RENAISSANCE®

TECHNICAL PAPER | 2020–2021 School Year

# Pathway to Proficiency: Linking the Star Reading® and Star Math® Scales with Performance Levels on the Kansas Assessments

## Quick reference guide to Renaissance Star Reading® and Renaissance Star Math®

RENAISSANCE
Star Reading®

Renaissance Star Reading® serves multiple purposes including screening, progress monitoring, instructional planning, forecasting proficiency, standards mastery, and measuring growth. It is a highly reliable, valid, and efficient standards-based, computer-adaptive assessment designed to measure student performance in key reading skills, providing valuable information regarding the acquisition of reading ability along the continuum of literary expectations. A Star Reading assessment can be completed in about 20 minutes.

RENAISSANCE
Star Math®

Renaissance Star Math® serves multiple purposes including screening, progress monitoring, instructional planning, forecasting proficiency, standards mastery, and measuring growth. It is a highly reliable, valid, and efficient standards-based, computer-adaptive assessment designed to measure student performance in key math skills, providing valuable information regarding the acquisition of math ability along the continuum of math expectations. A Star Math assessment can be completed in about 20 minutes.

National Center on
INTENSIVE INTERVENTION
at American Institutes for Research

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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## Introduction

Educators face many challenges; chief among them is making decisions regarding how to allocate limited resources to best serve diverse student needs. A good assessment system supports teachers by providing timely, relevant information that can help address key questions about which students are on track to meet important performance standards and which students may need additional help. Different educational assessments serve different purposes, but those that can identify students early in the school year as being at-risk to miss academic standards can be especially useful because they can help inform instructional decisions that can improve student performance and reduce gaps in achievement. Assessments that can do that while taking little time away from instruction are particularly valuable.

Indicating which students are on track to meet later expectations is one of the potential capabilities of a category of educational assessments called "interim" (Perie, Marian, Gong, & Wurtzel, 2007). They are one of three broad categories of assessment:

- Summative – typically annual tests that evaluate the extent to which students have met a set of standards. Most common are state-mandated tests such as the Kansas Assessment tests.

- Formative – short and frequent processes embedded in the instructional program that support learning by providing feedback on student performance and identifying specific things students know and can do as well as gaps in their knowledge.

- Interim – assessments that fall in between formative and summative in terms of their duration and frequency. Some interim tests can serve one or more purposes, including informing instruction, evaluating curriculum and student responsiveness to intervention, and forecasting likely performance on a high-stakes summative test later in the year.

This project focuses on the application of interim test results, notably their power to inform educators about which students are on track to succeed on the year-end summative state test and which students might need additional assistance to reach proficiency. Specifically, the purpose of this project is to explore statistical linkages between Renaissance interim assessments[1] (Star Reading and Star Math) and the Kansas Assessment. If these linkages are sufficiently strong, they may be useful for:

1. The early identification of students at risk of failing to make yearly progress goals in reading and math, which could help teachers decide to adjust instruction for selected students.

2. Forecasting percentages of students at each performance level on the state assessments sufficiently in advance to permit redirection of resources and serve as an early warning system for administrators at the building and district level.

1 For an overview of Star Reading and Star Math and how they work, please see the References section for a link to download *The Research Foundation for STAR Assessments* report. For additional information, full technical manuals are available for each assessment by contacting Renaissance at research@renaissance.com

## Sources of data

Star Reading and Star Math data were gathered from schools that use those assessments on the Renaissance Place hosted platform. Performance-level distributions from the Kansas Assessments for ELA and Mathematics were retrieved from the Kansas Department of Education school building report card website.

The Kansas Assessments use four performance levels: *Level 1, Level 2, Level 3,* and *Level 4.* Students scoring in the *Level 3* or *Level 4* categories would be counted as meeting proficiency standards for state and federal performance-level reporting.

This study uses Star Reading, Star Math, and Kansas Assessment data from the 2014–2015 school year.

**Kansas Assessment Performance Levels:**

Level 1

Level 2

Level 3

Level 4

## Methodology

Many of the ways to link scores between two tests require that the scores from each test be available at a student level. Obtaining a sufficient sample of student-level data can be a lengthy and difficult process. However, there is an alternative technique that produces similar results without requiring us to know each individual student's Kansas Assessment score and Star scaled score. The alternative involves using school-level data to determine the Star scaled scores that correspond to each Kansas Assessment performance level cutscore. School level Kansas Assessment data are publicly available, allowing us to streamline the linking process and complete linking studies more rapidly.

