achievement level range**

| Star Reading Unified cut-score equivalents | | | | |
|---|---|---|---|---|
| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
| 3 | < 943 | 943 − 992 | 993 − 1032 | ≥ 1033 |
| 4 | < 985 | 985 − 1021 | 1022 − 1060 | ≥ 1061 |
| 5 | < 1006 | 1006 − 1043 | 1044 − 1096 | ≥ 1097 |
| 6 | < 1012 | 1012 − 1067 | 1068 − 1129 | ≥ 1130 |
| 7 | < 1037 | 1037 − 1081 | 1082 − 1148 | ≥ 1149 |
| 8 | < 1041 | 1041 − 1097 | 1098 − 1165 | ≥ 1166 |
| Star Math Unified cut-score equivalents | | | | |
| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
| 3 | < 943 | 943 − 987 | 988 − 1028 | ≥ 1029 |
| 4 | < 977 | 977 − 1034 | 1035 − 1080 | ≥ 1081 |
| 5 | < 1033 | 1033 − 1087 | 1088 − 1114 | ≥ 1115 |
| 6 | < 1048 | 1048 − 1102 | 1103 − 1135 | ≥ 1136 |
| 7 | < 1065 | 1065 − 1117 | 1118 − 1151 | ≥ 1152 |
| 8 | < 1089 | 1089 − 1130 | 1131 − 1154 | ≥ 1155 |

# 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) Smarter Balanced 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 Smarter Balanced scores

To summarize the predictive power of Star Reading and Star Math, we calculated raw correlations between observed (actual) Smarter Balanced 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. 5), indicating that earlier Star scores have a strong relationship with end-of-year Smarter Balanced scores. For reading, the correlations averaged .84 and for math, the associations were also high, averaging .87.

> **Star scores have a strong relationship with end-of-year Smarter Balanced scores.**

**Figure 2. Projected scores from Star Reading and Star Math highly correlate with Smarter Balanced scores**
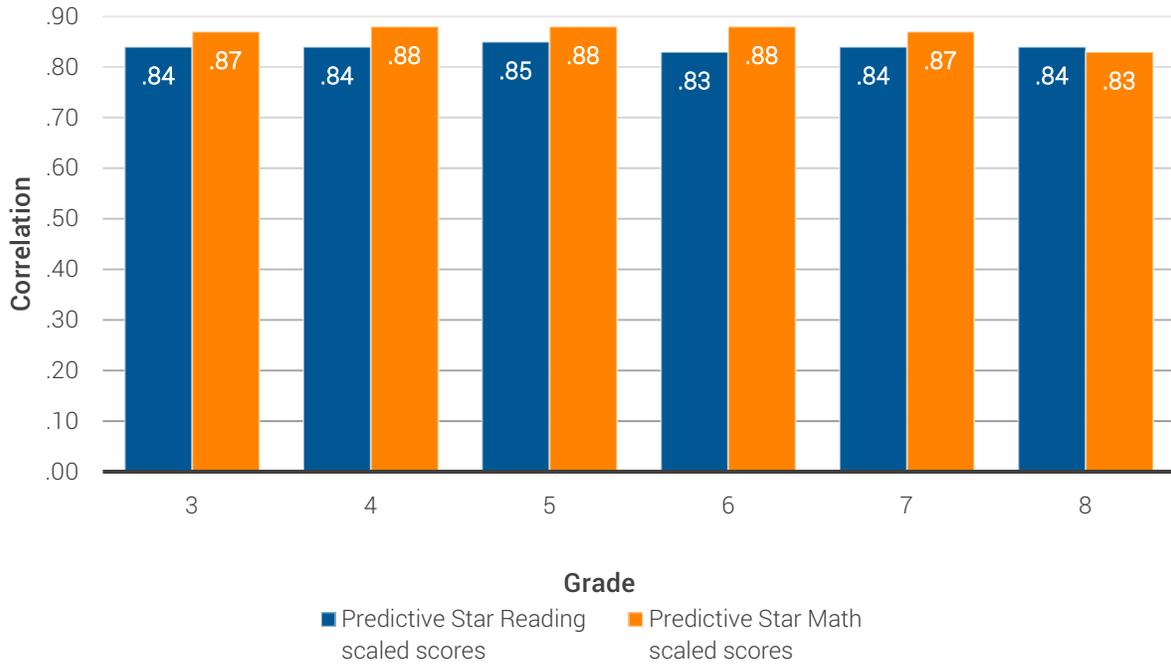


## Star scores discriminate well between students who score proficient or not

Using the sample of actual Smarter Balanced scores, we were able to compare how our projected Star scores aligned with the observed Smarter Balanced scores. Table 2 displays classification diagnostics about whether students were correctly or incorrectly classified as proficient or not on the Smarter Balanced assessments using projected Star scores. On average, students were correctly classified (i.e., overall classification accuracy) 84% of the time for reading and 87% of the time for math.

