RENAISSANCE®

Star Assessments™ for Spanish–Math Technical Documentation

RENAISSANCE Star Spanish®

RENAISSANCE Star Math®

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Introduction

Star Math Spanish: Screening and Progress-Monitoring Assessment

The current version of Star Math Spanish was published in the 2018–2019 school year to assess the mathematical abilities of students in grades K–12. At present, items have been calibrated for grades K–8 with plans underway to add content up to grade 12. However, students in all grades K–12 can test using Star Math Spanish. Star Math Spanish is a 34-item standards-based adaptive assessment, aligned to state and national curriculum standards, that takes an average of less than 23 minutes. It provides immediate feedback to teachers and administrators on each student's mathematical ability.

Star Math Spanish Purpose

As a periodic progress-monitoring assessment, Star Math Spanish progress monitoring serves three purposes. First, it provides educators with quick and accurate estimates of students' instructional math levels. Second, it assesses math levels relative to norms based on nationwide user data. Star Math Spanish is currently normed for grades 1–8. Third, it provides the means for tracking growth in a consistent manner longitudinally for all students. This is especially helpful to school- and district-level administrators.

While the Star Math Spanish test provides accurate normed data like traditional norm-referenced tests, it is not intended to be used as a "high-stakes" test. Generally, states are required to use high-stakes assessments to document growth, adequate yearly progress, and mastery of state standards. These high-stakes tests are also used to report end-of-period performance to parents and administrators or to determine eligibility for promotion or placement. Star Math Spanish is not intended for these purposes. Rather, when a high correlation between the Star Math Spanish test and high-stakes instruments exists, classroom teachers can use Star Math Spanish scores to fine-tune instruction while there is still time to improve performance before the regular test cycle. Furthermore, Star Math Spanish results can easily be disaggregated to identify and address the needs of various groups of students.

The Star Math Spanish test's repeatability and flexible administration provide specific advantages for everyone responsible for the education process:

- For students, Star Math Spanish software provides a challenging, interactive, and brief test that builds confidence in their math ability.
- For teachers, the Star Math Spanish test facilitates individualized instruction by identifying children who need remediation or enrichment most.
- For principals, the Star Math Spanish software provides regular, accurate reports on performance at the class, grade, and building level.
- For district administrators and assessment specialists, it provides a wealth of reliable and timely data on math growth at each school and districtwide. It also provides a valid basis for comparing data across schools, grades, and special student populations.

This technical document demonstrates the suitability of Star Math Spanish computer-adaptive testing for these purposes and documents quantitatively how well this innovative instrument in math assessment performs.

Design of Star Math Spanish

One Generation of Star Math Spanish Assessment

The introduction of the current version of Star Math Spanish in 2016 marked the first generation of Star Math Spanish assessment. An updated version of this generation was published in 2018.

Star Math Spanish is designed as a standards-based test. The content organization reflects current thinking, as embodied in many different sets of national and local curriculum standards. The following four domains were identified and included in Star Math Spanish: Numbers and Operations; Algebra; Geometry & Measurement; and Data Analysis, Statistics & Probability. Within each of these domains, skills are organized into skill sets; there are 54 blueprint skill sets in all, comprising a total of over 790 blueprint skills.

The Star Math Spanish test is a 34-item standards-based version, administered as 6 blocks of items in a single section. Each block of items contains a blend of items from the 4 domains. The number of items administered in a block varies by grade band. The item sequencing calls for more content balance at the beginning, middle, and end of the test by "spiraling" the content throughout the test, thus ensuring that the math ability estimate at any point during a test is based on a broad range of content, rather than on a limited sample of skills. The item bank contains

over 2,100 items tagged at grades K to 8 and measuring a single construct: mathematical achievement.

Overarching Design Considerations

One of the fundamental Star Math Spanish design decisions involved the choice of how to administer the test. The primary advantage of using computer software to administer Star Math Spanish tests is the ability to tailor each student's test based on his or her responses to previous items. Conventional assessments, including paper-and-pencil tests, typically entail fixed test forms: every student must respond to the same items in the same sequence. Using computer-adaptive procedures, it is possible for students to test on items that appropriately match their current level of proficiency. The item selection procedures, termed Adaptive Branching, effectively customize the test for each student's achievement level.

Adaptive Branching offers significant advantages in terms of test reliability, testing time, and student motivation. Reliability improves over fixed-form tests because the test difficulty is adjusted to each individual's performance level; students do not have to fit a "one test fits all" model. Most of the test items that students respond to are at levels of difficulty that closely match their achievement level. Testing time decreases because, unlike in paper-and-pencil tests, there is no need to expose every student to a broad range of material, portions of which are inappropriate because they are either too easy for high achievers or too difficult for those with low current levels of performance. Finally, student motivation improves simply because of these issues—test time is minimized and test content is neither too difficult nor too easy.

Another fundamental Star Math Spanish design decision involved the choice of the content and format of items for the test. Many types of stimulus and response procedures were explored, researched, discussed, and prototyped using the Star Math English items. The traditional multiple-choice format was chosen. This decision was made for interrelated reasons of efficiency, breadth of construct coverage, and objectivity and simplicity of scoring.

In Star Math Spanish, all management and test administration functions are controlled using a management system which is accessed by means of a computer with web access. This makes a number of features possible:

- It makes it possible for multiple schools to share a central database, such as a district-level database. Records of students transferring between schools within the district will be maintained in the database; the only Test Interface information that needs revision following a transfer is the student's updated school and class assignments.

- The same database that contains Star Math Spanish data can contain data on other Star tests, including Star Early Literacy and Star Reading in both English and Spanish. The Renaissance program is a powerful information management program that allows you to manage all your district, school, personnel, and student data in one place. Changes made to district, school, teacher, and student data for any of these products, as well as other Renaissance software, are reflected in every other Renaissance program sharing the central database.
- Multiple levels of access are available, from the test administrator within a school or classroom to teachers, principals, and district administrators.
- Renaissance takes reporting to a new level. Not only can you generate reports from the student level all the way up to the school level, but you can also limit reports to specific groups, subgroups, and combinations of subgroups. This supports "disaggregated" reporting; for example, a report might be specific to students eligible for free or reduced lunch, to English language learners, or to students who fit both categories. It also supports compiling reports by teacher, class, school, grade within a school, and many other criteria such as a specific date range. In addition, the Renaissance consolidated reports allow you to gather data from more than one program (such as Star Math Spanish and Accelerated Math) at the teacher, class, school, and district level and display the information in one report.
- Since the Renaissance software is accessed through a web browser, teachers (and administrators) will be able to access the program from home.

Test Interface

The Star Math Spanish test interface was designed to be both simple and effective. Students can use either the mouse or the keyboard to answer questions.

- If using the keyboard, students press one of the four letter keys (**A**, **B**, **C**, or **D**) and then press the **Enter** key (or the **return** key on Macintosh computers).
- If using the mouse, students click the answer choice and then click **Siguiente** to enter the answer.
- On a tablet, students tap their answer choice; then, they tap **Siguiente**.

Practice Session

Star Math Spanish software includes a provision for a brief practice test preceding the test itself. The practice session allows students to get comfortable with the test interface and to make sure that they know how to operate it properly. As soon as a student has answered two out of three practice questions correctly, the program takes the student into the actual test. If the student has not successfully answered two of the three items by the end of the practice session, Star Math Spanish will present three more questions, and the student can pass the practice session by answering two of those questions correctly. If the student does not pass after the second attempt, the student will not proceed to the actual Star Math Spanish test. Even students with low math and Spanish reading skills should be able to answer the practice questions correctly. However, Star Math Spanish will halt the testing session and tell the student to ask the teacher for help if the student does not pass the practice session after the second attempt.

Students may experience difficulty with the practice questions for a variety of reasons. The student may not understand math even at the most basic level or may be confused by the "no está" [not given] response option presented in some of the practice questions. Alternatively, the student may need help using the keyboard or mouse. If this is the case, the teacher (or monitor) should help the student through the practice session during the student's next Star Math Spanish test. If a student still struggles with the practice questions with teacher assistance, he or she may not yet be ready to complete a Star Math Spanish test. Once a student has successfully passed a practice session, the student will not be presented with practice items again on a test of the same type taken within the next 180 days.

Adaptive Branching/Test Length

Star Math Spanish's branching control uses a proprietary approach somewhat more complex than the simple Rasch maximum information IRT model. The Star Math Spanish approach was designed to yield reliable test results for both the criterion-referenced and norm-referenced scores by adjusting item difficulty to the responses of the individual being tested while striving to minimize test length and student frustration.

In order to minimize student frustration, the first administration of the Star Math Spanish test begins with items that have a difficulty level that is below what a typical student at a given grade can handle—usually one or two grades below grade placement. On the average, about 85 percent of students will be

able to answer the first item correctly. Teachers can override the use of grade placement for determining starting difficulty by entering the current level of mathematics instruction for the student using the MIL (Math Instructional Level). When an MIL is provided, the program uses that value to raise or lower the starting difficulty of the first test. On the second and subsequent administrations, the test begins about one grade lower than the ability last demonstrated within 180 days. Students generally have an 85 percent chance of answering the first item correctly on second and subsequent tests.

Test Length

Once the testing session is underway, the Star Math Spanish test administers 34 items of varying difficulty based on the student's responses; this is sufficient information to obtain a reliable Scaled Score and to determine the student's math level.

The length of time needed to complete a Star Math Spanish test varies across students. Table 1 provides an overview of the testing time by grade for the students who took Star Math Spanish during the 2017–2018 school year. The results of the analysis of test completion time indicate that half or more of students completed the test in less than 23 minutes, depending on grade; 95% of students finished their Star Math Spanish test in less than 39 minutes.

Table 1: Average and Percentiles of Total Time to Complete Star Math Spanish Assessment during the 2017–2018 School Year

Grade	Sample Size	Time to Complete Test (in Minutes)					
		Mean	Standard Deviation	5th Percentile	50th Percentile	95th Percentile	99th Percentile
1	55,964	13.20	7.33	4.97	11.6	26.35	38.05
2	57,959	15.96	7.90	6.13	14.52	30.43	41.53
3	42,765	20.59	9.52	7.80	19.22	37.73	49.17
4	25,044	21.73	9.37	8.77	20.50	38.67	49.18
5	15,111	21.23	8.81	8.78	20.30	36.97	46.68
6	7,120	21.86	9.11	9.13	20.80	37.98	48.25
7	6,992	22.44	9.21	9.30	21.36	38.33	50.18
8	6,585	22.78	9.01	9.87	22.10	38.18	48.18

Test Repetition

Star Math Spanish score data can be used for multiple purposes such as screening, placement, planning instruction, benchmarking, and outcomes measurement. The frequency with which the assessment is administered depends on the purpose for assessment and how the data will be used. Renaissance recommends assessing students only as frequently as necessary to get the data needed.

Teachers who want to monitor student progress more closely or use the data for instructional planning may use it more frequently. Star Math Spanish may be administered three times a year for progress monitoring purposes.

Star Math Spanish keeps track of the questions presented to each student from test session to test session and will not ask the same question more than once in any 75-day period.

Item Time Limits

The Star Math Spanish tests place no limits on total testing time. However, there are time limits for each test item. The per-item time limits are generous, and ensure that more than 90 percent of students can complete each item within the normal time limits. Each practice question has a 180-second time limit and each test question has a 3-minute time limit.

Standard Time Limits:

- Practice questions: 180 seconds (3 minutes) for each question
- Test questions 180 seconds (3 minutes) for each question

Star Math Spanish also provides the option of extended time limits for selected students who, in the judgment of the test administrator, require more than the standard amount of time to read and answer the test questions. Extended time limits are twice as long as standard time limits.

Extended Time Limits:

- Practice questions: 360 seconds (6 minutes) for each question
- Test questions: 360 seconds (6 minutes) for each question

Extended time may be a valuable accommodation for some students with disabilities. Test users who elect the extended time limit for their students should be aware that Star Math Spanish norms, as well as other technical data such as reliability and validity, are based on test administration using the

standard time limits. When the extended time limit accommodation is elected, students have twice as long as the standard time limits to answer each question.

At all grades, regardless of the extended time limit setting, when a student has only 15 seconds remaining for a given item, a time-out warning appears, indicating that he or she should make a final selection and move on. Items that time out are counted as incorrect responses unless the student has the correct answer selected when the item times out. If the correct answer is selected at that time, the item will be counted as a correct response.

If a student doesn't respond to an item, the item times out and briefly gives the student a message describing what has happened. Then the next item is presented. The student does not have an opportunity to take the item again. If a student doesn't respond to any item, all items are scored as incorrect.

Test Security

Star Math Spanish software includes a number of security features to protect the content of the test and to maintain the confidentiality of the test results.

Split Application Model

When students log into Star Math Spanish, they do not have access to the same functions that teachers, administrators, and other personnel can access. Students are allowed to take the test, but no other features available in Star Math Spanish are available to them; therefore, they have no access to confidential information. When teachers and administrators log in, they can manage student and class information, set preferences, and create informative reports about student test performance.

Individualized Tests

Using Adaptive Branching, every Star Math Spanish test consists of items chosen from a large number of items of similar difficulty based on the student's estimated ability. Because each test is individually assembled based on the student's past and present performance, identical sequences of items are rare. This feature, while motivated chiefly by psychometric considerations, contributes to test security by limiting the impact of item exposure.

Data Encryption

A major defense against unauthorized access to test content and student test scores is data encryption. All of the items and export files are encrypted. Without the appropriate decryption code, it is practically impossible to read the Star Math Spanish data or access or change it with other software.

Access Levels and Capabilities

Each user's level of access to a Renaissance program depends on the primary position assigned to that user. Each primary position is part of a group: these groups have different names depending on the which platform the user's Renaissance site is on.

- For customers on the original platform, the groups are called *user groups,* and there are seven of them (district administrator, district staff, school administrator, school staff, teachers, students, and parents). Each user group is granted a specific set of *capabilities*.
- For customers who have been migrated to the new Renaissance Growth Platform, the groups are called *user permission groups,* and there are six of them (district level administrator, district dashboard owner, district staff, school level administrator, school staff, and teacher). Each user permission group is granted a specific set of *user permissions*.

Each capability or user permission corresponds to one or more tasks that can be performed in the program. The capabilities/user permissions for these groups can be changed, and they can be granted or removed on an individual level.

Renaissance also allows you to restrict students' access to certain computers. This prevents students from taking Star Math Spanish tests from unauthorized computers (such as home computers). For more information, see https://help.renaissance.com/RP/SettingSecurityOptions or https://help2.renaissance.com/setup/22509.

The security of the Star Math Spanish data is also protected by each person's user name (which must be unique) and password. User names and passwords identify users, and the program only allows them access to the data and features that they are allowed based on their primary position and the user permissions that they have been granted. Personnel who log in to Renaissance (teachers, administrators, or staff) must enter a user name and password before they can access the data and create reports. Parents on original sites who are granted access to Renaissance must also log in with a user name and password before they can access information about their

children. Without an appropriate user name and password, personnel and parents cannot use the Star Math Spanish software.

Test Monitoring/Password Entry

Test monitoring is another useful Star Math Spanish security feature. Test monitoring is implemented using the Password Requirement preference, which specifies whether monitors must enter their passwords at the start of a test.

Students are required to enter a user name and password to log in before taking a test. This ensures that students cannot take tests using other students' names.

Final Caveat

While Star Math Spanish software can do much to provide specific measures of test security, the most important line of defense against unauthorized access or misuse of the program is the user's responsibility. Teachers and test monitors need to be careful not to leave the program running unattended and to monitor all testing to prevent students from cheating, copying down questions and answers, or performing "print screens" during a test session. Taking these simple precautionary steps will help maintain Star Math Spanish's security and the quality and validity of its scores.

Test Administration Procedures

In order to ensure consistency and comparability of results to the Star Math Spanish norms, students taking Star Math Spanish tests should follow standard administration procedures. The testing environment should be as free from distractions for the student as possible.

The Test Administration Manual included with the Star Math Spanish product describes the standard test orientation procedures that teachers should follow to prepare their students for the Star Math Spanish test. These instructions are intended for use with students of all ages and were successfully field-tested with students ranging from grades K–12. It is important to use these same instructions with all students before they take the Star Math Spanish test.

Content and Item Development

Content of Star Math Spanish has developed through three stages since it was released in 2016. The first stage involved drawing on the specifications for curriculum content that has been developed and refined for the English-language version of Star Math and reviewing the suitability of those specifications for Spanish-language assessment. In the second stage, previously validated English-language items for grades K–8 were translated into Spanish, put through an internal editorial review, and tested with students to verify psychometric effectiveness. The third stage of development is intended to expand the item bank to include items through grade 12. That stage is still in progress at this writing. The following section describes the content- and item-development specification for Star Math Spanish.

Content Specification: Star Math Spanish

Star Math Spanish is a 34-item standards-based assessment, with a content distribution that changes as grade levels increase between the primary and high school grades. The Star Math Spanish item bank contains 2,100+ items covering 4 domains that are comprised of 759 skills, with plans to cover an additional 31 skills at the high school level. The item bank and the skills that it covers will continue to grow as items are calibrated and as standards and curriculums evolve.

For information regarding the development of Star Math Spanish items, see "Item Development Guidelines: Star Math Spanish" on page 15. Before inclusion in the Star Math Spanish item bank, all Star items are reviewed to ensure they meet the content specifications for Star Math Spanish assessment item development, as well as pass psychometric calibration. Items that do not meet the specifications are revised and recalibrated or discarded. All new item development adheres to the content specifications.

The first stage of Star Math Spanish development was to draw on the research conducted for the English-language version of the product to identify the set of skills to be assessed. Multiple resources were consulted to determine the set of skills most appropriate for assessing the mathematics development of K–12 US students, typical mathematics curricula, and current mathematics standards. The resources include, but are not limited to:

- *Common Core State Standards for Mathematics*
- National Mathematics Advisory Panel, *Foundations for Success: The final report of the National Mathematics Advisory Panel*

- National Council of Teachers of Mathematics (NCTM), *Curriculum Focal Points for Prekindergarten Through Grade 8 Mathematics*
- NCTM, *Principles and Standards for School Mathematics*
- US State standards from all 50 states, updated annually
- Singapore primary and secondary mathematics standards
- *National Assessment of Educational Progress (NAEP)*
- *Trends in International Mathematics and Science Study* (TIMSS)

The development of the skills list included iterative reviews by mathematicians, mathematics educators, assessment experts, and psychometricians specializing in educational assessment. See "Conversion Tables" on page 67 for the Star Math Spanish Skills List.

For the purpose of content development, the skills list has been organized into four domains: Numbers and Operations; Algebra; Geometry and Measurement; and Data Analysis, Statistics, and Probability. To ensure appropriate distribution of items within each individual test, the assessment blueprint uses six content domains by treating Numbers, Operations, Geometry, and Measurement as separate domains.