The Star scores used in this analysis were "projected" scaled scores using Star Reading and Star Math decile-based growth norms. The growth norms are both grade- and subject-specific and are based on the growth patterns of more than one million students using Star assessments over a three-year period. They provide typical growth rates for students based on their starting Star test score, making predictions much more accurate than a "one-size-fits-all" growth rate.

For each observed score, the number of weeks between the Star test administration date and the middle of the Kansas Assessment window was calculated. Then, the number of weeks between the two dates was multiplied by the student's expected weekly scaled score growth (from our decile-based growth norms, which take into account grade and starting observed score). Expected growth was added to the observed scaled score to determine each student's projected Star score. For students with multiple Star tests within a school year, the average of their projected scores was used.

This method used to link our Star scale to the Kansas Assessment proficiency levels is equivalent groups equipercentile equating. This method looks at the distribution of Kansas Assessment performance levels in the sample and compares that to the distribution of projected Star scores for the sample; the Star scaled score that cuts off the same percentage of students as each Kansas Assessment performance level is taken to be the cutscore for each respective proficiency level.

For several different states, we compared the results from the equivalent groups equipercentile equating to results from student-level data and found the accuracy of the two methods to be nearly identical (Renaissance Learning, 2016a, 2016b). McLaughlin and Bandeira de Mello (2002) employed a similar method in their comparison of NAEP scores and state assessment results, and this method has been used multiple times since 2002 (Bandeira de Mello, Blankenship, & McLaughlin, 2009; McLaughlin & Bandeira de Mello, 2003; McLaughlin & Bandeira de Mello, 2005; McLaughlin, Bandeira de Mello, Blankenship, Chaney, Esra, Hikawa, Rojas, William, & Wolman, 2008). Additionally,

Cronin, Kingsbury, Dahlin, Adkins, and Bowe (2007) found this method could determine performance level cutscore estimates very similar to the cutscores generated by statistical methods requiring student-level data.

## Sample selection

To find a sample of students who were assessed by both the Kansas Assessment and Star, we began by gathering all hosted Star Reading and Star Math test records for Kansas for the years 2014–2015. 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 Kansas Assessment data. To do this, performance level distribution data from the Kansas Assessment was obtained from the Kansas Department of Education school building report card website. The file included the number of students tested in each grade and the percentage of students in each performance level. Star Reading and Star Math data were matched to the Kansas Assessment ELA and Mathematics data by district and school name.

Once we determined how many students in each grade at a school were tested on the Kansas Assessment for ELA and took a Star Reading assessment, we calculated the percentage of enrolled 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 Kansas Assessment had taken a Star assessment, that grade was included in the sample. The process was conducted separately for the Reading and Math assessments. This method of sample selection ensured that our sample consisted of schools in which all or nearly all of the enrolled students who took the Kansas Assessment also took Star 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.

Through the Kansas Department of Education website, demographic information was available for the schools in our sample; we aggregated this data to the grade level to create Table 1 on the following page and Table 3 on page 7.

### Sample description: Reading

A total of 227 unique schools across grades 3 through 8 met the sample requirements (explained previously in *Sample selection*). Racial/ethnic characteristics for each grade of the sample are presented along with statewide averages in Table 1. For each grade, percentages for each subgroup in the sample were calculated by summing counts of students in each subgroup and dividing by the total number of students for which subgroup data were reported. Due to masking to protect student privacy, data for subgroups with fewer than 10 students were not available on the Kansas Department of Education website. As a result, the demographics information for some racial/ethnic subgroups is likely an underestimation of the actual representation of that group in the sample. Consistent with this idea, Asian and Pacific Islander, Hispanic, Black, and students of multiple races appeared to be under-represented in the reading sample and White students appeared to be over-represented in the reading sample.

Table 2 displays by-grade test summaries for the reading sample. It includes counts of students taking Star Reading and the Kansas Assessment for ELA. It also includes percentages of students in each performance level, both for the sample and statewide.