For Area Under the ROC Curve (AUC), a summary measure of diagnostic accuracy, Star Reading and Star Math averaged .92 and .94, 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**
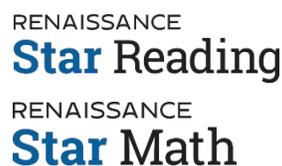
| Star Reading | | | | | | |
|---|---|---|---|---|---|---|
| **Measure** | **Grade** | | | | | |
| | **3** | **4** | **5** | **6** | **7** | **8** |
| Overall classification accuracy (percentage of correct classifications) | 85% | 84% | 85% | 83% | 84% | 84% |
| Area Under the ROC Curve | 0.93 | 0.93 | 0.93 | 0.91 | 0.92 | 0.92 |
| **Star Math** | | | | | | |
| **Measure** | **Grade** | | | | | |
| | **3** | **4** | **5** | **6** | **7** | **8** |
| Overall classification accuracy (percentage of correct classifications) | 86% | 86% | 88% | 86% | 88% | 86% |
| Area Under the ROC Curve | 0.94 | 0.94 | 0.95 | 0.94 | 0.95 | 0.93 |

Other diagnostic accuracy measures studied:

✓ **Sensitivity** represents the percentage of proficient students that were correctly forecasted, which for Star Reading averaged 86% and for Star Math averaged 84%.

✓ **Specificity** represents the percentage of not-proficient students that were correctly forecasted, which for Star Reading averaged 82% and for Star Math averaged 88%.

✓ **Positive predictive values** indicate that when Star scores forecasted students to be proficient, they actually were proficient 84% of the time for Star Reading and 84% of the time for Star Math.

✓ **Negative predictive values** indicate that when Star scores forecasted students to miss proficiency, they actually weren't proficient 85% of the time for reading and 88% 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 1% 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.

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**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: Smarter Balanced achievement levels

**Table B1. Smarter Balanced achievement level score ranges**

| Smarter Balanced achievement level score ranges: English language arts/literacy | | | | |
|---|---|---|---|---|
| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
| 3 | 2114 − 2366 | 2367 − 2431 | 2432 − 2489 | 2490 − 2623 |
| 4 | 2131 − 2415 | 2416 − 2472 | 2473 − 2532 | 2533 − 2663 |
| 5 | 2201 − 2441 | 2442 − 2501 | 2502 − 2581 | 2582 − 2701 |
| 6 | 2210 − 2456 | 2457 − 2530 | 2531 − 2617 | 2618 − 2724 |
| 7 | 2258 − 2478 | 2479 − 2551 | 2552 − 2648 | 2649 − 2745 |
| 8 | 2288 − 2486 | 2487 − 2566 | 2567 − 2667 | 2668 − 2769 |
| Smarter Balanced achievement level score ranges: Mathematics | | | | |
| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
| 3 | 2189 − 2380 | 2381 − 2435 | 2436 − 2500 | 2501 − 2621 |
| 4 | 2204 − 2410 | 2411 − 2484 | 2485 − 2548 | 2549 − 2659 |
| 5 | 2219 − 2454 | 2455 − 2527 | 2528 − 2578 | 2579 − 2700 |
| 6 | 2235 − 2472 | 2473 − 2551 | 2552 − 2609 | 2610 − 2748 |
| 7 | 2250 − 2483 | 2484 − 2566 | 2567 − 2634 | 2635 − 2778 |
| 8 | 2265 − 2503 | 2504 − 2585 | 2586 − 2652 | 2653 − 2802 |

# Appendix C: Star Reading and Star Math Enterprise score equivalents

Since the 2017–2018 school year, Renaissance has offered educators the additional option of reporting student Star scores on an alternative scale referred to as the Unified scale. Table C1 below includes the Enterprise scaled scores for Star Reading and Star Math that correspond to achievement levels on the Smarter Balanced assessments for English language arts and Mathematics. Table 1 contains the Unified scaled scores for Star Reading and Star Math that correspond to achievement levels on the Smarter Balanced assessments for English language arts and Mathematics.

**Table C1. Star Reading and Star Math Enterprise score equivalents for each Smarter Balanced achievement level range**

| Star Reading Enterprise cut-score equivalents | | | | |
|---|---|---|---|---|
| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
| 3 | 0 − 332 | 333 − 454 | 455 − 561 | 562 − 1400 |
| 4 | 0 − 434 | 435 − 530 | 531 − 660 | 661 − 1400 |
| 5 | 0 − 483 | 484 − 599 | 600 − 852 | 853 − 1400 |
| 6 | 0 − 499 | 500 − 691 | 692 − 1015 | 1016 − 1400 |
| 7 | 0 − 576 | 577 − 772 | 773 − 1168 | 1169 − 1400 |
| 8 | 0 − 589 | 590 − 857 | 858 − 1249 | 1250 − 1400 |
| Star Math Enterprise cut-score equivalents | | | | |
| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
| 3 | 0 − 546 | 547 − 620 | 621 − 686 | 687 − 1400 |
| 4 | 0 − 602 | 603 − 695 | 696 − 771 | 772 − 1400 |
| 5 | 0 − 692 | 693 − 781 | 782 − 826 | 827 − 1400 |
| 6 | 0 − 716 | 717 − 807 | 808 − 859 | 860 − 1400 |
| 7 | 0 − 745 | 746 − 830 | 831 − 885 | 886 − 1400 |
| 8 | 0 − 783 | 784 − 851 | 852 − 891 | 892 − 1400 |

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