The second stage of item development included item creation and calibration. Spanish-language items were created by drawing on the existing item bank of validated English-language items. These items were developed according to established specifications for grade-level appropriateness and then reviewed to ensure the items meet the specifications. Grade-level appropriateness was determined by multiple factors including math skill, reading level, cognitive load, sentence structure, sentence length, subject matter, and interest level.

Star Math Spanish items were cloned directly from English items when the item contained no language (for example, asking students to complete an addition problem presented in numbers only), translated when direct translation was sufficient (for example, labels on charts and bar graphs), and reviewed and revised when necessary. The review and revision process involved retaining the mathematical details of the item while revising language components of the item as necessary to maintain coherence and understanding in Spanish. All Spanish-language adaptation was performed by a professional Spanish-language translation vendor and reviewed by Spanish-fluent editors at Renaissance.

In 2016, Star Math Spanish expanded from an assessment of grade K–8 skills to grade K–12 skills. The language components of these items were reviewed and revised as necessary from English-language items, with the

mathematical components adhering to the specifications of the Star Math Spanish skills. A strict development process was maintained to ensure quality item development.

Assessment items, once identified, edited, and reviewed, were field tested and calibrated to estimate their Rasch difficulty parameters and goodness of fit to the model. Field testing and calibration are conducted in a single step. This dynamic calibration method is done by embedding candidate items in appropriate, random positions within the Star assessments to collect the item response data needed for psychometric evaluation and calibration analysis. These candidate items do not affect a student's score.

Following these analyses, each assessment item, along with both traditional and IRT analysis information (including fit plots) and information about the test level, form, and item identifier, were stored in an item statistics database. A panel of content reviewers then examined each item to determine whether the item meets all criteria for use in an operational assessment. More detailed information about the field testing and calibration of Star Math items may be found in the Item and Scale Calibration chapter of this technical document.

Calculator and Formula Reference Sheets

For specific Star Math Spanish skills, a calculator or formula reference sheet is made available to the student alongside of the test item. Depending on the item and the skill addressed, either the calculator, a formula reference sheet specific to the skill, or both may be used. For the purpose of test validity, these tools are provided in the application rather than the student using their own to ensure that they are used only for appropriately identified skills.

Calculator or Formula Reference sheets are available for two general circumstances: 1) the calculation is overly difficult to perform without either a calculator or a reference chart or 2) the ability to perform the calculations is not the focus of the skill, and the calculations are difficult or time-consuming (e.g., word problems, solving equations, or finding the terms of a sequence).

Formula reference sheets are available for upper-grade skills in which the formula and math relations needed are not expected for student memorization. This decision is based on analysis of the ACT, SAT, ADP, and formula reference sheets used on state end-of-year tests.

An analysis of state assessments produced the following guidelines in determining when a calculator should be made available for Star Math Spanish:

Table 2: Determination of Calculator Availability in Star Math Spanish

Calculation	Upper Limits of Not Using a Calculator[a]
Division (1–2 step problems)	Divisors may be 1-digit, multiples of 25, fractions with 1-digit denominators, or related to basic math facts (1440/120). Other 2-digit divisors may be included if the division is carried out to only 2 or 3 places.
Multiplication (1–2 step problems)	3-digit by 2-digit, 1-digit by 4-digit (non-zero digits).
Multi-step problems (3+ steps)	2-digit by 2-digit multiplication, 1-digit divisors, other limits listed below.
Powers	2-digit numbers squared, 1-digit numbers raised to the 4th power, 2 or 3 raised to a higher power.
Square roots	Perfect squares related to square of the numbers 1–13 (e.g., square root of 144).
Nth roots	Cube roots resulting in one-digit numbers, nth roots resulting in 2 or 3.
Mean (average)	Up to 6 one- or two-digit numbers or 4 multi-digit numbers.

a. When calculation is not the focus of the skill.

Read-Aloud Guidance

For students challenged by textual reading and the language involved in a Star Math Spanish test, read-aloud audio guidance was developed as an accommodation. Read-aloud guidance is turned off for all students by default, but teachers may choose to turn it on either for individual students or an entire class. The accommodation is not intended to be used for all students, blind or low-vision students, but instead is intended to assist teachers to work with students whose language skills are at a lower level than their math skills or who have reading challenges that might prevent them from understanding the item. Audio scripts are not intended to read the entire item aloud for students who cannot read or have extreme visual disabilities.

In order to ensure students receiving read-aloud audio guidance do not have an advantage over other students, some items receive a standard audio prompt of “Elige la respuesta major” [Choose the best answer]. Examples of items receiving this prompt would be if the stem included a single below-grade word such as “resuelve” [solve] or “simplifica” [simplify]. For content-specific scripts, only numbers and math expressions embedded within sentences are read. Audio is not included for labels on charts and graphs. Content-specific scripts will be provided for answer choices in items that would pose significant difficulty for struggling readers.

For technical reasons, a single audio file is used for each item requiring audio support, even when audio support contains both the stem and answer options. Students may replay the audio at any time, and may answer the item before the audio has finished playing.

Item Development Guidelines: Star Math Spanish

Star Math Spanish assesses 4 blueprint domains comprised of 759 blueprint skills, with plans to cover an additional 31 skills at the high school level. Item development is skill-specific. Each item in the item bank is developed for and clearly aligned to one skill. Answering an item correctly does not require math knowledge beyond the expected knowledge for the skill being assessed. The reading level and math level of the item are grade-level appropriate. The Spanish ATOS readability formula is used to identify reading level.

Star Math Spanish items are multiple-choice. Most items have four answer choices. An item may have two or three answer choices if appropriate for the skill. Items are distributed among difficulty levels. Correct answer choices are equally distributed by difficulty level.

Item development meets established demographic and contextual goals that are monitored during development to ensure the item bank is demographically and contextually balanced. Goals are established and tracked in the following areas: gender, ethnicity, occupation, age, and disability. Items adhere to strict bias and fairness criteria. Items are free of stereotyping, representing different groups of people in non-stereotypical settings. Items do not refer to inappropriate content that includes, but is not limited to content that presents stereotypes based on ethnicity, gender, culture, economic class, or religion; presents any ethnicity, gender, culture, economic class, or religion unfavorably; introduces inappropriate information, settings, or situations; references illegal activities; references sinister or depressing subjects; references religious activities or holidays based on religious activities; references witchcraft; or references unsafe activities.

The majority of items within a skill are homogeneous in presentation, format, or scenario, but have differing computations. A skill may have two or three scenarios which serve as the basis for homogeneous groupings of items within a skill. All items for a skill are unique. Text is typically presented as 18-point Arial, but smaller text may be necessary to label charts or graphs. Every complete item is presented on screen with stimulus, stem and answer choices visible. Scroll bars are never used, to minimize cognitive load and confusion created by not having all relevant information available at once. Graphics are included in an item only when necessary to solve the problem.

Item stems meet the following criteria with limited exceptions. When possible, the stem is presented in purely mathematical form or may be limited to a single direction such as "simplifica" [simplify]. When an item requires more complex language, the question is concise, direct, and a complete sentence. The question is written so students can answer it without reading the distractors. Generally, completion (blank) stems are not used. If a completion stem is necessary, the stem contains enough information for the student to complete the stem without reading the distractors, and the completion blank is as close to the end of the stem as possible. The stem does not include verbal or other clues that hint at correct or incorrect distractors. The syntax and grammar are straightforward and appropriate for the grade level.

Negative construction is avoided. The stem does not contain more than one question or part. Concepts and information presented in the items are accurate, up-to-date, and verifiable. This includes but is not limited to dates, measurements, locations, and events.

Distractors meet the following criteria with limited exceptions. All distractors are plausible and reasonable. Distractors do not contain clues that hint at correct or incorrect distractors. Incorrect answers are created based on common student mistakes. Distractors that are not common mistakes may vary between being close to the correct answer or close to a distractor that is the result of a common mistake. Distractors are independent of each other, are approximately the same length, have grammatically parallel structure, and are grammatically consistent with the stem. None of these, none of the above, not given, all of the above, and all of these are generally avoided as distractors.

Balanced Items: Bias and Fairness

Item development meets established demographic and contextual goals that are monitored during development to ensure the item bank is demographically and contextually balanced. Goals are established and tracked in the following areas: gender, ethnicity, occupation, age, and disability.

- Items are free of stereotyping, representing different groups of people in non-stereotypical settings.
- Items do not refer to inappropriate content that includes, but is not limited to content that presents stereotypes based on ethnicity, gender, culture, economic class, or religion.
- Items do not present any ethnicity, gender, culture, economic class, or religion unfavorably.

- Items do not introduce inappropriate information, settings, or situations.
- Items do not reference illegal activities, sinister or depressing subjects, religious activities or holidays based on religious activities, witchcraft, or unsafe activities.

Accuracy of Content

Concepts and information presented in items are accurate, up-to-date, and verifiable. This includes, but is not limited to, references, dates, events, and locations.

Language Conventions

Grammar, usage, mechanics, and spelling conventions in all Star Math Spanish items adhere to the rules and guidelines in the approved content reference books. *The Dictionary of Spanish Usage* by María Moliner and the *Royal Spanish Academy Dictionary of Spanish Language* are the references for pronunciation, spelling, grammar, mechanics, and usage.

Item and Scale Calibration

Background

Item calibration entails estimating the scaled difficulty of test items by administering them to examinees whose ability is known or estimated, then fitting response models that express the probability of a correct response to each item as a function of examinee ability. To provide accurate item difficulty parameter estimates requires an adequate number of responses to each item, from examinees spanning a broad range of ability. The distribution of ability in the examinee samples need not be closely representative of the distribution of ability in the population, but it needs to be diverse, with large enough numbers of observations above and below the middle of the ability range, as well as from the middle itself.

For the introduction of Star Math Spanish, data collection was done entirely by computer, using a special-purpose application program that administered fixed test forms, but did so on screen, with the same display format and user interface later used in the adaptive version of Star Math Spanish. For Star Math Spanish, new test items to be calibrated are embedded as unscored items in Star Math Spanish itself, and the data for calibration are collected by the Star Math Spanish software. Renaissance calls this data collection process *dynamic calibration*.

For Star Math Spanish, over 6,000 items spanning grades 1–12 were available for calibration. Of those, 3,774 items were tagged at grades K–8.

All of the new items had to be calibrated on a common difficulty scale for Star Math Spanish. During that Calibration Study, the 3,700+ grades K–8 items were administered to a national sample of more than 25,000 students in grades 1–8 between the spring of 2014 and 2016. Calibration analyses were completed in the spring of 2018.

Star Math Spanish is an application of the Rasch, 1-parameter logistic item response model. For each new item, its location on the Rasch difficulty scale is estimated by fitting a logistic response function to the item responses and Rasch ability scores of the participating examinees. This chapter will describe Rasch item response model, and the criteria applied to screen calibrated items for inclusion in the Star Math Spanish item banks.

The Rasch Item Response Model

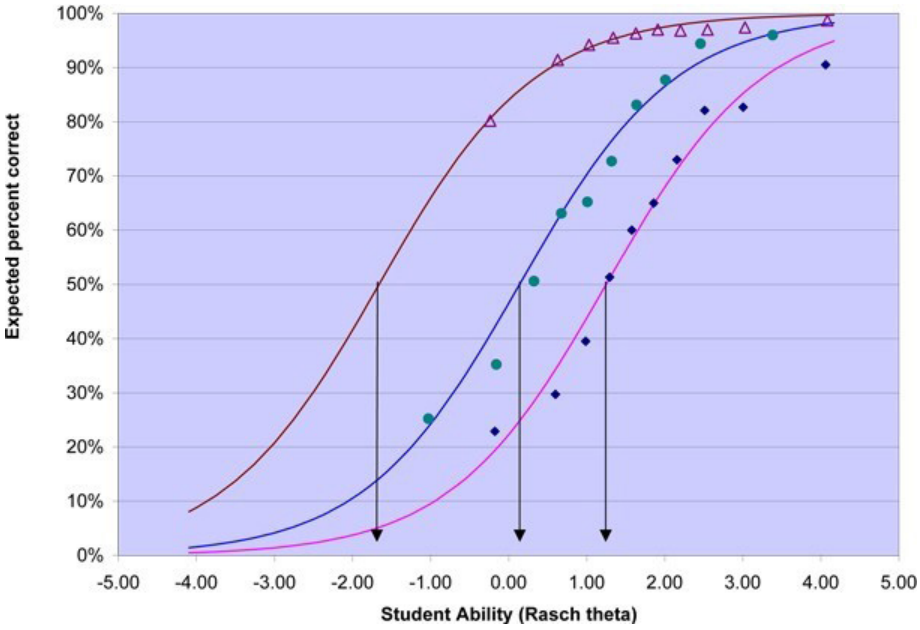
In addition to traditional item analyses, the Star Math Spanish calibration data are analyzed using item response theory (IRT) methods. With IRT, the performance of students and the items they answer are placed on the same scale. To accomplish this, every test question is calibrated. Calibration is an IRT-based analytical method for estimating the location of a test question on a common scale used to measure both examinee ability and item difficulty. It is done by administering each question to hundreds and sometimes thousands of students with known performance levels. As a result of calibration, Star "knows" the relative difficulty of every item from kindergarten through grade 12, and expresses it on a developmental scale spanning from the easiest to the hardest questions in the item bank. After taking a Star assessment, a student's score can be plotted on this developmental scale. Placing students and items on the same scale is the breakthrough of IRT because it makes it possible to assign scores on the same scale even though students take different tests. IRT also provides a means to estimate what skills a student knows and doesn't know, without explicitly testing each and every skill.

IRT methods develop mathematical models of the relationship of student ability to the difficulty of specific test questions; more specifically, they model the probability of a correct response to each test question as a function of student ability. Although IRT methods encompass a family of mathematical models, the one-parameter (or Rasch) IRT model was selected for the Star Math Spanish data both for its simplicity and its ability to accurately model the performance of the Star Math Spanish items.

Within IRT, the probability of answering an item correctly is a function of the student's ability and the difficulty of the item. Since IRT places the item difficulty and student ability on the same scale, this relationship can be represented graphically in the form of an item response function (IRF).

Figure 1 is a plot of three item response functions: one for an easy item, one for a more difficult one, and one for an even harder item. Each plot is a continuous S-shaped (ogive) curve. The horizontal axis is the scale of student ability, ranging from very low ability (–5.0 on the scale) to very high ability (+5.0 on the scale). The vertical axis is the percent of students expected to answer each of the three items correctly at any given point on the ability scale. Notice that the expected percent correct increases as student ability increases, but varies from one item to another.

Figure 1: Three Examples of Item Response Functions



In Figure 1, each item's difficulty is the scale point where the expected percent correct is exactly 50. These points are depicted by vertical lines going from the 50% point to the corresponding locations on the ability scale. The easiest item has a difficulty scale value of about–1.67; this means that students located at –1.67 on the ability scale have a 50-50 chance of answering that item right. The scale values of the other two items are approximately +0.20 and +1.25, respectively.

Calibration of test items estimates the IRT difficulty parameter for each test item and places all of the item parameters onto a single scale used to assess the difficulty of test items, and the ability of students, ranging from Kindergarten through 12th grade level. The difficulty parameter for each item is estimated, along with measures to indicate how well the item conforms to (or "fits") the theoretical expectations of the presumed IRT model.

Also plotted in Figure 1 are the actual percentages of correct responses of groups of students to all three items. Each group is represented as a small triangle, circle, or diamond. Each of those geometric symbols is a plot of the percent correct against the average ability level of the group. Ten groups' data are plotted for each item; the triangular points represent the groups responding to the easiest item. The circles and diamonds, respectively, represent the groups responding to the moderate and to the most difficult item.

Calibration of Star Math Spanish

This section summarizes the psychometric research and development undertaken to prepare the large pool of calibrated math grades K–8 test items for use in Star Math Spanish. As already described above, about 3,700 K–8 items were used in the Star Math Spanish calibration. Data were collected over multiple years. The calibration analyses of those items established the underlying Star Math Spanish Rasch scale that exists today. The methodology used to develop that scale is summarized below.

Sample Description

To obtain a sample that was representative of the diversity of mathematics achievement in the US school population, school districts, specific schools, and individual students were selected to participate in the Star Math Spanish Calibration Study. The Star Math Spanish calibration sample included students from 302 schools. A total of 25,611 students participated in the calibration study. Table 3 provides the number of students in each grade who participated in the calibration study.

Table 3: Numbers of Student Tested by Grade, Star Math Spanish Item Calibration Study—Spring 2018

Grade Level	Number of Students Tested	Grade Level	Number of Students Tested
1	5,906	5	2,382
2	6,809	6	1,240
3	3,935	7	1,343
4	3,005	8	991

Item Presentation

The Star Math Spanish calibration data were collected by administering test items on screen, with display characteristics identical to those implemented in all Star versions. However, the calibration items were administered in forms consisting of fixed sequences of items, as opposed to the adaptive testing format.

Items were tagged with a grade level. The items were then grouped in forms according to grade level while ensuring that each form contained an adequate balance of content measured by Star Math Spanish. To facilitate

vertical scaling, common items (anchors) were included both within grade across the forms (horizontal anchors) and across grades (vertical anchors). The horizontal anchors were used to link forms within grade and the vertical anchors were used to link forms across grade. The vertical anchors were administered at the assigned grade level and one grade level above. The use of anchor items facilitated equating of both test forms and test levels for purposes of data analysis and the development of the overall score scale.

Table 4 breaks down the composition of test forms at each grade level in terms of number of test questions, as well as the number of calibration test forms at each level. Students answered a set number of questions at their current grade level, as well as a number of questions one grade level below their grade level.

Table 4: Calibration Test Forms Design by Grade Level, Star Math Spanish Calibration Study—Spring 2018

Grade Level	Items per Form	Number of Forms
1	35	19
2	35	16
3	35	26
4	35	19
5	45	18
6	45	15
7	45	10
8	45	10
Sum		133
	× Counterbalancing factor	2
	Total Number of forms	266

To avoid problems with positioning effects resulting from the placement of items within each test booklet form, items were shuffled within each test form. This created two variations of each test form such that items appeared in different sequential positions within each “shuffled” test form as indicated by the counterbalancing factor in Table 4 above. Since the final items would be administered as part of a computer-adaptive test, it was important to remove any effects of item positioning from the calibration data so that each item could be administered at any point during the test.

Calibration test forms were spiraled within the Renaissance calibration software by grade level such that each student received a test form essentially at random. This design ensured that no more than two or three students in any classroom attempted any particular tryout item.

Following extensive quality control checks, the item response data were analyzed using both traditional item analysis techniques and item response theory (IRT) methods. For each test item, the following information was derived using traditional psychometric item analysis techniques:

- The number of students who attempted to answer the item.
- The number of students who did not attempt to answer the item.
- The percentage of students who answered the item correctly (a traditional measure of difficulty).
- The percentage of students answering each option and the alternatives.
- The correlation between answering the item correctly and the total score (a traditional measure of discrimination).
- The correlation between the endorsement of each alternative answer and the total score.