Table 1. Characteristics of reading sample: Racial/ethnic statistics

| Grade | Number of Schools | Percent of Students by Racial/Ethnic Category | | | | | |
|---|---|---|---|---|---|---|---|
| | | Native American | Asian | Black | Hispanic | White | Multiple Races |
| 3 | 95 | 0.0% | 0.4% | 0.9% | 4.3% | 94.1% | 0.3% |
| 4 | 99 | 0.0% | 0.3% | 0.3% | 7.9% | 91.2% | 0.3% |
| 5 | 93 | 0.4% | 0.0% | 0.6% | 5.6% | 92.8% | 0.6% |
| 6 | 75 | 0.7% | 0.8% | 0.5% | 9.2% | 86.8% | 2.0% |
| 7 | 50 | 0.9% | 0.4% | 0.8% | 9.7% | 85.6% | 2.6% |
| 8 | 52 | 0.0% | 0.0% | 1.6% | 12.0% | 85.0% | 1.4% |
| Statewide | | 0.9% | 2.8% | 7.0% | 18.7% | 65.6% | 5.0% |

Table 2. Characteristics of reading sample: Performance on Star Reading® and Kansas Assessment ELA

| Grade | Star Reading® Students | Kansas Assessment ELA Students | Level 1 | | Level 2 | | Level 3 | | Level 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample | State | Sample | State | Sample | State | Sample | State |
| 3 | 4,107 | 4,037 | 13% | 20% | 32% | 33% | 41% | 34% | 14% | 13% |
| 4 | 4,092 | 4,009 | 6% | 11% | 31% | 34% | 50% | 44% | 13% | 11% |
| 5 | 4,372 | 4,306 | 14% | 19% | 32% | 33% | 38% | 34% | 16% | 14% |
| 6 | 4,769 | 4,659 | 21% | 28% | 33% | 33% | 42% | 36% | 4% | 3% |
| 7 | 3,493 | 3,413 | 20% | 26% | 35% | 35% | 41% | 36% | 4% | 3% |
| 8 | 3,317 | 3,255 | 16% | 21% | 51% | 50% | 31% | 27% | 2% | 2% |

### Sample description: Math

Kansas Assessment Mathematics grade counts were matched to counts of students who took Star Math the same year. A total of 110 unique schools across grades 3 through 8 met the sample requirements for math (explained in *Sample selection*). Racial/ethnic characteristics for each of the math samples were calculated in the same manner as for reading and are presented along with statewide averages in Table 3. Consistent with the masking issue noted in the description of the reading sample, Asian and Pacific Islander, Hispanic, Black, and students of multiple races appeared to be under-represented in the math sample and White students appeared to be over-represented in the math sample.

Table 4 displays by-grade test summaries for the math sample. It includes counts of students taking Star Math and a Kansas Assessment Mathematics test. It also includes percentages of students in each performance level, both for the sample and statewide.

Table 3. Characteristics of math sample: Racial/ethnic statistics

| Grade | Number of Schools | Percent of Students by Racial/Ethnic Category | | | | | |
|---|---|---|---|---|---|---|---|
| | | Native American | Asian | Black | Hispanic | White | Multiple Races |
| 3 | 41 | 0.0% | 0.7% | 0.0% | 3.4% | 95.9% | 0.0% |
| 4 | 41 | 0.0% | 0.5% | 0.5% | 6.5% | 90.9% | 1.6% |
| 5 | 43 | 0.8% | 0.0% | 1.1% | 5.6% | 91.4% | 1.1% |
| 6 | 34 | 1.5% | 0.9% | 0.5% | 6.9% | 89.0% | 1.2% |
| 7 | 31 | 0.7% | 0.9% | 0.0% | 3.9% | 92.4% | 2.1% |
| 8 | 27 | 0.0% | 0.0% | 1.0% | 7.3% | 89.3% | 2.4% |
| Statewide | | 1.0% | 2.9% | 7.0% | 18.7% | 65.4% | 5.0% |