Item Difficulty

The difficulty of an item in traditional item analysis is the percentage (or proportion) of students who answer the item correctly. This is typically referred to as the "p-value" of the item. Low p-values (such as 15%) indicate that the item is difficult since only a small percentage of students answered it correctly. High p-values indicate that the majority of students answered the item correctly and thus, the item is easy. It should be noted that the p-value only has meaning for a particular item relative to the characteristics of the sample of students who responded to it.

Item Discriminating Power

The traditional measure of the discriminating power of an item is the correlation between the "score" on the item (correct or incorrect) and the total test score. Items that correlate highly with total test score will also tend to correlate with one another more highly and produce a test with more internal consistency. For the correct answer, the higher the correlation between the item score and the total score, the better the item is at discriminating between low-scoring and high-scoring individuals. When the correlation between the correct answer and the total test is low (or negative), the item is most likely not performing as intended. The correlation between endorsing incorrect answers and the total score should generally be negative, since there should not be a positive relationship between selecting an incorrect answer and scoring higher on the overall test.

At least two different correlation coefficients are commonly used during item analysis: the point-biserial and the biserial coefficients. The former is a traditional product-moment correlation that is readily calculated, but is known to be somewhat biased in the case of items with p-values that deviate from 0.50. The biserial correlation is derived from the point-biserial and the p-value, and is preferred by many because it in effect corrects for the point-biserial's bias at low and high p-values. For item analysis of Star Math Spanish data, the correlation coefficient of choice was the biserial.

Urry (1975) demonstrated that in cases where items could be answered correctly by guessing (e.g., multiple choice items) the value of the biserial correlation is itself attenuated at p-values different from 0.50, and particularly as the p-value approaches the chance level. He derived a correction for this attenuation, which we will refer to as the "Urry biserial correlation." Urry demonstrated that multiple choice adaptive tests are more efficient than conventional tests only if the adaptive tests use items with Urry biserial values that are considerably higher than the target levels often used to select items for conventional test use. His suggestion was to reject items with Urry biserial values lower than 0.62. Item analyses of the Star Math Spanish test have used the Urry biserial as the correlation coefficient of choice; item selection/rejection decisions have been based in part on his suggested target of 0.62.

Rules for Item Retention

Following these analyses, each test item, along with both traditional and IRT analysis information (including IRF and EIRF plots), and information about the test level, form, and item identifier, is stored in a specialized item statistics database system. A panel of internal reviewers then examines each item's statistics to determine whether the item met all criteria for inclusion in the bank of Star Math Spanish items. The item statistics database system allows experts easy access to all available information about an item in order to interactively designate items that, in their opinion, meet acceptable standards for inclusion in the Star Math Spanish item bank.

- Items were eliminated when they met one or more of the following criteria:
- Item-total correlation (item discrimination) less than the minimum (Urry biserial < 0.62)
- One or more incorrect answer options has a positive item discrimination value
- Sample size of students responding to the item less than 100
- The traditional item difficulty indicated that the item was too difficult or too easy
- The item does not appear to fit the Rasch IRT model

In the case of the batch of 3,700+ test items used in the Star Math Spanish item calibration, 2,120 items met all the retention rules above, and were accepted for operational use as part of the Star Math Spanish adaptive test item bank.

Scale Calibration and Linking

The outcome of the item calibration study described above was a sizable bank of test items suitable for use in the Star Math Spanish test, with an IRT difficulty scale parameter for each item. The item difficulty scale itself was devised such that it spanned a range of item difficulty from grades K–8. An important feature of Item Response Theory is that the same scale used to characterize the difficulty of the test items is also used to characterize examinees' ability; in fact, IRT models express the probability of a correct response as a function of the difference between the scale values of an item's difficulty and an examinee's ability. The IRT ability/difficulty scale is continuous; values of observed Rasch ability ranged from about –7.0 to +7.0, with the zero-value occurring at about the third-grade level.

Because of the relationship between Star Math Spanish and its counterpart Star Math English, a decision was made to place both tests on a common scale that can be used to report scores on both tests. Such a scale, the Unified Score Scale, has been developed, and was introduced into use in the 2017–2018 school year as the default scale for reporting achievement on Star Math Spanish tests.

The Star Math Spanish unified score scale was developed by performing the following steps:

- The Rasch scale used by Star Math Spanish was linked (transformed) to the Star Math English Rasch scale.
- A linear transformation of the transformed Rasch scale was developed that spans the entire range of knowledge and skills measured by both Star Math Spanish and Star Math English.

Details of the steps are presented below.

1. The Rasch scale used by Star Math Spanish was linked to the Star Math English Rasch scale.

   In this step, a linear transformation of the Star Math Spanish Rasch scale to the Rasch scale used by Star Math English was developed, using a method for linear equating of IRT (item response theory) scales described by Kolen and Brennan (2004, pages 161–165). The linear equating process

used all of the common items between Star Math Spanish and Star Math English. Because Renaissance calibrates items and persons on the same scale using the Rasch model, the linking equation developed based on common items could be used to transform the student scores from the Spanish scale to the English scale.

2. The linear transformation link previously developed to place Star Math English on the same scale as Star Reading English was then applied. This essentially placed the Star Math Spanish items on the same Rasch scale as Star Reading English which forms the basis for the Unified Scale that unites all Star applications.

3. Because Rasch scores are expressed as decimal fractions, and may be either negative or positive, a more user-friendly scale score was developed that uses positive integer numbers only. A linear transformation of the extended Star Math Spanish Rasch scale was developed that spans the entire range of knowledge and skills measured by both Star Math Spanish and Star Math English. The transformation formula is as follows:

$$\text{Unified Scale Score} = \text{INT}(42.93 * \text{Adjusted Star Math Spanish Rasch Score} + 958.74)$$

Reported Star Math Spanish unified scale scores range from 600–1400.

On-line Data Collection for New Item Calibration

Beginning with the 2018–2019 school year, new test items at grade levels K–12 are being developed and calibrated for use in Star Math Spanish. The data needed for item calibration are collected on-line, by embedding small numbers of uncalibrated items within Star Math Spanish tests. After sufficient numbers of item responses have accumulated, the Rasch difficulty of each new item is estimated by fitting a logistic model to the item response data and the Star Math Spanish Rasch scores of the students' tests. Renaissance calls this overall process "dynamic calibration."

Typically, dynamic calibration is done in batches of several hundred new test items. Each student's test may include between 1 and 3 uncalibrated items. Each item is tagged with a grade level, and is typically administered only to students at that grade level and the next higher grade. The selection of the uncalibrated items to be administered to each student is at random, resulting in nearly equivalent distributions of student ability for each item at a given grade level.

Both traditional and IRT item analyses are conducted of the item response data collected. The traditional analyses yield proportion correct statistics,

as well as biserial and point-biserial correlations between scores on the new items and actual scores on the Star Math Spanish tests.

For dynamic calibration, a minimum of 1,000 responses per item is the data collection target. In practice, because of the number of Star Math Spanish tests administered each year, the number of students responding to each new test item is expected to equal or exceed the target. The calibration analysis proceeds one item at a time, using SAS/STAT™ software to estimate the threshold (difficulty) parameter of every new item by calculating the non-linear regression of each new item score (0 or 1) on the Star Math Spanish Rasch ability estimates. The accuracy of the non-linear regression approach has been corroborated by conducting parallel analyses using Winsteps© software. In tests, the two methods yielded virtually identical results.

Computer-Adaptive Test Design

An additional level of content specification is determined by the student's performance during testing. In conventional paper-and-pencil standardized tests, items retained from the item tryout or item calibration program are organized by level. Then, each student takes all items within a given test level. Thus, the student is only tested on those mathematical operations and concepts deemed to be appropriate for his or her grade level.

On the other hand, in computer-adaptive tests, such as Star Math Spanish, the items taken by a student are dynamically selected in light of that student's performance during the testing session. Thus, a low-performing student's knowledge of math operations may branch to easier operations to better estimate math achievement level, and high-performing students may branch to more challenging operations or concepts to better determine the breadth of their math knowledge and their math achievement level.

During an adaptive test, a student may be "routed" to items at the lowest level of difficulty within the overall pool of items, dependent upon the student's unfolding performance during the testing session. In general, when an item is answered correctly, the student is routed to a more difficult item. When an item is answered incorrectly, the student is instead routed to an easier item. In the case of Star Math Spanish, the brancher selects items with a 67 percent expectation of a correct response, given the student's estimated ability and the item's calibrated difficulty.

A Star Math Spanish test consists of a fixed-length, 34-item adaptive test. Students who have not taken a Star Math Spanish test within 180 days initially receive an item whose difficulty level is relatively easy for students at that grade level. This minimizes any effects of initial anxiety that students

may have when starting the test and serves to better facilitate the students' initial reactions to the test. The starting points vary by grade level and are based on research conducted as part of the norming process.

When a student has taken a Star Math Spanish test within the previous 180 days, the appropriate starting point is based on his or her previous test score information. Following the administration of the initial item, and after the student has entered an answer, the program determines an updated estimate of the student's math achievement level. Then, it selects the next item randomly from among all of the available items having a difficulty level that closely matches a target based on the estimated achievement level. Randomization of items with difficulty values near the target level allows the program to avoid overexposure of test items.

Items that have been administered to the same student within the past 75 days are not available for administration. In addition, to avoid frustration, items that are intended to measure advanced mathematical concepts and operations that are more than three grade levels beyond the student's grade level, as determined by where such concepts or operations are typically introduced in math textbooks, are also not available for administration. Because the item pools make a large number of items available for selection, these minor constraints have a negligible impact on the quality of each Star Math Spanish computer-adaptive test.

Scoring in the Star Math Spanish Tests

Following the administration of each Star Math Spanish item, and after the student has selected a response, an updated estimate of the student's underlying math achievement level is computed based on the student's responses to all of the items administered up to that point. A proprietary Bayesian-modal item response theory estimation method is used for scoring until the student has answered at least one item correctly and at least one item incorrectly. Once the student has met this 1-correct/1-incorrect criterion, the software uses a proprietary Maximum-Likelihood IRT estimation procedure to avoid any potential bias in the Scaled Scores.

This approach to scoring enables the software to provide Scaled Scores that are statistically consistent and efficient. Scaled Scores are expressed on a common scale that spans all grade levels covered by the Star Math Spanish test.

Because the software expresses Scaled Scores on a common scale, Scaled Scores are directly comparable with each other, regardless of grade level. Other scores, such as Percentile Ranks and Grade Equivalents, are derived from the Scaled Scores obtained during the Star Math Spanish norming studies.

Reliability and Measurement Precision

Measurement is subject to error. A measurement that is subject to a great deal of error is said to be *imprecise*; a measurement that is subject to relatively little error is said to be *reliable*. In psychometrics, the term *reliability* refers to the degree of measurement precision, expressed as a proportion. A test with perfect score precision would have a reliability coefficient equal to 1, meaning that 100 percent of the variation among persons' scores is attributable to variation in the attribute the test measures, and none of the variation is attributable to error. Perfect reliability is probably unattainable in educational measurement; for example, a test with a reliability coefficient of 0.90 is more likely. On such a test, 90 percent of the variation among students' scores is attributable to the attribute being measured, and 10 percent is attributable to errors of measurement. Another way to think of score reliability is as a measure of the consistency of test scores. Two kinds of consistency are of concern when evaluating a test's measurement precision: internal consistency and consistency between different measurements. First, internal consistency refers to the degree of confidence one can have in the precision of scores from a single measurement. If the test's internal consistency is 95 percent, just 5 percent of the variation of test scores is attributable to measurement error.

Second, reliability as a measure of consistency between two different measurements indicates the extent to which a test yields consistent results from one administration to another and from one test form to another. Tests must yield somewhat consistent results in order to be useful; the reliability coefficient is obtained by calculating the coefficient of correlation between students' scores on two different occasions, or on two alternate versions of the test given at the same occasion.

Because the amount of the attribute being measured may change over time, and the content of tests may differ from one version to another, the internal consistency reliability coefficient is generally higher than the correlation between scores obtained on different administrations.

There are a variety of methods of estimating the reliability coefficient of a test. Methods such as Cronbach's alpha and split-half reliability are single administration methods and assess internal consistency. Coefficients of correlation calculated between scores on alternate forms, or on similar tests administered two or more times on different occasions, are used to assess alternate forms reliability, or test-retest reliability (stability).

In a computerized adaptive test such as Star Math Spanish, content varies from one administration to another, and it also varies with each student's performance.

Another feature of computerized adaptive tests based on Item Response Theory (IRT) is that the degree of measurement error can be expressed for each student's test individually.

The Star Math Spanish tests provide two ways to evaluate the reliability of scores: reliability coefficients, which indicate the overall precision of a set of test scores, and standard errors of measurement (SEM), which provide an index of the degree of error in test scores.

A reliability coefficient is a summary statistic that reflects the average amount of measurement precision in a specific examinee group or in a population as a whole.

In Star Math Spanish, two types of SEM are calculated: "global SEM", which is a summary of a test's measurement error, calculated for a sample or population of examinees; and "conditional SEM", CSEM. CSEM is an estimate of the measurement error in each individual test score. While a reliability coefficient is a single value that applies to the test in general, the magnitude of the CSEM may vary substantially from one person's test score to another's.

This chapter presents three different types of reliability coefficients: generic reliability, split-half reliability, and alternate forms (test-retest) reliability. This is followed by statistics on the conditional standard error of measurement and the global standard error of measurement of Star Math Spanish test scores.

Generic Reliability

Test reliability is generally defined as the proportion of test score variance that is attributable to true variation in the trait the test measures. This can be expressed analytically as

$$Reliability = 1 - \frac{\sigma^2_{error}}{\sigma^2_{total}}$$

where σ^2_{error} is the variance of the errors of measurement, and σ^2_{total} is the variance of test scores. In Star Math Spanish, the variance of the test scores is easily calculated from Scaled Score data. The variance of the errors of measurement may be estimated from the conditional standard error of

measurement (CSEM) statistics that accompany each of the IRT-based test scores, including the Scaled Scores, as depicted below.

$$\sigma^2_{error} = \frac{1}{n}\sum_{i=1}^{n} SEM_i^2$$

where the summation is over the squared values of the reported CSEM for students *i* = 1 to n. In each Star Math Spanish test, CSEM is calculated along with the IRT ability estimate and Scaled Score. Squaring and summing the CSEM values yields an estimate of total squared error; dividing by the number of observations yields an estimate of mean squared error, which in this case is tantamount to error variance. "Generic" reliability is then estimated by calculating the ratio of error variance to Scaled Score variance, and subtracting that ratio from 1. Using this technique with a stratified random sample of the Star Math Spanish data from the 2016–2017 and 2017–2018 school years resulted in the generic reliability estimates shown in the third column of Table 5. Results in Table 5 indicate that the overall generic reliability of the scores was 0.96. Coefficients ranged from a low of 0.92 in grade 1 to a high of 0.95 in grades 6, 7, and 8. Because this method is not susceptible to error variance introduced by repeated testing, multiple occasions, and alternate forms, the resulting estimates of reliability are generally higher than the more conservative alternate forms reliability coefficients. These generic reliability coefficients are, therefore, plausible upper-bound estimates of the internal consistency reliability of the Star Math Spanish computer-adaptive test.

Table 5: Reliability Estimates from the Star Math Spanish 2016–2017 and 2017–2018 Data on the Unified Scale

	Reliability Estimates: For Unified Scale						
	Generic		Split-Half		Alternate Forms		
Grade	N	ρxx	N	ρxx	N	ρxx	Average Days between Testing
1	17,000	0.92	15,000	0.89	2,700	0.65	98
2	17,000	0.93	15,000	0.90	2,700	0.70	109
3	17,000	0.93	15,000	0.90	2,700	0.71	116
4	17,000	0.94	15,000	0.92	2,700	0.74	114
5	12,000	0.94	15,000	0.92	2,700	0.74	114
6	3,500	0.95	3,500	0.92	630	0.81	106
7	3,500	0.95	3,500	0.91	630	0.74	103
8	3,500	0.95	3,500	0.92	630	0.76	102
Overall	90,500	0.96	85,500	0.95	15,390	0.83	109

As the data in Table 5 shows, Star Math Spanish reliability is high, grade by grade and overall. Star Math Spanish's technical quality for an interim assessment is on a virtually equal footing with the highest-quality summative assessments in use today.

Split-Half Reliability

While generic reliability does provide a plausible estimate of measurement precision, it is a theoretical estimate, as opposed to traditional reliability coefficients, which are more firmly based on item response data. Traditional internal consistency reliability coefficients such as Cronbach's alpha and Kuder-Richardson Formula 20 (KR-20) are not meaningful for adaptive tests. However, an estimate of internal consistency reliability can be calculated using the split-half method.

A split-half reliability coefficient is calculated in three steps. First, the test is divided into two halves, and scores are calculated for each half. Second, the correlation between the two resulting sets of scores is calculated; this correlation is an estimate of the reliability of a half-length test. Third, the resulting reliability value is adjusted, using the Spearman-Brown formula,[1] to estimate the reliability of the full-length test.

In internal simulation studies, the split-half method provided accurate estimates of the internal consistency reliability of adaptive tests, and so it has been used to provide estimates of Star Math Spanish reliability. These split-half reliability coefficients are independent of the generic reliability approach discussed earlier and more firmly grounded in the item response data.

Split-half scores were based on all of the 34 items of the Star Math Spanish tests; scores based on the odd- and the even-numbered items were calculated separately. The correlations between the two sets of scores were corrected to a length of 34 items, yielding the split-half reliability estimates displayed in Table 5.

Results indicated that the overall split-half reliability of scores was 0.95. The coefficients ranged from a low of 0.89 in grade 1 to a high of 0.92 in grades 4, 5, 6, and 8. These reliability estimates are quite consistent across grades 1–8, and quite high, again a result of the measurement efficiency inherent in the adaptive nature of the Star Math Spanish test.

1. See Lord, F. M. and Novick, M. R. (1968). *Statistical Theories of Mental Test Scores.* Reading, MA: Addison-Wesley, pp. 112–113.

Alternate Forms Reliability

Another method of evaluating the reliability of a test is to administer the test twice to the same examinees. Next, a reliability coefficient is obtained by calculating the correlation between the two sets of test scores. This is called a test-retest reliability coefficient if the same test was administered both times and an alternate forms reliability coefficient if different, but parallel, tests were used.

Content sampling, temporal changes in individuals' performance, and growth or decline over time can affect alternate forms reliability coefficients, usually making them appreciably lower than internal consistency reliability coefficients.

The alternate forms reliability study provided estimates of Star Math Spanish reliability using a variation of the test-retest method. In the traditional approach to test-retest reliability, students take the same test twice, with a short time interval, usually a few days, between administrations. In contrast, the Star Math Spanish alternate form reliability study administered two different tests by avoiding during the second test the use of any items the student had encountered in the first test. All other aspects of the two tests were identical. The correlation coefficient between the scores on the two tests was taken as the reliability estimate.

The alternate forms reliability estimates for the Star Math Spanish test were calculated using the Star Math Spanish Unified scaled scores. Checks were made for valid test data on both test administrations and to remove cases of apparent motivational discrepancies.

Table 5 includes overall and within-grade alternate forms reliability, along with an indication of the average number of days between testing occasions. The average number of days between testing occasions ranged from 98–116 days. Results indicated that the overall reliability of the scores was about 0.83. The alternate form coefficients ranged from a low of 0.65 in grade 1 to a high of 0.81 in grade 6.

Because errors of measurement due to content sampling and temporal changes in individuals' performance can affect this correlation coefficient, this type of reliability estimate provides a conservative estimate of the reliability of a single Star Math Spanish administration. In other words, the actual Star Math Spanish reliability is likely higher than the alternate forms reliability estimates indicate.

Standard Error of Measurement

When interpreting the results of any test instrument, it is important to remember that the scores represent estimates of a student's true ability level. Test scores are not absolute or exact measures of performance. Nor is a single test score infallible in the information that it provides. The standard error of measurement can be thought of as a measure of how precise a given score is; smaller values of SEM or CSEM indicate greater precision.

The standard error of measurement (SEM) describes the extent to which scores would be expected to fluctuate because of chance. If measurement errors follow a normal distribution, an SEM of 18 means that if a student were tested repeatedly, his or her scores would fluctuate within 18 points of his or her first score about 68 percent of the time, and within 36 points (twice the SEM) roughly 95 percent of the time. Since reliability can also be regarded as a measure of precision, there is an inverse relationship between the reliability of a test and the standard error of measurement for the scores it produces: lower standard errors of measurements results in higher reliability.

The Star Math Spanish tests differ from traditional tests in at least two respects with regard to the standard error of measurement. First, Star Math Spanish software computes the SEM for each individual student based on his or her performance, unlike most traditional fixed tests that report the same SEM value for every examinee. Each administration of Star Math Spanish yields a unique "conditional" SEM (CSEM) that reflects the amount of information estimated to be in the specific combination of items that a student received in his or her individual test. Second, because the Star Math Spanish test is adaptive, the CSEM will tend to be lower than that of a conventional test of the same length, particularly at the highest and lowest score levels, where conventional tests' measurement precision is weakest. Because the adaptive testing process attempts to provide equally precise measurement, regardless of the student's ability level, the average CSEMs for the IRT ability estimates are generally similar for all students.

Table 6 contains two different sets of estimates of Star Math Spanish measurement error: conditional standard error of measurement (CSEM) and global standard error of measurement (SEM). Conditional SEM was just described; the estimates of CSEM in Table 6 are the average CSEM values observed for each grade.

Global standard error of measurement is based on the traditional SEM estimation method, using the estimated generic reliability and the variance of the test scores to estimate the SEM:

$$SEM = \sqrt{1 - \rho_{xx}}\,\sigma_x$$

where ρ_{xx} is the estimated generic reliability, and σ_x is the standard deviation of the observed scores (in this case, Scaled Scores).

Table 6 summarizes the distribution of CSEM values for a stratified random sample of 2016–2017 and 2017–2018 school year data, overall and by grade level. The overall average CSEM on the Unified scale across all grades was 17 scaled score units and ranged from a low of 16 in grades 1–2 to a high of 18 in grades 4–8.

Table 6 also shows the estimates of the global SEM. The global SEM estimates were slightly higher than the CSEM estimates. The overall SEM was 20. Across grades, the SEM ranged from a low of 19 in grade 1 to a high of 23 in grade 7.

Table 6: Standard Error of Measurement for the 2016–2017 and 2017–2018 Star Math Spanish data on the Unified Scale

	Standard Error of Measurement Unified Scale				
	Conditional			Global	
Grade	N	Average	Standard Deviation	N	SEM
1	17,000	16	1.0	15,000	19
2	17,000	16	1.0	15,000	19
3	17,000	17	1.0	15,000	20
4	17,000	18	1.1	15,000	21
5	12,000	18	1.3	15,000	21
6	3,500	18	1.2	3,500	22
7	3,500	18	1.2	3,500	23
8	3,500	18	1.2	3,500	22
All	90,500	17	1.3	85,500	20

Validity

Test validity was long described as the degree to which a test measures what it is intended to measure. An updated conceptualization of test validity is that test validity consists of the collection of evidentiary data to support specific claims as to *what* the test measures, the *interpretation* of its scores, and the *uses* for which it is recommended or applied. Evidence of test validity is often indirect and incremental, consisting of a variety of data that in the aggregate are consistent with the theory that the test measures the intended construct(s), or is suitable for its intended uses and interpretations of its scores. Determining whether there is test validity evidence to support the intended uses and interpretations of test scores involves the use of data and other information both internal and external to the test instrument itself.

Content Validity

One touchstone is content validity, which is the relevance of the test questions to the attributes or dimensions intended to be measured by the test—namely math achievement, in the case of the Star Math Spanish assessments. The content of the item bank and the content balancing specifications that govern the administration of each test together form the foundation for "content validity" for the Star Math Spanish assessments. These content topics were discussed in detail in "Content and Item Development" and were an integral part of the test items that are the basis of Star Math Spanish today.

Construct Validity

Construct validity, which is the overarching criterion for evaluating a test, investigates the extent to which a test measures the construct(s) that it claims to be assessing. Establishing construct validity involves the use of data and other information external to the test instrument itself. For example, Star Math Spanish claims to provide an estimate of a child's math achievement level. Therefore, demonstration of Star Math Spanish's construct validity rests on the evidence that the test provides such estimates. There are a number of ways to demonstrate this.

This section deals with both internal and external evidence of the validity of Star Math Spanish as an assessment of math achievement and competence.

Internal Evidence: Evaluation of Unidimensionality of Star Math

Star Math Spanish is a 34-item computerized-adaptive assessment that measures math achievement. Its items are selected adaptively for each student from a very large bank of math test items, each of which is aligned to one of four blueprint domains:

- Numeration & Operations (NUM)
- Algebra (ALG)
- Geometry & Measurement (GEO)
- Data Analysis, Statistics & Probability (DAT)

Star Math Spanish is an application of item response theory (IRT); each test item's difficulty has been calibrated using the Rasch 1-parameter logistic IRT model. One of the assumptions of the Rasch model is unidimensionality: that a test measures only a single construct such as math achievement in the case of Star Math Spanish. To evaluate whether Star Math Spanish measures a single construct, factor analyses were conducted. Factor analysis is a statistical technique used to determine the number of dimensions or constructs that a test measures. Both exploratory and confirmatory factor analyses were conducted across grades 1 to 8.

To begin, a large sample of student Star Math Spanish data was assembled. The overall sample consisted of 129,700 student records of Star Math Spanish tests in the 2016–2017 or 2017–2018 school years. From that sample, stratified random samples of 7,000 students per grade were taken to yield a sample of 56,000 students for analysis. These data were the focus of the exploratory and confirmatory factor analyses.

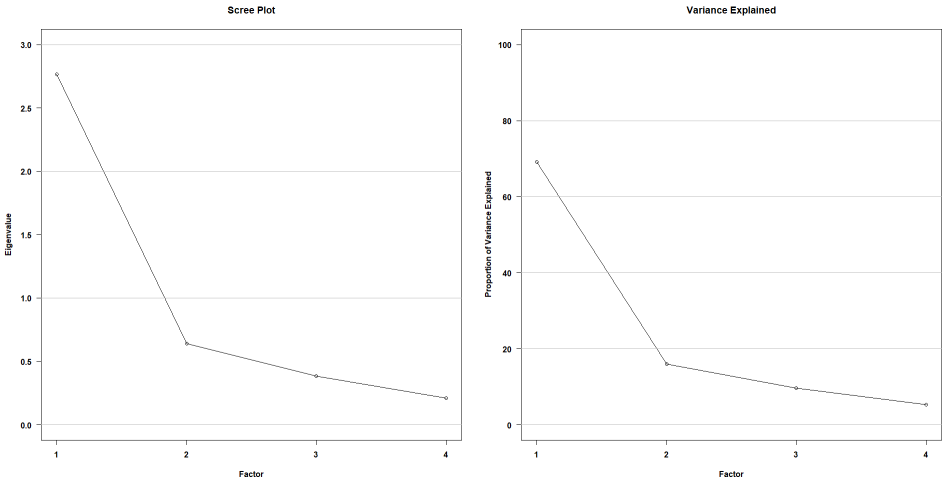
Prior to performing the factor analyses, each student's 34 Star Math Spanish item responses were divided into subsets of items aligned to each of the 4 blueprint domains.

For each student, separate Rasch ability estimates (subtest scores) were calculated from each domain-specific subset of item responses. A Bayesian sequential procedure developed by Owen (1969, 1975) was used for the subtest scoring. The number of items included in each subtest ranged from 1 to 24, following the Star Math Spanish test blueprints, which specify different numbers of items per domain, depending on the student's grade level.

Intercorrelations of the blueprint domain-specific Rasch subtest scores were analyzed using exploratory factor analysis (EFA) to evaluate the number of

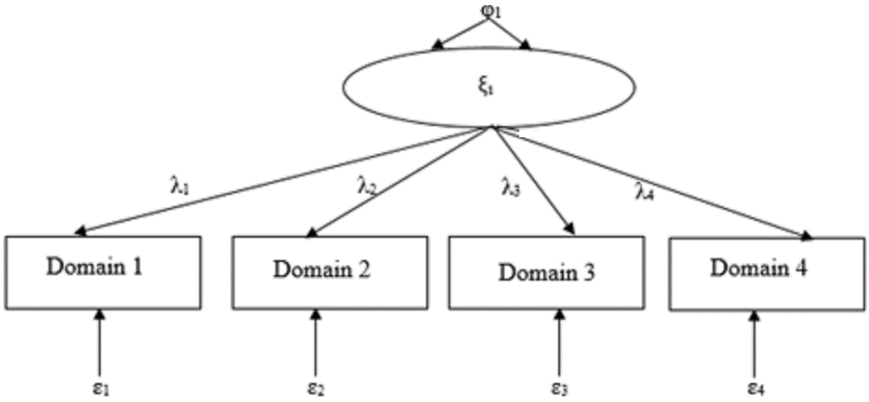
dimensions/ factors underlying Star Math Spanish. Varimax rotation was used. The EFA retained a single dominant underlying dimension based on either the MINEIGEN (eigenvalue greater than 1) or the PROPORTION criterion (proportion of variance explained by the factor), as expected. Figure 2 shows the scree plots and variance explained per factor for the combined analyses of grades 1 through 8.

Figure 2: Scree Plot and Variance Explained by Factor Plot from the Grades 1 through 8 Exploratory Factor Analysis in Star Math Spanish



Subsequent to the EFA, confirmatory factor analyses (CFA) were also conducted using the subtest scores from the CFA sub-sample. A separate confirmatory analysis was conducted for each grade. The CFA models tested a single underlying model as shown in Figure 3.

Figure 3: Confirmatory Factor Analyses (CFA) in Star Math Spanish



The results of the CFA are summarized in Table 7. As the table indicates, the sample size for each grade was 7,000; because the chi-square (x^2) test is not a reliable test of model fit when sample sizes are large, fit indices are presented. The

comparative fit index (CFI) and the Tucker-Lewis index (TLI) are shown; for these indices, values are either 1 or very close to 1, indicating strong evidence of a single construct/dimension. In addition, the root mean square error of approximation (RMSEA), and the standardized root mean square residual (SRMR) are presented. RMSEA and SRMR values less than 0.08 indicate good fit. Cutoffs for the indices are presented in Hu and Bentler (1999). Overall, the CFA results strongly support a single underlying construct in Star Math Spanish.

Table 7: Summary of the Goodness-of-Fit of the CFA Models for Star Math Spanish by Grade

Grade	N	x^2	df	CFI	TLI	RMSEA	SRMR
1	7,000	41.01	2	0.99	0.99	0.05	0.01
2	7,000	28.65	2	1.00	0.99	0.04	0.01
3	7,000	11.00	2	1.00	1.00	0.03	0.01
4	7,000	1.52	2	1.00	1.00	0.00	0.00
5	7,000	2.66	2	1.00	1.00	0.01	0.00
6	7,000	71.09	2	0.99	0.98	0.07	0.02
7	7,000	58.92	2	1.00	0.99	0.06	0.01
8	7,000	44.06	2	1.00	0.99	0.06	0.01
All Grades	56,000	140.83	2	1.00	1.00	0.04	0.01

The EFA were conducted using the factanal function in R 3.5.1 (R Core Team, 2018), while the CFA were conducted using the lavaan package (Rosseel, 2012) in R.

Another part of assessing the dimensionality of the Star Math Spanish is looking at the measurement invariance of the assessments across grades that share the same blueprint. There are four models of measurement invariance that can be tested to see whether they hold across grades. The most constrained model called strict measurement invariance, where the factor loadings, intercepts, and residuals are constrained to be equal across grades. If only the factor loadings and intercepts are constrained to be equal, it is called strong measurement invariance, and if only the loadings are constrained to be equal, it is called weak measurement invariance. Configural measurement invariance is the weakest type of measurement invariance, where there is the same pattern of loadings across grades, but there are no equality constraints. Given that the Star Math Spanish assessment is fit with the Rasch model using a single underlying vertical scale and the levels of performance across grades sometimes differ, the configural and weak measurement invariance models should hold, but the strong and strict measurement invariance models may not hold.

Table 8 shows the measurement invariance models and fit statistics for grades 1–8. The results in the table suggest that the configural and weak measurement invariance models fit fairly well, but the strong and strict models did not fit very well. These results provide additional support that the construct assessed by the Star Math Spanish assessments is consistent across grades and that application of the Rasch model and a single vertical scale is appropriate.

Table 8: Measurement Invariance Statistics for Star Math Spanish for Grades 1 through 8

Model Type	N	x^2	df	CFI	TLI	RMSEA	SRMR
Configural	56,000	258.90	16	1.00	0.99	0.05	0.01
Weak	56,000	613.22	37	0.99	0.99	0.05	0.02
Strong	56,000	4894.35	58	0.95	0.95	0.11	0.07
Strict	56,000	8672.77	86	0.90	0.95	0.12	0.09

Types of External Evidence

In an ongoing effort to gather evidence for the validity of Star Math Spanish scores, continual research on score validity has been undertaken. In addition to original validity data gathered at the time of initial development, a small number of studies have investigated correlations between Star Math Spanish tests and other external measures. There are generally three types of correlations with external measures that can be explored; concurrent validity estimates, predictive validity estimates, and discriminant validity estimates.

For Star Math Spanish, concurrent validity is defined as taking a Star Math Spanish test and another external measure that also assesses math achievement in Spanish within a month time period. At present, only a small number of concurrent validity studies have been conducted since Star Math Spanish has only been used operationally for a few years. Predictive validity provides estimates of the extent to which scores on the Star Math Spanish test predict scores on an external measure of math achievement in Spanish at a later point in time, operationally defined as more than a month between the Star test (predictor) and the criterion test. No studies of the predictive validity of Star Math Spanish have yet been conducted. Future studies will explore the predictive validity of Star Math Spanish as the test continues to be used. Discriminant validity estimates consist of taking Star Math Spanish and another external measure that assess another content area besides math achievement in Spanish (e.g., correlations with a reading achievement

measure) within a month time period. Typically, the goal is that discriminant validity estimates are lower than concurrent validity estimates. Only a small number of discriminant validity estimates have been collected.

External Evidence: Relationship of Star Math Spanish Scores to Other Tests of Spanish Math Achievement

As of the end of 2018, one study has correlated Star Math Spanish results with the Common Core State Standard Subtest with Spanish translations for easyCBM and two studies have correlated Star Math Spanish results with the State of Texas Assessments of Academic Readiness (STAAR) Math Spanish test to provide concurrent validity estimates. Table 9 provides a summary of those analyses. The easyCBM study took place during the 2015–2016 school year and the STAAR studies took place in Spring 2017 and Spring 2018. Concurrent validity estimates with easyCBM ranged from 0.41–0.61 and concurrent validity estimates with STAAR ranged from 0.53–0.78. These coefficients provide solid evidence of the external relationship between the Star Math Spanish assessments and these other two Spanish math assessments.

Table 9: Correlations Between Star Math Spanish and Other Spanish Math Achievement Measures

Test Form	Date	Score	1		2		3		4		5		6		7		8	
			n	r	n	r	n	r	n	r	n	r	n	r	n	r	n	r
easyCBM																		
Common Core State Standard Math Score	2015–2016	SS	1,016	0.41	1,033	0.53	501	0.61	111	0.59	–	–	–	–	–	–	–	–
State of Texas Assessments of Academic Readiness Standards Test (STAAR)																		
STAAR Math Spanish	Spring 2018	SS	–	–	–	–	5,751	0.71	4,082	0.69	83	0.53	–	–	–	–	–	–

External Evidence: Relationship of Star Math Spanish to Achievement Tests Measuring Reading Content

As of the end of 2018, four studies have examined the relationship of Star Math Spanish with achievement tests measuring reading content to provide discriminant validity estimates. One study looked at the relationship between Star Math Spanish and two Reading Spanish subtests for easyCBM, one study looked at the relationship between Star Math Spanish and STAAR Reading Spanish tests, and two studies looked at the relationship between

Star Reading Spanish and Star Math Spanish by correlating results for students' first and last assessments taken. Table 10 provides a summary of those analyses. Discriminant validity estimates with the easyCBM Common Core State Standards Reading subtest ranged from 0.43–0.57, discriminant validity estimates with STAAR ranged from 0.46–0.57, and discriminant validity estimates with Star Reading Spanish ranged from 0.44–0.62. These discriminant validity estimates show that the relationship of Star Math Spanish with achievement tests measuring reading content tends to be similar but, in several cases, somewhat lower than the concurrent validity estimates with Spanish math achievement measures. These coefficients provide some evidence of expected external relationships between Star Math Spanish assessments and these other achievement tests measuring content other than math achievement in Spanish.