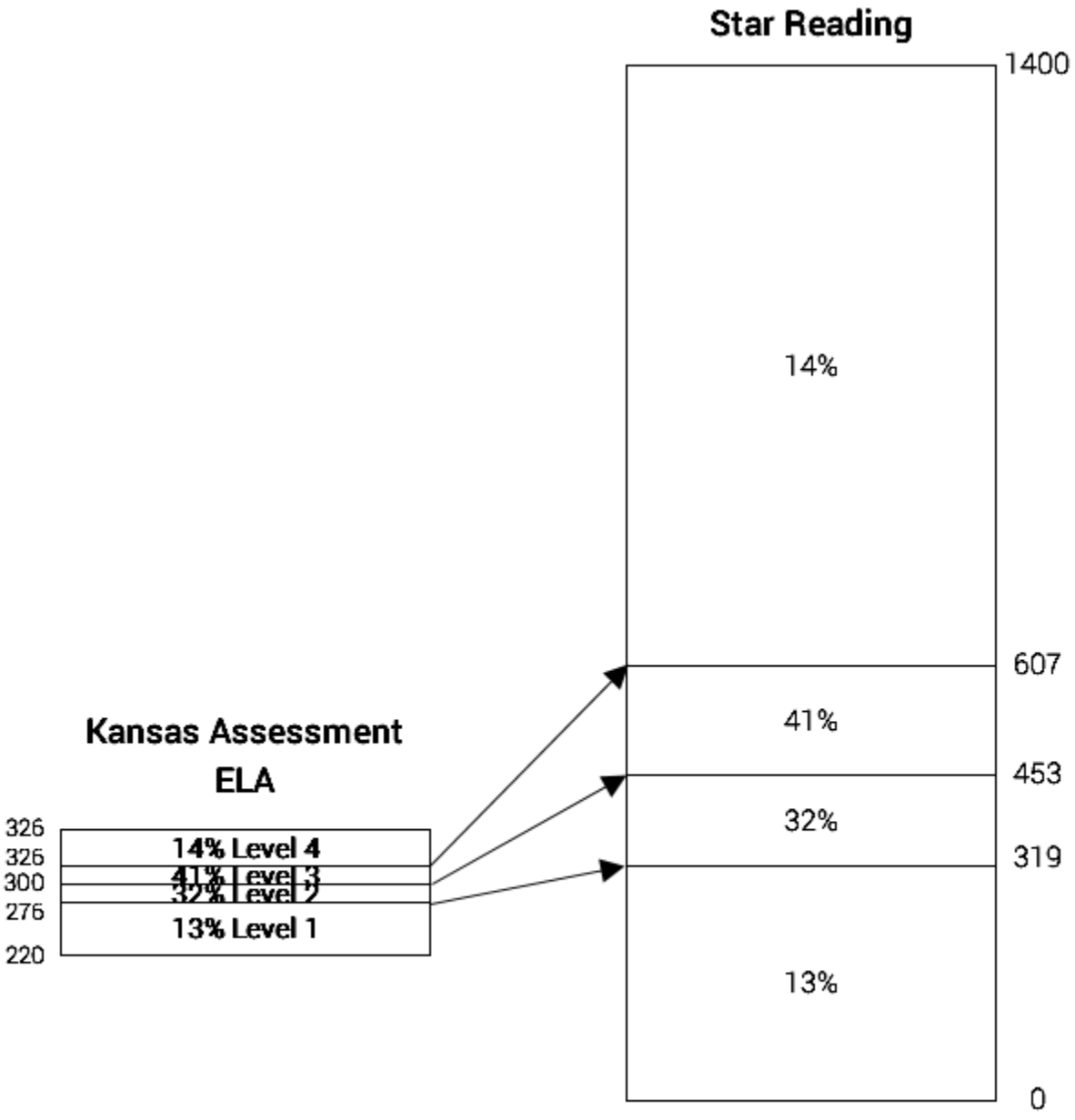
Table 4. Characteristics of math sample: Performance on Star Math® and Kansas Assessment for mathematics

| Grade | Star Math® Students | Kansas Assessment Math Students | Level 1 | | Level 2 | | Level 3 | | Level 4 | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Sample | State | Sample | State | Sample | State | Sample | State |
| 3 | 1,904 | 1,871 | 9% | 13% | 33% | 36% | 40% | 36% | 18% | 15% |
| 4 | 2,166 | 2,117 | 9% | 14% | 45% | 51% | 33% | 27% | 13% | 8% |
| 5 | 2,307 | 2,275 | 17% | 24% | 44% | 43% | 27% | 23% | 12% | 10% |
| 6 | 2,276 | 2,230 | 13% | 22% | 44% | 46% | 31% | 24% | 12% | 8% |
| 7 | 1,675 | 1,641 | 7% | 16% | 53% | 56% | 35% | 25% | 5% | 3% |
| 8 | 1,327 | 1,316 | 30% | 37% | 44% | 40% | 22% | 19% | 4% | 4% |