Table 10: Correlations Between Star Math Spanish and Other Achievement Tests Measuring Reading Achievement

			1		2		3		4		5		6		7		8	
Test Form	**Date**	**Score**	**n**	**r**	**n**	**r**	**n**	**r**	**n**	**r**	**n**	**r**	**n**	**r**	**n**	**r**	**n**	**r**
easyCBM																		
Spanish word reading	2015–2016	SS	–	–	823	0.57	453	0.43	–	–	–	–	–	–	–	–	–	–
Spanish sentence reading	2015–2016	SS	–	–	822	0.57	452	0.48	–	–	–	–	–	–	–	–	–	–
State of Texas Assessments of Academic Readiness Standards Test (STAAR)																		
STAAR Reading Spanish	Spring 2018	SS	–	–	–	–	5,780	0.57	4,106	0.55	85	0.46	–	–	–	–	–	–
STAAR Reading English	Spring 2018	SS	–	–	–	–	37	0.30	24	0.17	–	–	–	–	–	–	–	–
Renaissance Star assessments																		
Star Reading Spanish first assessment taken	2016–2017	SS	2,419	0.48	6,868	0.54	5,268	0.54	3,086	0.55	1,650	0.52	570	0.56	499	0.54	438	0.58
Star Reading Spanish last assessment taken	2016–2017	SS	1,659	0.45	6,626	0.53	5,669	0.54	3,155	0.56	2,327	0.52	498	0.44	499	0.49	698	0.52
Star Reading Spanish first assessment taken	2017–2018	SS	–	–	–	–	3,350	0.51	1,339	0.51	107	0.55	–	–	–	–	–	–
Star Reading Spanish last assessment taken	2017–2018	SS	–	–	–	–	3,492	0.62	1,373	0.62	95	0.61	–	–	–	–	–	–

External Evidence: Relationship of Star Math Spanish to Achievement Tests Measuring Math Achievement in English

As of the end of 2018, one study has examined the relationship of Star Math Spanish with Star Math English to provide discriminant validity estimates. This study took place in the Spring of 2017. Table 11 provides a summary of these analyses. Correlations between Star Math Spanish and Star Math English ranged between 0.51 and 0.55. These correlations were similar but, in several cases, a little bit lower than the concurrent validity estimates with Spanish Math achievement measures. These coefficients provide some evidence of expected external relationships between Star Math Spanish assessments and these other math achievement tests in English.

Table 11: Correlations Between Star Math Spanish and Other Math Achievement Measures in English

Test Form	Date	Score	1		2		3		4		5		6		7		8	
			n	r	n	r	n	r	n	r	n	r	n	r	n	r	n	r
Renaissance Star Assessments																		
Star Math English	Spring 2017	SS	–	–	–	–	3,350	0.51	1,339	0.51	107	0.55	–	–	–	–	–	–

Summary of Star Math Spanish Validity Evidence

The validity data presented in this technical document includes evidence of Star Math Spanish's content and construct validity. While the amount of data presented in this technical report is less than the amount of data provided for the English version of Star Math since the test has only been in operation for a few years, the data provided was quite positive. The information presented in the "Content and Item Development" chapter supported the content validity of Star Math Spanish. Exploratory and confirmatory factor analyses provided evidence that Star Math Spanish measures a unidimensional construct, consistent with the assumption underlying its use of the Rasch 1-parameter logistic item response model, while measurement invariance analyses provided further evidence to support the use of a single vertical scale and the Rasch model. The small number of concurrent and discriminant validity estimates indicate that Star Math Spanish exhibits appropriate moderate to high correlations with other measures of Spanish Math achievement and that these correlations in some cases were slightly higher than correlations with scores on reading and math achievement measures in English. Taken together, these data provide support for the claim that Star Math Spanish is a measure of math achievement in Spanish.

Norming

Two distinct kinds of norms are described in this chapter: test score norms and growth norms. The former refers to distributions of test scores themselves. The latter refers to distributions of changes in test scores over time; such changes are generally attributed to growth in the attribute that is measured by a test. Hence distributions of score changes over time may be called "growth norms."

The 2020 Star Math Spanish Norms

New US norms for the Star Math Spanish assessments were introduced at the start of the 2020–2021 school year. Separate early fall and late spring norms were developed for grades 1–8. The norms introduced in 2020 are based on test scores of grades 1–8 students that took the Star Math Spanish test during the 2018–2019 school year who had complete assessment data. These norms are on the Star Unified scale.

Students participating in the norming study took assessments between August 1, 2018 and June 30, 2019. Students took the Star Math Spanish tests under normal test administration conditions. No specific norming test was developed, and no deviations were made from the usual test administration. Thus, students in the norming sample took Star Math Spanish tests as they are administered in everyday use.

Sample Characteristics

During the norming period, a total of 295,426 US students in grades 1–8 took the Star Math Spanish tests. The first step in sampling was to select a representative sample of students who had tested in the fall, in the spring, or in both the fall and spring of the 2018–2019 school year under normal testing conditions and who had complete assessment data. Data used for the norming analyses consisted of the full sample of students that took the test in either the fall or the spring. If a student took more than one assessment in the fall, the first assessment administered in the fall was included in the norming sample, and if a student took more than one assessment in the spring, the last assessment taken was included in the norming sample. Since there is not currently a widely accepted definition of what constitutes a representative national population of US students taking Spanish tests, Renaissance's typical post-stratification procedure used with Star Reading, Star Early Literacy, and Star Math to make the norms nationally representative was not applied to these data. However, data on the percentages in different geographic regions,

school enrollments, socioeconomic statuses, school locations, and school types is provided.

The final norming sample size, after selecting only students with test scores in the fall, the spring, or both fall and spring in the norming year was 88,910 students in grades 1–8. There were 45,860 students in the fall norming sample and 43,050 students in the spring norming sample. Some students contributed test results in both the fall and spring of the 2018–2019 school year. These students were counted for each unique assessment when computing the norming sample size. These students came from schools across the 50 US states and the District of Columbia.

Table 12 and Table 13 provide a breakdown of the number of students participating per grade in the fall and spring, respectively.

Table 12: N Counts per Grade in the Fall Norms Sample

Grade	N
1	11,120
2	11,900
3	8,850
4	6,340
5	3,610
6	1,610
7	1,230
8	1,200
Total	45,860

Table 13: N Counts per Grade in the Spring Norms Sample

Grade	N
1	10,860
2	10,630
3	8,350
4	5,830
5	3,490
6	1,550
7	1,190
8	1,150
Total	43,050

Estimates of US school-related characteristics included in the norming sample were obtained from the Market Data Retrieval (November 2019 MDR) databases. The MDR database contains the most recent data on schools. These data can be directly linked to assessment data of students included in the norming sample.

Table 14 on page 48 shows the percentages of children in grades 1–8 by region, school enrollment, school socioeconomic status, location, and school type nationally, and for the fall and spring norming samples. There were some missing data for some students where MDR data could not be linked to the student assessment data. For the fall norming sample, 10,350 records (22.57%) of the sample was missing MDR data, and for the spring norming sample, 10,248 records (23.80%) of the sample was missing MDR data. A brief description of the geographic region, school enrollment, school socioeconomic, location, and school type variables based on MDR is provided below.

A brief description of the geographic region, school enrollment, school socioeconomic, location, and school type variables based on MDR is provided below.

Geographic Region

Using the categories established by the National Center for Education Statistics (NCES), students were grouped into four geographic regions as defined below: Northeast, Southeast, Midwest, and West.

Northeast

Connecticut, District of Columbia, Delaware, Massachusetts, Maryland, Maine, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, Vermont

Southeast

Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, West Virginia

Midwest

Iowa, Illinois, Indiana, Kansas, Minnesota, Missouri, North Dakota, Nebraska, Ohio, South Dakota, Michigan, Wisconsin

West

Alaska, Arizona, California, Colorado, Hawaii, Idaho, Montana, New Mexico, Nevada, Oklahoma, Oregon, Texas, Utah, Washington, Wyoming

School Size

Based on total school enrollment, schools were classified into one of three school size groups: small schools had under 200 students enrolled, medium schools had 200–499 students enrolled, and large schools had 500 or more students enrolled.

Socioeconomic Status

Schools were classified into one of four classifications based on the percentage of students in the school who had free or reduced student lunch. The classifications were coded as follows:

- High socioeconomic status (0%–24%)
- Above-median socioeconomic status (25%–49%)
- Below-median socioeconomic status (50%–74%)
- Low socioeconomic status (75%–100%)

School Location

Schools were classified into one of four categories based on the school metro code type. The classifications were as follows:

- Rural
- Suburban
- Town
- Urban

School Type

Schools were also classified into one of two categories based on whether the school was a public or non-public school.

Table 14 presents the sample characteristic percentages for the MDR variables for the fall and spring norming samples.

Table 14: Sample Characteristics for the Fall and Spring Norming Samples

		National Estimates	Fall Norming Sample	Spring Norming Sample
Region	Midwest	25.96%	13.98%	14.30%
	Northeast	19.41%	8.91%	8.96%
	Southeast	21.48%	3.43%	3.41%
	West	33.15%	73.68%	73.33%
School Enrollment	< 200	24.55%	0.51%	0.55%
	200–499	39.88%	16.31	16.17%
	≥ 500	35.47%	83.19%	83.28%
District Socioeconomic Status	Low	12.16%	68.14%	71.17%
	Below Median	17.65%	19.12%	16.53%
	Above Median	19.35%	8.05%	7.93%
	High	50.64%	4.69%	4.37%
Location	Rural	23.64%	3.39%	2.84%
	Suburban	33.14%	35.86%	38.54%
	Town	14.35%	4.34%	3.91%
	Urban	28.87%	56.41%	54.71%
School Type	Public	82.08%	99.36%	99.23%
	Non-Public	17.92%	0.64%	0.77%

The norming sample also included students of different gender and ethnicities as well as students with disabilities and English Language Learners. Table 15 provides information on the demographic characteristics of students in the sample. No weighting was done based on these demographic variables; they are provided to help describe the sample of students and the schools they attended. Because Star assessment users do not universally enter individual student demographic information such as gender and ethnicity/race, some students were missing demographic data, and the sample summaries in Table 15 are based on only those students that had gender and ethnicity information available. Data on students with disabilities and English Language Learners are not provided because many Star assessment users do not enter that information, and initial analyses of data in the norming samples suggested that the percentages of students with disabilities and English Language Learners may underestimate the total percentage of students in these two

groups. School type was defined to be either public (including charter schools) or non-public (private, Catholic).

Table 15: Student Gender and School Information: Samples Percentages for Fall and Spring Norming Samples

			National Estimates	Fall Norming Sample[c]	Spring Norming Sample[c]
Gender	Public	Female	49.5%	49.35%	49.61%
		Male	50.5%	50.65%	50.39%
	Non-Public	Female	–	50.49%	50.34%
		Male	–	49.51%	49.66%
Race/Ethnicity[a]	Public	American Indian	0.97%	3.77%	2.34%
		Asian	5.64%	0.44%	0.37%
		Black	15.15%	1.86%	1.65%
		Hispanic	27.12%	84.22%	86.01%
		White	47.08%	8.74%	8.72%
		Multiple Race[b]	4.05%	0.98%	0.91%
	Non-Public	American Indian	0.50%	0.00%	0.94%
		Asian	7.30%	1.79%	2.83%
		Black	9.30%	3.57%	3.77%
		Hispanic	11.30%	50.00%	65.09%
		White	66.70%	42.66%	27.36%
		Multiple Race[b]	4.90%	1.79%	0.00%

a. The race/ethnicity percentages for non-public schools are not reported because some of the sample sizes were less than typical guidelines used for reporting percentages.
b. Students identified as belonging to two or more races.
c. Three percent of students had an unspecified gender.

The most recent data on student demographics is from NCES 2017–2019. In 2019 NCES reports approximately 56.6 million students attended elementary and secondary schools in the US. 50.8 million were in public schools and 5.8 million were in private schools. In 2017, 9.6% of public school students were learning English as a second language.

Test Administration

All students took the current version of the Star Math Spanish tests under normal administration procedures. Some students in the norming sample took the assessment two or more times within the norming windows; scores from their initial test administration in the fall and the last test administration in the spring were used for computing the norms.

Data Analysis

Student test records were compiled from the complete database of Star Math Spanish test users. Data were the 2018–2019 school year from August to June. Students' Unified sscale Rasch scores on their first Star Math Spanish test taken during the first or the second month of the school year based on grade placement were used to compute norms for the fall; students' Unified scale Rasch scores on the last Star Math Spanish test taken during the 7th or the 8th month of the school year were used to compute the norms for the fall and from 4th and 5th months were used to compute norms for the spring. Interpolation was used to estimate norms for times of the year between the first month in the fall and the last month in the spring. The norms were based on the distribution of Unified scale Rasch scores for each grade.

Table 16 provides descriptive statistics for Unified scaled scores to describe the performance of the norming sample.

Table 16: Descriptive Statistics for Scaled Scores by Grade for the Norming Sample on the Unified Scale

	Fall Unified Scaled Scores				Spring Unified Scaled Scores			
Grade	N	Mean	Standard Deviation	Median	N	Mean	Standard Deviation	Median
1	11,120	745	55	740	10,860	830	66	837
2	11,900	831	62	834	10,630	897	68	909
3	8,850	885	65	894	8,350	946	70	958
4	6,340	933	71	943	5,830	978	79	991
5	3,610	964	71	973	3,490	988	83	996
6	1,610	971	75	978	1,550	975	85	979
7	1,230	979	76	981	1,190	996	84	996
8	1,200	993	80	994	1,150	1012	86	1013

Growth Norms

Student achievement typically is thought of in terms of status: a student's performance at one point in time. However, this ignores important information about a student's learning trajectory—how much students are growing over a period of time. When educators are able to consider growth information—the amount or rate of change over time—alongside current status, a richer picture of the student emerges, empowering educators to make better instructional decisions.

To facilitate deeper understanding of achievement, Renaissance Learning maintains growth norms for Star adaptive Assessments that provide insight both on growth to date and likely growth in the future. Growth norms are currently available for both English and Spanish versions of Star Math, Star Reading, and Star Early Literacy.

The growth model used by Star Assessments is Student Growth Percentile (Betebenner, 2009). SGPs were developed by Dr. Damian Betebenner, originally in partnership with several state departments of education.[1] It should be noted that the initial development of SGP involved annual state summative tests with reasonably constrained testing periods within each state. Because Star tests may be taken at multiple times throughout the year, a number of adaptations to the original model were made. For more information about Star SGPs, please refer to this overview: http://doc.renlearn.com/KMNet/R00571375CF86BBF.pdf.

SGPs are norm-referenced estimates that compare a student's growth to that of his or her academic peers nationwide. Academic peers are defined as those students in the same grade[2] with a similar score history. SGPs are generated via a process that uses quantile regression to provide a measure of how much a student changed from one Star testing window to the next relative to other students with similar score histories.

SGPs range from 1–99 and are interpreted similarly to Percentile Ranks, with 50 indicating typical or expected growth. For instance, an SGP score of 37 means that a student grew as much or more than 37 percent of her academic peers, and less than about 63 percent of her academic peers. The Star SGP package also produces a range of future growth estimates. Those are mostly hidden from users but are presented in goal-setting and related applications to help users understand what typical or expected growth looks like for a given student. At present, the Star Math Spanish SGP growth norms are based on a sample of about 235,000 student records across grades 1–8.

1. Core SGP documentation and source code are publicly available at https://cran.r-project.org/web/packages/SGP/index.html.
2. In rare instances, for some grade and testing window combinations, data may be pooled across nearby grades in order to increase sample sizes.

Score Definitions

This chapter enumerates the scores reported by Star Math Spanish, including scaled scores, norm-referenced, and criterion-referenced scores.

Types of Test Scores

In a broad sense, Star Math Spanish software provides three different types of test scores that measure student performance in different ways:

- *Scaled scores.* Star Math Spanish creates a virtually unlimited number of test forms as it dynamically interacts with the students taking the test. In order to make the results of all tests comparable, and in order to provide a basis for deriving the other types of test scores described below, it is necessary to convert the results of Star Math Spanish tests to scores on a common scale. Star Math Spanish software does this in two steps. First, maximum likelihood is used to estimate each student's score on the Rasch ability scale, based on the difficulty of the items administered, and the pattern of right and wrong answers. In the case that a student gets all items right or wrong, a proprietary Bayesian-modal item response theory estimation method is used. Second, the Rasch ability scores are converted to scaled scores. The score scale on which the scaled scores are reported is known as the "Unified" score scale.

  Unified Scale Scores

  Renaissance developed a single score scale that applies to all Star assessments: the Unified score scale. That development began with equating each test's underlying Rasch ability scales to a common Rasch scale; the result was the "Unified Rasch scale," which is an extension of the Rasch scale used in Star Reading. The next step was to develop an integer scale based on the unified Rasch scale, with scale scores anchored to important points on the original Enterprise score scales that were developed for Star Math and Star Reading. The end result was a reported score scale that extends from 200–1400.

  Star Math, Star Reading, Star Reading Spanish, and Star Math Spanish report Unified scale scores that range from 600–1400. Star Early Literacy and Star Early Literacy Spanish report Unified scale scores that range from 200–1100. One benefit of the Unified scale is an improvement in certain properties of the scale scores: test scores are much less variable from grade to grade; measurement error is likewise less variable; and Unified

score reliability is slightly higher than that of the Enterprise scores. The Unified score scale is the only scale used to report results for Star Spanish assessments.

- *Criterion-referenced scores* describe what a student knows or can do, relative to a specific content domain or to a standard. Such scores may be expressed either on a continuous score scale or as a classification. An example of a criterion-referenced score on a continuous scale is a percent-correct score, which expresses what proportion of test questions the student can answer correctly in the content domain. An example of a criterion-referenced classification is a proficiency category on a standards-based assessment: the student may be said to be "proficient" or not, depending on whether his score equals, exceeds, or falls below a specific criterion (the "standard") used to define "proficiency" on the standards-based test. The domain scores and mastery classification charts in the Diagnostic Report are criterion-referenced.
- *Norm-referenced scores* compare a student's test results to the results of other students who have taken the same test. In this case, scores provide a relative measure of student achievement compared to the performance of a group of students at a given time. Percentile Ranks and Grade Equivalents are the two primary norm-referenced scores provided by Star Math Spanish software. Both of these scores are based on a comparison of a student's test results to the data collected during the 2018 Star Math Spanish norming program.

Grade Equivalent (GE)

A Grade Equivalent (GE) indicates the normal grade placement of students for whom a particular score is typical. If a student receives a GE of 8.0, this means that the student scored as well on Star Math Spanish as did the typical student at the beginning of grade 8. It does not necessarily mean that the student has mastered math objectives at an eighth-grade level—only that he or she obtained a Scaled Score as high as the average beginning eighth-grade student in the norms group.

GE scores are often misinterpreted as though they convey information about what a student knows or can do—that is, as if they were criterion-referenced scores. To the contrary, GE scores are norm-referenced.

GEs in Star Math Spanish range from 1.0 to 8.9. The scale divides the academic year into 10 monthly increments and is expressed as a decimal with the unit denoting the grade level and the individual "months" in tenths.

Table 17 indicates how the GE scale corresponds to the various calendar months. For example, if a student obtained a GE of 4.6 on a Star Math Spanish assessment, this would suggest that the student was performing similarly to the average student in the fourth grade at the sixth month (March) of the academic year. Because Star Math Spanish norms are based on fall and spring score data only, monthly GE scores are derived through interpolation by fitting a curve to the grade-by-grade medians.

Table 18 on page 61 contains the Star Math Spanish Scaled Score to GE conversions for the Unified Scaled Scores.

Table 17: Incremental Grade Placement Values per Month

Month	Decimal Increment	Month	Decimal Increment
July	0.0 or 0.99[a]	January	0.4
August	0.0 or 0.99	February	0.5
September	0.0	March	0.6
October	0.1	April	0.7
November	0.2	May	0.8
December	0.3	June	0.9

a. Depends on the school year entered.

The GE scale is not an equal-interval scale. For example, an increase of 50 Scaled Score points might represent only three or four months of GE change at the lower grades, but this same increase in Scaled Scores may signify over a year of GE change in higher grades. This occurs because student growth in math proficiency (and other academic areas) is not linear; proficiency develops much more rapidly in the lower grades than in the middle to upper grades. Consideration of this phenomenon should be made when averaging GE scores, especially those spanning two or more grades.

Comparing Star Math Spanish GEs with Those from Conventional Tests

Because Star Math Spanish adapts to the proficiency level of the student being tested, the GE scores that Star Math Spanish provides are more consistently accurate across the achievement spectrum than those provided by conventional paper-and-pencil test instruments. In addition, Grade Equivalent scores obtained using conventional test instruments are less accurate when a student's grade placement and GE score differ markedly. It is not uncommon for a fourth-grade student to obtain a GE score of 8.9 when using a conventional test instrument. However, this does not necessarily

mean that the student is performing at a level typical of an end-of-year eighth-grader.

More likely, it means that the student answered all, or nearly all, of the items correctly on the conventional test and thus performed beyond the range of the fourth-grade test.

On the other hand, Star Math Spanish GE scores are more consistently accurate, even as a student's achievement level deviates from the level of grade placement. A student may be tested on any level of material up to three grade levels above grade placement, depending upon his or her actual performance on the test. Throughout a Star Math Spanish test, students are tested on items of an appropriate level of difficulty, based on their individual level of achievement.

Percentile Rank (PR)

Percentile Rank (PR) scores indicate the percentage of students in the same grade and at the same point of time in the school year who obtained scores lower than the score of a particular student. In other words, Percentile Ranks show how an individual student's performance compares to that of his or her same-grade peers in the norms group. For example, a Percentile Rank of 85 means that the student is performing at a level that exceeds 85% of other students in that grade at the same time of the year. Percentile Ranks simply indicate how a student performed compared to others who took Star Math Spanish tests as a part of the 2018 Star Math Spanish norming study. PRs range from 1–99.

The PR scale is not an equal-interval scale. For example, a grade placement of 7.0 and a Star Math Spanish Unified Scaled Score of 1002 correspond to a PR of 80, and, using the same grade placement, a Star Math Spanish Unified Scaled Score of 1034 corresponds to a PR of 90. Thus, a difference of 32 Scaled Score points represents a 10-point difference in PR.

However, for another student at the same grade placement, a Scaled Score of 930 corresponds to a PR of 50, and a Star Math Spanish Unified Scaled Score of 953 corresponds to a PR of 60. While there is now only a 23-point difference in Scaled Scores, there is still a 10-point difference in PR. For this reason, PR scores should not be averaged or otherwise algebraically manipulated. NCE scores, described below, are much more appropriate for these types of calculations.

Table 19 on page 63 contains abridged versions of the Unified Scaled Score to Percentile Rank conversion tables used by Star Math Spanish. The

unabridged table includes data for all of the monthly grade placement values from 1.0–8.9. Because the norming of Star Math Spanish occurred in the fall and the spring, the first-month and last-month are empirically based, and the remaining monthly values were estimated by interpolating between the empirical points for the Fall and Spring norms.

Normal Curve Equivalent (NCE)

Normal Curve Equivalents (NCEs) are scores that have been scaled in such a way that they have a normal distribution, with a mean of 50 and a standard deviation of 21.06 in the norming sample for a specific grade for a given test. Because NCEs range from 1 to 99, they appear similar to Percentile Ranks, but they have the advantage of being based on an equal interval scale. That is, the difference between two successive scores on the scale has the same meaning throughout the scale. Because of this feature, NCEs are useful for purposes of statistically manipulating norm-referenced test results, such as interpolating test scores, calculating averages, and computing correlation coefficients between different tests. For example, in Star Math Spanish score reports, average Percentile Ranks are obtained by first converting the PR values to NCE values, averaging the NCE values, and then converting the average NCE back to a PR.

Table 20 on page 67 lists the NCEs corresponding to integer PR values and facilitates the conversion of PRs to NCEs. Table 21 on page 68 provides the conversions from NCE to PR. The NCE values are given as a range of scores that convert to the corresponding PR value.

Student Growth Percentile (SGP)

Student Growth Percentiles (SGPs) are a norm-referenced quantification of individual student growth derived using quantile regression techniques. An SGP compares a student's growth to that of his or her academic peers nationwide with a similar achievement history on Star assessments. Academic peers are students who

- are in the same grade,[1]
- had the same scores on the current test and (up to) two prior tests from different testing windows, and
- took the most recent test and the first prior test on the same dates.

1. In rare instances, for some grade and testing window combinations, data may be pooled across nearby grades in order to increase sample sizes.

SGPs provide a measure of how a student changed from one Star testing window[2] to the next relative to other students with similar starting Star Reading Spanish scores. SGPs range from 1–99 and interpretation is similar to that of Percentile Rank scores; lower numbers indicate lower relative growth and higher numbers show higher relative growth. For example, an SGP of 70 means that the student's growth from one test window to another exceeds the growth of 70% of students nationwide in the same grade with a similar Star Reading Spanish score history. All students, no matter their starting Star score, have an equal chance to demonstrate growth at any of the 99 percentiles.

SGPs are often used to indicate whether a student's growth is more or less than can be expected. For example, without an SGP, a teacher would not know if a Scaled Score increase of 100 points represents good, not-so-good, or average growth. This is because students of differing achievement levels in different grades grow at different rates relative to the Star Reading Spanish scale. For example, a high-achieving second-grader grows at a different rate than a low-achieving second-grader. Similarly, a high-achieving second-grader grows at a different rate than a high-achieving eighth-grader.

SGPs can be aggregated to describe typical growth for groups of students—for example, a class, grade, or school as a whole—by calculating the group's median, or middle, growth percentile. No matter how SGPs are aggregated, whether at the class, grade, or school level, the statistic and its interpretation remain the same. For example, if the students in one class have a median SGP of 62, that particular group of students, on average, achieved higher growth than their academic peers.

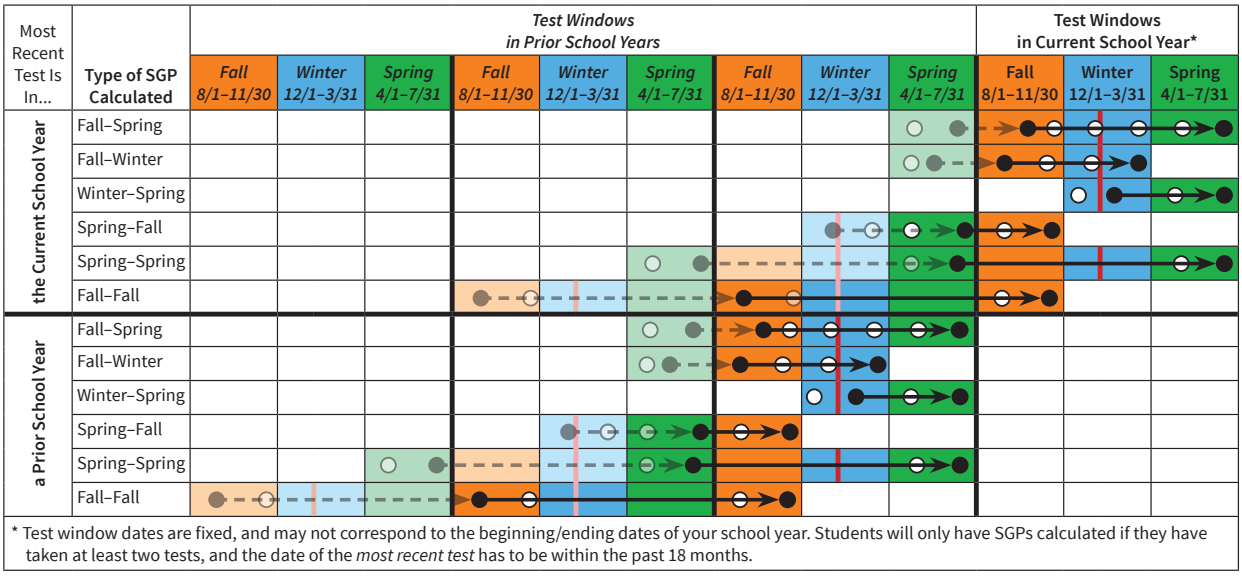
SGP is calculated for students who have taken at least two tests (a *current* test and a *prior* test) within at least two different testing windows (Fall, Winter, or Spring).

If a student has taken more than one test in a single test window, the SGP calculation is based off the following tests:

- The current test is always the last test taken in a testing window.
- The test used as the prior test depends on what testing window it falls in:
  - Fall window: The first test taken in the Fall window is used.

2. We collect data for our growth norms during three different time periods: fall, winter, and spring. More information about these time periods is provided on page 58.

- Winter window: The test taken closest to January 15 in the Winter window is used.
- Spring window: The last test taken in the Spring window is used.



Test Window	If more than one test was taken in a prior test window, which is used to calculate SGP?
Fall Window	First test taken
Winter Window	Test closest to 1/15 (red line)
Spring Window	Last test taken

Grade Placement

Star Math Spanish software uses students' grade placement values when determining norm-referenced scores. The values of PR (Percentile Rank) and NCE (Normal Curve Equivalent) are based not only on what Scaled Score the student achieved, but also on the grade placement of the student at the time of the test. For example, a second-grader in the seventh month with a Scaled Score of 966 would have a PR of 92, while a third-grader in the seventh month with the same Scaled Score would have a PR of 65.

Thus, it is crucial that student records indicate the proper grade and month within grade when students take a Star Math Spanish test, and that any testing in July or August reflects the proper understanding of how Star software deals with those months in determining grade placement.

Indicating the Appropriate Grade Placement

The numeric representation of a student's grade placement is based on the specific month in which he or she takes a test. Although teachers indicate a student's grade level or Math Instructional Level (MIL) using whole numbers, the Star Math Spanish software automatically adds fractional increments to that grade based on the month of the test. To determine the appropriate increment, Star Math Spanish considers the standard school year to run from September–June and assigns increment values of 0.0–0.9 to these months. The increment values for July and August depend on the school year setting:

- If teachers will use the July and August test scores to evaluate the student's math performance at the beginning of the year, in the Renaissance program, make sure the start date for that school year is before your testing in July and August. Grades are automatically increased by one level in each successive school year, so promoting students is not necessary. In this case, the increment value for July and August is 0.00 because these months are at the beginning of the school year.
- If teachers will use the test scores to evaluate the student's math performance at the end of the school year, make sure the end date for that school year falls after your testing in July and August. In this case, the increment value for July and August is 0.99 because these months are at the end of the school year that has passed.

Table 17 on page 54 summarizes the increment values assigned to each month.

If your school follows the standard school calendar used in Star Math Spanish and you will not be testing in the summer, assigning the appropriate grade placements for your students is automatic.

However, if you're going to test students in July or August, whether it is for a summer program or because your normal calendar extends into these months, grade placements become an extremely important issue.

To ensure the accurate determination of norm-referenced scores when testing in the summer, you must determine whether to include the summer months in the past school year or in the next school year. Student grade levels are automatically increased in the new school year. In most cases, you can use the above guidelines.

Instructions for specifying school years and grade assignments can be found at https://help.renaissance.com/RP (original platform) and https://help2.renaissance.com/setup (Renaissance Growth Platform).

Compensating for Incorrect Grade Placements

Teachers cannot make retroactive corrections to a student's grade placement by editing the grade assignments in a student's record or by adjusting the increments for the summer months after students have tested. In other words, the Star Math Spanish software cannot go back in time and correct scores resulting from erroneous grade placement information. Thus, it is extremely important for the test administrator to make sure that the proper grade placement procedures are followed.

Conversion Tables

Table 18: Scaled Score to Grade Equivalent Conversions

Grade Equivalent	Unified Scaled Score	
	Low	High
1	600	762
1.1	763	773
1.2	774	783
1.3	784	794
1.4	795	803
1.5	804	813
1.6	814	822
1.7	823	831
1.8	832	839
1.9	840	847
2	848	855
2.1	856	862
2.2	863	869
2.3	870	876
2.4	877	882
2.5	883	888
2.6	889	894
2.7	895	900
2.8	901	905
2.9	906	910
3	911	914
3.1	915	919
3.2	920	923
3.3	924	927
3.4	928	930
3.5	931	934
3.6	935	937
3.7	938	940

Table 18: Scaled Score to Grade Equivalent Conversions

Grade Equivalent	Unified Scaled Score	
	Low	High
3.8	941	943
3.9	944	945
4	946	947
4.1	948	950
4.2	951	952
4.3	953	953
4.4	954	955
4.5	956	956
4.6	957	958
4.7	959	959
4.8	960	960
4.9	961	961
5	962	962
5.1	963	963
5.2	964	964
5.3	965	965
5.4	966	966
5.5	967	967
5.6	968	968
5.7	969	969
5.8	970	970
5.9	971	971
6	972	972
6.1	973	973
6.2	974	974
6.3	975	975
6.4	976	976
6.5	977	977
6.6	978	978
6.7	979	979
6.8	980	980

Table 18: Scaled Score to Grade Equivalent Conversions

Grade Equivalent	Unified Scaled Score	
	Low	High
6.9	981	981
7	982	982
7.1	983	983
7.2	984	984
7.3	985	985
7.4	986	986
7.5	987	987
7.6	988	988
7.7	989	989
7.8	990	990
7.9	991	991
8	992	992
8.1	993	993
8.2	994	994
8.3	995	995
8.4	996	996
8.5	997	997
8.6	998	998
8.7	999	999
8.8	1000	1000
8.9	1001	1001
> 8.9	1002	1400

Table 19: Scaled Score to Percentile Ranks Conversion by Grade on the Unified Scale

PR	Grade (First Month)							
	1	2	3	4	5	6	7	8
1	600	600	600	600	600	600	600	600
2	687	742	776	792	804	774	778	778
3	694	756	783	802	814	792	787	804
4	701	764	790	810	825	797	795	814
5	706	769	795	817	831	806	798	822

Table 19: Scaled Score to Percentile Ranks Conversion by Grade on the Unified Scale

PR	Grade (First Month)							
	1	2	3	4	5	6	7	8
6	709	773	799	824	837	814	811	827
7	714	776	804	830	842	819	818	833
8	718	779	808	836	849	822	821	840
9	721	782	811	841	856	827	829	845
10	726	784	814	845	861	830	833	848
11	729	786	817	850	866	832	837	850
12	734	788	820	855	873	836	840	853
13	736	790	823	859	878	841	843	856
14	740	792	826	863	883	848	848	858
15	743	794	829	867	888	852	851	861
16	746	796	831	871	893	858	855	868
17	749	798	833	873	897	862	858	872
18	752	800	836	876	900	864	860	878
19	755	801	838	880	905	865	862	881
20	758	803	840	883	908	868	865	885
21	760	805	842	886	911	870	867	887
22	762	806	844	888	914	872	871	890
23	764	808	846	892	917	875	874	892
24	765	809	848	895	920	879	876	894
25	767	811	851	897	923	881	878	895
26	768	812	852	900	924	883	879	897
27	769	813	855	902	926	884	883	899
28	771	815	857	905	929	886	886	903
29	772	816	858	907	931	889	887	905
30	773	817	860	910	934	890	890	909
31	774	819	862	912	937	892	891	912
32	775	820	864	914	939	896	894	914
33	777	821	866	916	941	898	896	915
34	778	822	868	918	943	901	897	917
35	779	823	869	919	945	903	900	919
36	780	824	871	921	946	907	901	921
37	781	826	873	923	949	909	902	924

Table 19: Scaled Score to Percentile Ranks Conversion by Grade on the Unified Scale

	Grade (First Month)							
PR	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
38	782	827	874	925	951	911	904	925
39	783	828	876	927	953	913	907	928
40	784	829	878	928	954	915	909	930
41	785	830	880	930	956	918	912	931
42	786	831	882	931	958	920	914	933
43	787	833	883	933	960	922	917	935
44	788	834	885	935	962	923	918	—
45	789	835	887	936	964	925	920	937
46	—	836	889	938	966	927	921	939
47	790	838	891	939	968	929	925	941
48	—	839	893	941	970	931	926	944
49	791	840	894	942	972	933	928	946
50	793	841	896	944	973	936	930	948
51	794	843	898	946	975	937	932	950
52	795	844	899	947	977	940	934	952
53	796	845	901	948	978	942	936	953
54	—	847	903	950	980	945	939	956
55	797	848	904	951	982	946	942	958
56	798	850	906	952	984	948	944	962
57	799	851	907	954	985	950	947	965
58	800	852	909	955	988	953	948	967
59	801	854	910	957	990	957	950	970
60	802	855	911	959	991	958	953	973
61	803	857	913	960	993	960	956	976
62	804	858	914	962	995	962	957	980
63	805	860	916	964	996	964	959	983
64	806	861	918	965	998	969	961	986
65	807	863	919	967	1000	972	962	990
66	808	865	921	968	1002	973	964	992
67	809	866	922	970	1004	975	966	994
68	810	868	924	972	1005	978	969	997
69	811	869	925	974	1007	981	972	999

Table 19: Scaled Score to Percentile Ranks Conversion by Grade on the Unified Scale

PR	Grade (First Month)							
	1	2	3	4	5	6	7	8
70	812	871	926	976	1009	983	974	1001
71	813	873	928	977	1010	987	976	1004
72	814	875	930	980	1012	990	978	1007
73	815	876	931	981	1013	993	982	1008
74	816	878	933	983	1015	996	984	1011
75	—	880	934	985	1017	998	986	1013
76	817	882	936	986	1018	1002	990	1016
77	819	883	937	988	1020	1004	992	1019
78	820	885	939	990	1021	1005	995	1020
79	822	887	941	992	1024	1007	997	1024
80	823	889	943	993	1026	1010	1002	1026
81	824	891	945	995	1028	1013	1005	1029
82	826	893	946	996	1029	1015	1008	1030
83	827	895	949	999	1031	1020	1011	1033
84	829	898	951	1001	1034	1024	1015	1035
85	830	900	952	1003	1036	1027	1017	1039
86	832	902	955	1005	1038	1030	1020	1040
87	835	904	957	1007	1040	1034	1026	1043
88	836	906	960	1009	1043	1037	1031	1047
89	839	909	962	1011	1045	1040	1033	1049
90	841	912	965	1014	1047	1043	1034	1051
91	844	915	967	1017	1051	1048	1038	1054
92	847	918	970	1019	1054	1052	1043	1056
93	850	922	974	1023	1058	1053	1049	1059
94	854	927	978	1027	1061	1056	1052	1064
95	859	931	983	1030	1064	1059	1057	1068
96	865	937	988	1036	1069	1062	1064	1073
97	871	943	994	1041	1075	1067	1075	1084
98	880	950	1001	1048	1082	1073	1083	1100
99	895	963	1013	1061	1094	1087	1097	1112