## Analysis

First, we aggregated the sample of schools for each subject to grade level. Next, we calculated the percentage of students scoring in each Kansas Assessment performance level for each grade. Finally, we ordered Star scores and analyzed the distribution to determine the scaled score at the same percentile as the Kansas Assessment proficiency level. For example, in our third-grade reading sample, 13% of students were at *Level 1*, 32% at *Level 2*, 41% at *Level 3*, and 14% at *Level 4*. Therefore, the cutscores for achievement levels in the third grade are at the 13th percentile for *Level 2*, the 45th percentile for *Level 3*, and the 86th percentile for *Level 4*.

Figure 1. Illustration of linked Star Reading® and the third-grade Kansas Assessment ELA scale




## Results and reporting

Table 5 presents estimates of equivalent scores on Star Reading and Kansas Assessment for ELA. Table 6 presents estimates of equivalent scores on Star Math and Kansas Assessment for mathematics. These results will be incorporated into Star Performance Reports that can be used to help educators determine early and periodically which students are on track to reach *Level 3* or *Level 4* in order to make instructional decisions accordingly.

Table 5. Estimated Star Reading® cut scores for Kansas Assessment ELA performance levels

| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|
| 3 | < 319 | 319 | 453 | 607 |
| 4 | < 327 | 327 | 509 | 769 |
| 5 | < 470 | 470 | 631 | 870 |
| 6 | < 578 | 578 | 785 | 1200 |
| 7 | < 615 | 615 | 873 | 1291 |
| 8 | < 653 | 653 | 1051 | 1336 |

Table 6. Estimated Star Math® cut scores for Kansas Assessment mathematics performance levels

| Grade | Level 1 | Level 2 | Level 3 | Level 4 |
|---|---|---|---|---|
| 3 | < 536 | 536 | 623 | 685 |
| 4 | < 594 | 594 | 719 | 782 |
| 5 | < 684 | 684 | 786 | 838 |
| 6 | < 707 | 707 | 814 | 870 |
| 7 | < 708 | 708 | 846 | 921 |
| 8 | < 809 | 809 | 889 | 945 |

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Thomas P. Hogan, Ph.D., is a professor of psychology and a Distinguished University Fellow at the University of Scranton. He has more than 40 years of experience conducting reviews of mathematics curricular content, principally in connection with the preparation of a wide variety of educational tests, including the Stanford Diagnostic Mathematics Test, Stanford Modern Mathematics Test, and the Metropolitan Achievement Test. Hogan has published articles in the *Journal for Research in Mathematics Education* and *Mathematical Thinking and Learning*, and he has authored two textbooks and more than 100 scholarly publications in the areas of measurement and evaluation. He has also served as consultant to a wide variety of school systems, states, and other organizations on matters of educational assessment, program evaluation, and research design.

James R. McBride, Ph.D., is vice president and chief psychometrician for Renaissance. He was a leader of the pioneering work related to computerized adaptive testing (CAT) conducted by the Department of Defense. McBride has been instrumental in the practical application of item response theory (IRT) and since 1976 has conducted test development and personnel research for a variety of organizations. At Renaissance, he has contributed to the psychometric research and development of Star Math, Star Reading, and Star Early Literacy. McBride is co-editor of a leading book on the development of CAT and has authored numerous journal articles, professional papers, book chapters, and technical reports.

Michael Milone, Ph.D., is a research psychologist and award-winning educational writer and consultant to publishers and school districts. He earned a Ph.D. in 1978 from The Ohio State University and has served in an adjunct capacity at Ohio State, the University of Arizona, Gallaudet University, and New Mexico State University. He has taught in regular and special education programs at all levels, holds a Master of Arts degree from Gallaudet University, and is fluent in American Sign Language. Milone served on the board of directors of the Association of Educational Publishers and was a member of the Literacy Assessment Committee and a past chair of the Technology and Literacy Committee of the International Reading Association. He has contributed to both readingonline.org and *Technology & Learning* magazine on a regular basis. Over the past 30 years, he has been involved in a broad range of publishing projects, including the SRA reading series, assessments developed for Academic Therapy Publications, and software published by The Learning Company and LeapFrog. He has completed 34 marathons and 2 Ironman races.