Table 20: Percentile Rank to Normal Curve Equivalent Conversions

PR	NCE	PR	NCE	PR	NCE	PR	NCE
1	1.0	26	36.5	51	50.5	76	64.9
2	6.7	27	37.1	52	51.1	77	65.6
3	10.4	28	37.7	53	51.6	78	66.3
4	13.1	29	38.3	54	52.1	79	67.0
5	15.4	30	39.0	55	52.6	80	67.7
6	17.3	31	39.6	56	53.2	81	68.5
7	18.9	32	40.1	57	53.7	82	69.3
8	20.4	33	40.7	58	54.2	83	70.1
9	21.8	34	41.3	59	54.8	84	70.9
10	23.0	35	41.9	60	55.3	85	71.8
11	24.2	36	42.5	61	55.9	86	72.8
12	25.3	37	43.0	62	56.4	87	73.7
13	26.3	38	43.6	63	57.0	88	74.7
14	27.2	39	44.1	64	57.5	89	75.8
15	28.2	40	44.7	65	58.1	90	77.0
16	29.1	41	45.2	66	58.7	91	78.2
17	29.9	42	45.8	67	59.3	92	79.6
18	30.7	43	46.3	68	59.9	93	81.1
19	31.5	44	46.8	69	60.4	94	82.7
20	32.3	45	47.4	70	61.0	95	84.6
21	33.0	46	47.9	71	61.7	96	86.9
22	33.7	47	48.4	72	62.3	97	89.6
23	34.4	48	48.9	73	62.9	98	93.3
24	35.1	49	49.5	74	63.5	99	99.0
25	35.8	50	50.0	75	64.2		

Table 21: Normal Curve Equivalent to Percentile Rank Conversions

NCE Range Low–High	PR	NCE Range Low–High	PR	NCE Range Low–High	PR	NCE Range Low–High	PR
1.0–4.0	1	36.1–36.7	26	50.3–50.7	51	64.6–65.1	76
4.1–8.5	2	36.8–37.3	27	50.8–51.2	52	65.2–65.8	77
8.6–11.7	3	37.4–38.0	28	51.3–51.8	53	65.9–66.5	78
11.8–14.1	4	38.1–38.6	29	51.9–52.3	54	66.6–67.3	79
14.2–16.2	5	38.7–39.2	30	52.4–52.8	55	67.4–68.0	80
16.3–18.0	6	39.3–39.8	31	52.9–53.4	56	68.1–68.6	81
18.1–19.6	7	39.9–40.4	32	53.5–53.9	57	68.7–69.6	82
19.7–21.0	8	40.5–40.9	33	54.0–54.4	58	69.7–70.4	83
21.1–22.3	9	41.0–41.5	34	54.5–55.0	59	70.5–71.3	84
22.4–23.5	10	41.6–42.1	35	55.1–55.5	60	71.4–72.2	85
23.6–24.6	11	42.2–42.7	36	55.6–56.1	61	72.3–73.1	86
24.7–25.7	12	42.8–43.2	37	56.2–56.6	62	73.2–74.1	87
25.8–26.7	13	43.3–43.8	38	56.7–57.2	63	74.2–75.2	88
26.8–27.6	14	43.9–44.3	39	57.3–57.8	64	75.3–76.3	89
27.7–28.5	15	44.4–44.9	40	57.9–58.3	65	76.4–77.5	90
28.6–29.4	16	45.0–45.4	41	58.4–58.9	66	77.6–78.8	91
29.5–30.2	17	45.5–45.9	42	59.0–59.5	67	78.9–80.2	92
30.3–31.0	18	46.0–46.5	43	59.6–60.1	68	80.3–81.7	93
31.1–31.8	19	46.6–47.0	44	60.2–60.7	69	81.8–83.5	94
31.9–32.6	20	47.1–47.5	45	60.8–61.3	70	83.6–85.5	95
32.7–33.3	21	47.6–48.1	46	61.4–61.9	71	85.6–88.0	96
33.4–34.0	22	48.2–48.6	47	62.0–62.5	72	88.1–91.0	97
34.1–34.7	23	48.7–49.1	48	62.6–63.1	73	91.1–95.4	98
34.8–35.4	24	49.2–49.7	49	63.2–63.8	74	95.5–99.0	99
35.5–36.0	25	49.8–50.2	50	63.9–64.5	75		

Appendix A: Star Math Spanish Blueprint Skills

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations	Count with objects and numbers	Count objects grouped in tens and ones
		Determine one more than or one less than a given number across decades
		Count on by ones from a number less than 100
		Count back by ones from a number less than 20
		Complete a skip pattern starting from a multiple of 2, 5, or 10
		Count on by 100s from any number
		Count objects to 20
		Identify a number to 20 represented by a point on a number line
		Determine one more than or one less than a given number
		Count by 2s to 50 starting from a multiple of 2
		Count objects grouped in tens and ones
		Locate a number to 20 on a number line
		Determine ten more than or ten less than a given number
		Count by 5s or 10s to 100 starting from a multiple of 5 or 10, respectively
		Complete a sequence of numbers to 10
		Answer a question involving an ordinal number up to “tenth”
		Complete a skip pattern of 2 or 5 starting from any number
		Complete a skip pattern of 10 starting from any number
	Identify odd and even numbers	Identify odd and even numbers less than 100
	Identify, compare, and order fractions	Compare monomial numerical expressions using the properties of powers
		Estimate fractions of a whole
		Identify a fraction equivalent to a given fraction
		Locate a mixed number on a number line

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Identify, compare, and order fractions (continued)	Determine a pictorial model of a fraction of a set of objects
		Locate a fraction on a number line
		Identify equivalent fractions using models
		Identify a fraction represented by a point on a number line
		Compare fractions using models
		Determine a pictorial model of a fraction of a whole
		Order fractions using models
		Compare fractions with unlike denominators
		Order fractions with unlike denominators in ascending or descending order
		Compare fractions with like denominators
	Relate a decimal number to a percent	Convert a decimal number in thousandths to a percentage
		Convert a percentage to its decimal equivalent
		Convert a decimal number to a percentage
	Relate a decimal to a fraction	Compare expressions involving unlike forms of real numbers
		Convert a fraction or mixed number in hundredths or thousandths to a decimal number
		Convert a decimal number in hundredths or thousandths to a fraction
		Compare numbers in decimal and fractional forms
		Determine the decimal number equivalent to a fraction model
		Determine the fraction equivalent to a decimal number model
	Relate place and value to a decimal number	Relate a decimal number through ten-thousandths to its word form
		Identify the place of a digit in a decimal number through hundredths
		Estimate a decimal number from its position on a number line
		Round a decimal number to a specified place through hundredths
		Read a decimal number through the hundredths place
		Locate a decimal number to tenths on a number line
		Represent a decimal number in expanded form using powers of ten
		Determine the decimal number represented in expanded form using powers of ten
		Identify a pictorial model of tenths or hundredths of a decimal number
		Compare decimal numbers through the hundredths place

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Relate place and value to a decimal number (continued)	Compare decimal numbers of differing places to thousandths
		Order decimal numbers through the hundredths place
		Order numbers in decimal and fractional forms
		Order decimal numbers of differing places to thousandths in ascending or descending order
		Convert a number less than 1 to scientific notation
		Convert a number less than 1 from scientific notation to standard form
		Determine the decimal number from a pictorial model of tenths or hundredths
		Identify a decimal number to tenths represented by a point on a number line
	Relate place and value to a whole number	Relate a whole number to the word form of the number to 100
		Order whole numbers to 1,000 in ascending or descending order
		Relate a 3-digit whole number to its word form
		Identify the place of a digit in a 3-digit number
		Represent a 3-digit whole number in expanded form
		Order 4-digit whole numbers in ascending or descending order
		Relate a 4- or 5-digit whole number to its word form
		Represent a 4-digit whole number in expanded form
		Order 4- to 6-digit whole numbers in ascending or descending order
		Relate a 7- to 10-digit whole number to the word form of the number
		Determine the value of a digit in a 6-digit number
		Represent a 5-digit whole number in expanded form
		Convert a whole number greater than 10 to scientific notation
		Determine the value of a digit in a 4- or 5-digit whole number
		Determine which digit is in a specified place in a 4- or 5-digit whole number
		Compare whole numbers to 100 using words
		Order whole numbers to 100 in ascending order
		Determine the 3-digit number represented as hundreds, tens, and ones
		Round a 4- to 6-digit whole number to a specified place
		Represent a 2-digit number as tens and ones
		Compare whole numbers to 1,000 using the symbols <, >, and =

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Relate place and value to a whole number (continued)	Determine the value of a digit in a 2-digit number
		Represent a 3-digit number as hundreds, tens, and ones
		Determine the 4-digit whole number represented in thousands, hundreds, tens, and ones
		Determine the 2-digit number represented as tens and ones
		Recognize equivalent forms of a 3-digit number using hundreds, tens, and ones
		Represent a 4-digit whole number as thousands, hundreds, tens, and ones
		Determine the 4- or 5-digit whole number represented in expanded form
		Compare 4- or 5-digit whole numbers using the symbols <, >, and =
		Determine the expanded form, written in powers of ten, of a whole number to 1,000,000
	Add and subtract fractions with like denominators	Add fractions with like 1-digit denominators
		Subtract fractions with like 1-digit denominators
		WP: Add fractions with like denominators no greater than 10 and simplify the sum
		WP: Subtract fractions with like denominators no greater than 10
		WP: Subtract fractions with like denominators no greater than 10 and simplify the difference
		WP: Subtract fractions with like denominators and simplify the difference
		WP: Add mixed numbers with like denominators and simplify the sum
		WP: Subtract mixed numbers with like denominators and simplify the difference
		WP: Add fractions with like denominators and simplify the sum
	Add and subtract fractions with unlike denominators	Add fractions with unlike 1-digit denominators
		Subtract fractions with unlike 1-digit denominators
		Add mixed numbers with unlike denominators
		Subtract mixed numbers with unlike denominators
		Add fractions with unlike denominators that have factors in common and simplify the sum
		Add fractions with unlike denominators that have no factors in common
		Subtract fractions with unlike denominators that have factors in common and simplify the difference

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Add and subtract fractions with unlike denominators (continued)	Subtract fractions with unlike denominators that have no factors in common
		Add fractions with unlike denominators and do not simplify the sum
		Estimate the sum of fractions with unlike 1-digit denominators
		Estimate the difference between fractions with unlike 1-digit denominators
		Estimate the sum of mixed numbers
		Estimate the difference between mixed numbers with unlike denominators
		WP: Add fractions with unlike 1-digit denominators
		WP: Subtract fractions with unlike 1-digit denominators
		WP: Add mixed numbers with unlike denominators
		WP: Subtract mixed numbers with unlike denominators
	Add and subtract whole numbers with regrouping	Add three 1-digit numbers
		Add a 2-digit number and a 1- or 2-digit number with regrouping
		Subtract a 1- or 2-digit number from a 2-digit number with one regrouping
		Subtract a 2- or 3-digit number from a 3-digit number with two regroupings
		Add four 1- to 4-digit whole numbers
		Subtract two 2- to 6-digit whole numbers
		Add 2- and 3-digit numbers with no more than one regrouping
		Add 3- and 4-digit whole numbers with regrouping
		Subtract 3- and 4-digit whole numbers with regrouping
		Add two 3-digit numbers with one regrouping
		Subtract a 1- or 2-digit number from a 3-digit number with one regrouping
		Subtract a 3-digit number from a 3-digit number with one regrouping
		Determine a number pair that totals 100
		Subtract a smaller number from a 3- or 4-digit whole number in expanded form
		WP: Add a 2-digit number and a 1- or 2-digit number with regrouping
		WP: Subtract a 1- or 2-digit number from a 2-digit number with one regrouping
		WP: Add 3- and 4-digit whole numbers with regrouping
		WP: Subtract 3- and 4-digit whole numbers with regrouping

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Add and subtract whole numbers without regrouping (continued)	Determine the missing portion in a partially screened (hidden) collection of up to 10 objects
		Add a 2-digit number and a 1-digit number without regrouping
		Subtract a 1-digit number from a 2-digit number without regrouping
		Know basic addition facts to 10 plus 10
		Know basic subtraction facts to 20 minus 10
		Add two 2-digit numbers without regrouping
		Subtract a 2-digit number from a 2-digit number without regrouping
		Estimate the sum of two 2-digit numbers
		Estimate the difference of whole numbers less than 100
		Estimate a sum or difference of 2- to 4-digit whole numbers using any method
		Estimate a sum or difference of whole numbers to 10,000 by rounding
		Add or subtract zero to or from any number less than 100
		Determine equivalent forms of a number, up to 10
		WP: Use basic addition facts to solve problems
		WP: Use basic subtraction facts to solve problems
		WP: Add a 2-digit number and a 1-digit number without regrouping
		WP: Estimate a sum or difference of two 3- or 4-digit whole numbers using any method
		WP: Subtract a 1-digit number from a 2-digit number without regrouping
		WP: Add two 2-digit numbers without regrouping
		WP: Subtract a 2-digit number from a 2-digit number without regrouping
		WP: Determine a basic addition-fact number sentence for a given situation
		WP: Determine a basic subtraction-fact number sentence for a given situation
		WP: Add two 3-digit numbers without regrouping
		WP: Subtract a 3-digit number from a 3-digit number without regrouping
	Add or Subtract Decimal Numbers	Determine the sum of a whole number and a decimal number to hundredths
		Subtract a decimal number from a whole number
		Determine money amounts that total $10
		Add decimal numbers and whole numbers

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Add or Subtract Decimal Numbers (continued)	Subtract two decimal numbers of differing places to thousandths
		Add two decimal numbers of differing places to thousandths
		Add or subtract cent amounts to or from whole dollar amounts
		Add dollars and cents to cents
		Add dollars and cents to dollars
		Subtract cents from dollars and cents
		Estimate the sum of two decimal numbers
		Estimate the sum of a whole number and a decimal number
		Estimate the difference of two decimal numbers
		Estimate the difference of a whole number and a decimal number
		Estimate the difference of two decimal numbers through thousandths and less than 1 by rounding to a specified place
		Estimate the sum of two decimal numbers through thousandths and less than 1 by rounding to a specified place
		WP: Determine the sum of a decimal number and a whole number
		WP: Subtract a decimal number from a whole number
		WP: Determine the amount of change from whole dollar amounts
		WP: Add or subtract decimal numbers through thousandths
		WP: Add or subtract a decimal number through thousandths and a whole number
		WP: Estimate the sum or difference of two decimal numbers through thousandths using any method
	Convert between an improper fraction and a mixed number	Convert an improper fraction to a mixed number
		Convert a mixed number to an improper fraction
	Determine a square root	Evaluate the positive square root of a perfect square
		Determine an approximate square root of a number
		Determine the square root of a perfect-square fraction or decimal
		Determine the two closest integers to a given square root
		Approximate the location of a square root on a number line
		Determine both square roots of a perfect square

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Divide a whole number resulting in a decimal quotient	Divide a whole number by a 1-digit whole number resulting in a decimal quotient through thousandths
		Divide a whole number by a 2-digit whole number resulting in a decimal quotient through thousandths
		WP: Divide a whole number by a 1- or 2-digit whole number resulting in a decimal quotient
	Divide whole numbers with a remainder in the quotient	Divide a 2- or 3-digit whole number by a 1-digit whole number with a remainder in the quotient
		Divide a multi-digit whole number by a 2-digit whole number, with a remainder and at least one zero in the quotient
		Divide a multi-digit whole number by a 2-digit whole number and express the quotient as a mixed number
		WP: Divide a 2- or 3-digit whole number by a 1-digit whole number with a remainder in the quotient
		WP: Solve a 2-step problem involving whole numbers
		WP: Divide a whole number and interpret the remainder
		WP: Divide a 3-digit whole number by a 1-digit whole number with a remainder in the quotient
	Divide Whole Numbers without a Remainder in the Quotient	Recognize equivalent multiplication or division expressions involving basic facts
		Divide a 2-digit whole number by a 1-digit whole number with no remainder in the quotient
		Divide whole numbers with no remainder in the quotient
		Know basic division facts to 100 ÷ 10
		Know basic division facts for 11 and 12
		Complete a multiplication and division fact family
		Divide a multi-digit whole number by 10 or 100 with no remainder
		Estimate the quotient of a 2-digit whole number divided by a 1-digit whole number with no remainder in the quotient
		Estimate a quotient using any method
		WP: Divide a 2-digit whole number by a 1-digit whole number with no remainder in the quotient
		WP: Divide whole numbers with no remainder in the quotient
		WP: Solve a 2-step whole number problem using more than one operation
		WP: Divide objects into equal groups by sharing
		WP: Estimate a quotient using any method

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Divide Whole Numbers without a Remainder in the Quotient (continued)	WP: Divide using basic facts to 100 ÷ 10
		WP: Divide a 3-digit whole number by a 1-digit whole number with no remainder in the quotient
	Evaluate a Numerical Expression	Evaluate a numerical expression involving one or more exponents and multiple forms of rational numbers
		Simplify a monomial numerical expression involving the square root of a whole number
		Apply the product of powers property to a monomial numerical expression
		Apply the power of a power property to a monomial numerical expression
		Apply the quotient of powers property to monomial numerical expressions
		Multiply monomial numerical expressions involving radicals
		Divide monomial numerical expressions involving radicals
		Multiply a matrix by a scalar
		Add or subtract matrices
		Multiply matrices
		Simplify an nth root
		Add or subtract complex numbers
		Simplify an expression involving a complex denominator
		Determine the logarithmic form of an exponential equation
		Evaluate a logarithm by converting it to exponential form
		Evaluate a multi-step numerical expression involving absolute value
		Add and/or subtract numerical radical expressions
		Multiply a binomial numerical radical expression by a numerical radical expression
		Rationalize the denominator of a numerical radical expression
		Determine the determinant of a matrix
		Simplify an expression with a fractional exponent
		Add and subtract radical expressions
		Write an imaginary number in standard form
		Evaluate a numeric expression involving two operations
		Determine the inverse of a matrix
		Multiply complex numbers

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Evaluate a Numerical Expression (continued)	Determine the magnitude of a vector
		Add or subtract vectors component-wise
		Evaluate a linear combination of vectors
		Evaluate the nth root of a whole number
		Evaluate a whole number raised to a whole number power
		Evaluate a whole number raised to a negative power
		Evaluate a whole number raised to a fractional power
		Evaluate a numerical expression of four or more operations, with parentheses, using order of operations
		Evaluate a numerical expression involving integer exponents and/or integer bases
		Evaluate an integer raised to a whole number power
		Write a whole number raised to a whole number power as a product
	Find prime factors, common factors, and common multiples	Identify the prime factors of a 2-digit number
		Determine the greatest common factor of two whole numbers
		Determine the least common multiple of two whole numbers
	Multiply and divide with decimals	Multiply two decimal numbers
		Divide decimal numbers
		Multiply decimal numbers less than one in hundredths or thousandths
		Divide a decimal number through thousandths by a 1- or 2-digit whole number where the quotient has 2–5 decimal places
		Divide a 1- to 3-digit whole number by a decimal number to tenths where the quotient is a decimal number to thousandths
		Divide a decimal number by a decimal number through thousandths, rounded quotient if needed
		Multiply a decimal number through thousandths by 10, 100, or 1,000
		Divide a decimal number by 10, 100, or 1,000
		Divide a 1- to 3-digit whole number by a decimal number to tenths where the quotient is a whole number
		Divide a 2- or 3-digit whole number by a decimal number to hundredths or thousandths, rounded quotient if needed
		Multiply a decimal number through thousandths by a whole number
		Multiply decimal numbers greater than one where the product has 2 or 3 decimal places

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Multiply and divide with decimals (continued)	WP: Multiply two decimal numbers
		WP: Divide a whole number by a decimal number
		WP: Estimate the product of two decimals
		WP: Multiply a decimal number through thousandths by a whole number
		WP: Divide a decimal through thousandths by a decimal through thousandths, rounded quotient if needed
		WP: Solve a multi-step problem involving decimal numbers
		WP: Divide a decimal number through thousandths by a 1- or 2-digit whole number
		WP: Divide a whole number by a decimal number through thousandths, rounded quotient if needed
		WP: Estimate the quotient of two decimals
		WP: Solve a 2-step problem involving decimals
	Multiply and divide with fractions	Determine the reciprocal of a positive whole number, a proper fraction, or an improper fraction
		Determine the reciprocal of a negative rational number
		Multiply a fraction by a fraction
		Divide a fraction by a fraction
		Multiply mixed numbers
		Divide mixed numbers
		Multiply a mixed number by a fraction
		Multiply a mixed number by a whole number
		Divide a fraction by a whole number resulting in a fractional quotient
		Divide a whole number by a fraction resulting in a fractional quotient
		WP: Multiply or divide a fraction by a fraction
		WP: Multiply or divide two mixed numbers or a mixed number and a fraction
		WP: Solve a 2-step problem involving fractions
		WP: Solve a multi-step problem involving fractions or mixed numbers
	Multiply whole numbers	Multiply a 2-digit whole number by a 1-digit whole number with no regrouping
		Multiply a 2-digit whole number by a 1- or 2-digit whole number with regrouping
		Multiply a 1- or 2-digit whole number by a multiple of 10, 100, or 1,000

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Multiply whole numbers (continued)	Apply the distributive property to multiply a multi-digit number by a 1-digit number
		Multiply a 3- or 4-digit whole number by a 1-digit whole number
		Use a multiplication sentence to represent an area or an array model
		Multiply a 2-digit whole number by a 2-digit whole number
		Know basic multiplication facts to 10 × 10
		Know multiplication tables for 2, 5, and 10
		Know basic multiplication facts for 11 and 12
		Multiply a 1-digit whole number by a multiple of 10 to 100
		Multiply a 3-digit whole number by a 2-digit whole number
		Multiply three 1- and 2-digit whole numbers
		Estimate the product of a 2-digit number and a 1-digit number
		Estimate the product of whole numbers using any method
		WP: Multiply a 2-digit whole number by a 1-digit whole number without regrouping
		WP: Multiply a 2-digit whole number by a 1- or 2-digit whole number
		WP: Multiply whole numbers
		WP: Multiply a multi-digit whole number by a 1-digit whole number
		WP: Solve a multi-step problem involving whole numbers
		WP: Multiply using basic facts to 10 × 10
		WP: Estimate a product of two whole numbers using any method
	Perform operations with integers	Add integers
		Subtract integers
		WP: Add and subtract using integers
		Multiply integers
		Divide integers
		WP: Multiply or divide integers
	Solve a problem involving percents	Determine a percent of a number given a percent that is not a whole percent
		Determine the percent one number is of another number
		Determine a number given a part and a decimal percentage or a percentage more than 100%

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Solve a problem involving percents (continued)	WP: Determine the percent a whole number is of another whole number, with a result less than 100%
		WP: Determine a percent of a whole number using percents less than 100
		WP: Determine a whole number given a part and a percent
		WP: Determine the result of applying a percent of decrease to a value
		WP: Answer a question involving a fraction and a percent
		WP: Determine a given percent of a number
		WP: Determine the percent one number is of another number
		WP: Determine a number given a part and a decimal percentage or a percentage more than 100%
		WP: Determine the percent of decrease applied to a number
		WP: Determine the percent of increase applied to a number
		WP: Determine the result of applying a percent of increase to a value
		WP: Estimate a given percent of a number
	Solve a proportion, rate, or ratio	Determine the percent a whole number is of another whole number
		Determine a given percent of a number
		Determine a whole number given a part and a percent
		Solve a proportion involving whole numbers
		Determine if ratios are equivalent
		Solve a proportion that generates a linear equation
		Solve a proportion that generates a quadratic equation
		Estimate the percent a whole number is of another whole number
		Estimate a given percent of a number
		Estimate a whole number given a part and a percent
		WP: Solve a proportion
		WP: Determine if ratios are equivalent
		WP: Determine the whole, given part-to-part ratio and a part, where the whole is greater than 50
		WP: Determine a unit rate with a whole number value
		WP: Determine a part, given part-to-whole ratio and the whole, where the whole is greater than 50

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Numbers & Operations (continued)	Solve a proportion, rate, or ratio (continued)	WP: Determine a part, given part-to-whole ratio and a part, where the whole is greater than 50
		WP: Determine the whole, given part-to-whole ratio and a part, where the whole is greater than 50
		WP: Determine a part given a ratio and the whole where the whole is less than 50
		WP: Determine the whole given a ratio and a part where the whole is less than 50
		WP: Use a unit rate, with a whole number or whole cent value, to solve a problem
		WP: Determine a part, given part-to-part ratio and the whole, where the whole is greater than 50
		WP: Determine a part, given part-to-part ratio and a part, where the whole is greater than 50
		WP: Determine a unit rate
		WP: Use a unit rate to solve a problem
Algebra	Determine a linear equation	Use a 1-variable, 1-step equation to represent a verbal statement
		Determine an equation for a line given a graph
		Use a 2-variable equation to construct an input-output table
		Use a 2-variable equation to represent a relationship expressed in a table
		Determine an equation of a line in slope-intercept form given the slope and y-intercept
		Determine an equation for a line given the slope of the line and a point on the line that is not the y-intercept
		Determine an equation of a line in point-slope or slope-intercept form given two points on the line
		Determine the slope-intercept form or the standard form of a linear equation
		Determine the table of values that represents a linear equation with rational coefficients in two variables
		Determine a linear equation in two variables that represents a table of values
		Determine an equation for a line that goes through a given point and is parallel or perpendicular to a given line
		WP: Determine a trigonometric function that represents a situation
		Represent a proportional relationship as a linear equation
		Use a table to represent a linear function

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Determine a linear equation (continued)	WP: Determine an exponential function that represents a situation such as exponential growth or decay
		Determine an equation of a line in standard form given the slope and y-intercept
		Determine an equation of a line in standard form given two points on the line
		Determine an equation for a line parallel or perpendicular to a given graphed line
		Use a 2-variable linear equation to represent a situation
		WP: Use a 1-variable equation with rational coefficients to represent a situation involving two operations
		Use a 2-variable equation to represent a situation involving a direct proportion
		WP: Use a 1-variable 1-step equation to represent a situation
		WP: Use a 2-variable equation with rational coefficients to represent a situation
	Determine a system of linear equations	Represent a system of linear equations as a single matrix equation
		WP: Determine a system of linear equations that represents a given situation
	Determine the operation given a situation	WP: Determine the operation needed for a given situation
		Translate a verbal statement into an algebraic equation
		Determine the operation needed to make a number sentence true
		Use a division sentence to represent objects divided into equal groups
		WP: Determine a multiplication or division sentence for a given situation
	Evaluate an algebraic expression or function	Evaluate a 2-variable expression, with two or three operations, using whole number substitution
		Evaluate a 2-variable expression, with two or three operations, using integer substitution
		Evaluate a function written in function notation for a given value
		Write a quadratic equation given its solutions
		Determine values of the inverse of a function using a table or a graph
		WP: Evaluate a 1- or 2-variable expression or formula using whole numbers
	Graph a 1-variable inequality	Relate a 1-variable inequality to its graph

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Graph on a coordinate plane	Relate a graph to a 2-variable linear inequality
		Relate a graph to an equation of a parabola
		Relate a graph of an ellipse centered at the origin to its equation
		Determine the graph of a 1-operation linear function
		Determine the graph of a linear equation given in slope-intercept, point-slope, or standard form
		Determine the graph of a given quadratic function
		Determine the graph of a line using given information
		Determine the graph of a 2-operation linear function
		Determine the slope of a line given its graph or a graph of a line with a given slope
		Use a table to represent the values from a first-quadrant graph
		Determine the graph of a 2-variable absolute value equation
		Determine the graph of the solution set of a system of linear inequalities in two variables
		Determine the graph of a circle given the equation in standard form
		Determine the graph of a hyperbola given the equation in standard form
		Determine the graph of a vertically oriented parabola
		Determine the graph of a horizontally oriented parabola
		Determine the graph of a sine, cosine or tangent function
		Determine a 2-variable linear inequality represented by a graph
		Determine the graph of a 1-variable absolute value inequality
		Graph the inverse of a linear function
		Relate a quadratic inequality in two variables to its graph
		Graph an ellipse
		Determine the graph of a piecewise-defined function
		Determine the component form of a vector represented on a graph
		Relate a graph to a polynomial function given in factored form
		Identify a complex number represented as a vector on a coordinate plane
		Relate a graph to a square or cube root function
		Determine the ordered pair of a point in the first quadrant
		Determine the ordered pair of a point in any quadrant

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Graph on a coordinate plane (continued)	Determine the location of an ordered pair in any quadrant
		WP: Answer a question using the graph of a quadratic function
	Identify characteristics of a linear equation or function	Determine the slope of a line given a table of values
		Determine the slope of a line given the coordinates of two points on the line
		Determine the x- or y-intercept of a line given a 1-variable equation
		WP: Determine a reasonable domain or range for a function in a given situation
		Determine the slope of a line given an equation in point-slope or slope-intercept form
		Determine the x- or y-intercept of a line given its graph
		Determine if a relation is a function
		Determine if a function is linear or nonlinear
		Determine whether a graph or a table represents a linear or nonlinear function
		Determine the independent or dependent variable in a given situation
		Determine the domain or range of a function
		Determine if a table or an equation represents a direct variation, an inverse variation, or neither
		Identify the domain or range of a radical function
		Determine the domain and range of a graphed function
		Determine the domain of a rational function
		Determine the effect of a change in the slope and/or y-intercept on the graph of a line
		Determine the result of a change in a or c on the graph of y=ax^2 + c
		Identify the vertex, axis of symmetry, or direction of the graph of a quadratic function
		Identify the end behavior, asymptotes, excluded values, or behavior near excluded values of a rational function
		WP: Interpret an interest rate, rate of change, initial amount, frequency of compounding and other parameters of an exponential function
		Determine if the inverse of a function is a function
		Determine the equation of the inverse of a linear, rational root, or polynomial function
		Determine the equation of a function resulting from a translation and/or scaling of a given function

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Identify characteristics of a linear equation or function (continued)	Determine the x- or y-intercept of a line given a 2-variable equation
		Determine the slope of a line given the graph of the line
		Determine if lines through points with given coordinates are parallel or perpendicular
		Determine the coordinates of a point through which a line must pass in order to be parallel or perpendicular to a given line
		WP: Interpret the meaning of the slope of a graphed line
		WP: Interpret the meaning of the y-intercept of a graphed line
	Relate a rule to a pattern	Determine the common difference in an arithmetic sequence
		Find a specified term in an arithmetic sequence
		Extend a number pattern involving addition
		Identify a missing term in a multiplication or a division number pattern
		Determine the variable expression with one operation for a table of paired numbers
		Determine the rule for an addition or subtraction number pattern
		Identify a missing figure in a growing pictorial or non-numeric pattern
		Generate a table of paired numbers based on a rule
		Extend a number pattern involving subtraction
		Determine a rule that relates two variables
		Determine the algebraic equation that describes a pattern represented by data in a table
		Find a specified term of an arithmetic sequence given the first term and the common difference
		Find a specified term of an arithmetic sequence
		Find a specified term of an arithmetic sequence given the formula for the nth term
		WP: Solve a problem that can be represented by an arithmetic sequence
		Find a specified term of a geometric sequence
		Find a specified term of a geometric sequence given the first three terms of the sequence
		Extend a number pattern
		Determine the explicit formula for an arithmetic sequence
		Identify a given sequence as arithmetic, geometric, or neither

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Relate a rule to a pattern (continued)	Find a specified term of a binomial expression raised to a positive integer power
		WP: Solve a problem that can be represented by a geometric sequence
		WP: Solve a problem that can be represented by a finite geometric series
		Use inductive reasoning to determine a rule
		WP: Generate a table of paired numbers based on a variable expression with one operation
		WP: Determine the variable expression with one operation for a table of paired numbers
	Simplify an Algebraic Expression	Add or subtract polynomial expressions
		Multiply two binomials
		Factor a common term from a binomial expression
		Simplify a rational expression involving polynomial terms
		Multiply rational expressions
		Divide a polynomial expression by a monomial
		Add or subtract two rational expressions with unlike polynomial denominators
		Simplify an algebraic expression by combining like terms
		Apply the product of powers property to a monomial algebraic expression
		Apply the power of a power property to a monomial algebraic expression
		Apply the power of a product property to a monomial algebraic expression
		Apply the quotient of powers property to monomial algebraic expressions
		Apply the power of a quotient property to monomial algebraic expressions
		Multiply two binomials of the form (ax +/− b)(cx +/− d)
		Factor the GCF from a polynomial expression
		Factor trinomials that result in factors of the form (ax +/− b)(cx +/− d)
		Multiply two monomial algebraic expressions
		Simplify a monomial algebraic radical expression
		Apply terminology related to polynomials
		Multiply two binomials of the form (x +/− a)(x +/− b)
		Simplify a polynomial expression by combining like terms
		Multiply a polynomial by a monomial

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Simplify an Algebraic Expression (continued)	Multiply two binomials of the form (ax +/– by)(cx +/– dy)
		Multiply a trinomial by a binomial
		Factor trinomials that result in factors of the form (x +/– a)(x +/– b)
		Factor a trinomial that results in factors of the form (ax +/– by)(cx +/– dy)
		Factor the difference of two squares
		Factor a perfect-square trinomial
		Multiply monomial algebraic radical expressions
		Divide monomial algebraic radical expressions
		Divide rational expressions
		Divide a polynomial expression by a binomial
		Add or subtract two rational expressions with like denominators
		Add or subtract two rational expressions with unlike monomial denominators
		Determine the composition of two functions
		Represent an algebraic radical expression in exponential form
		Simplify an expression with rational exponents
		Factor a polynomial using long division
		Factor a polynomial by grouping
		Convert between a simple exponential equation and its corresponding logarithmic equation
		Apply properties of exponents to monomial algebraic expressions
		Factor a polynomial that has a GCF and two linear binomial factors
		Rationalize the denominator of an algebraic radical expression
		Add or subtract algebraic radical expressions
		Factor a difference of squares
		Factor the sum or difference of 2 cubes
		Factor a polynomial into a binomial and trinomial
		Simplify a monomial algebraic expression that includes fractional exponents and/or nth roots
		Multiply or divide functions
		Identify equivalent logarithmic expressions using the properties of logarithms

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Solve a linear equation	Determine a missing addend in a number sentence involving 2-digit numbers
		Determine a solution to a 2-variable linear equation
		Determine a missing addend in a basic addition-fact number sentence
		Solve a proportion involving decimals
		Solve a 2-step linear equation involving integers
		Solve a 1-step equation involving whole numbers
		Solve a 1-step linear equation involving integers
		Solve a 1-variable linear equation with the variable on both sides
		Determine a missing subtrahend in a basic subtraction-fact number sentence
		Solve a 1-step equation involving rational numbers
		Solve a 2-step equation involving rational numbers
		Rewrite an equation to solve for a specified variable
		Solve a 1-variable linear equation that requires simplification and has the variable on one side
		Solve a direct or inverse variation problem
		Determine the missing subtrahend in a number sentence involving 3-digit numbers
		Determine the missing dividend or divisor in a number sentence involving basic facts
		WP: Solve a problem involving a 1-variable, 2-step equation
		WP: Determine a missing addend in a basic addition-fact number sentence
		WP: Determine a missing subtrahend in a basic subtraction-fact number sentence
	Solve a Linear Inequality	Determine the solution set of a 1-variable linear inequality
		Determine the graph of the solutions to a 2-step linear inequality in one variable
		Solve a 1-variable linear inequality with the variable on both sides
		Solve a 2-step linear inequality in one variable
		Solve a 1-variable linear inequality with the variable on one side
		Solve a 1-variable compound inequality
		Solve a 2-variable linear inequality for the dependent variable

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Algebra (continued)	Solve a Linear Inequality (continued)	Determine if an ordered pair is a solution to a 2-variable linear inequality
		WP: Solve a problem involving a 2-step linear inequality in one variable
	Solve a Nonlinear Equation	Solve a quadratic equation using the square root rule
		Solve a quadratic equation by factoring
		Determine the term needed to complete the square in a quadratic equation
		Solve a radical equation that leads to a quadratic equation
		Solve a rational equation involving terms with monomial denominators
		Solve a rational equation involving terms with polynomial denominators
		Solve a 1-variable absolute value inequality
		Solve a quadratic equation using the quadratic formula
		Solve a radical equation that leads to a linear equation
		Solve a quadratic equation by taking the square root
		Determine the solution(s) of an equation given in factored form
		Use the discriminant to determine the number of real solutions
		Solve a quadratic equation with complex solutions
		Solve a logarithmic equation
		Solve a 1-variable absolute value equation
		Solve a cubic equation
		Write the equation of a circle given its center and radius
		Solve a problem involving the Pythagorean identity sin^2(theta) + cos^2(theta) = 1
		Determine an equation of a circle
		Determine the radius, center, or diameter of a circle given an equation
	Solve a system of linear equations	Solve a system of linear equations in two variables using any method
		Solve a number problem that can be represented by a linear system of equations
		Determine the number of solutions to a system of linear equations
		Solve a problem involving matrices
		Solve a system of three equations

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement	Determine a missing figure in a pattern	Identify a missing figure in a repeating pictorial or non-numeric pattern
		Identify a missing figure in a geometric pattern
	Determine a missing measure or dimension of a shape	Relate the radius to the diameter in a circle
		Determine a missing angle measure in a triangle
		Use the Pythagorean theorem to determine a length
		Determine a missing dimension given two similar shapes
		Determine the midpoint of a line segment given the coordinates of the endpoints
		Determine the measure of an angle formed by parallel lines and one or more transversals given an angle measure
		Determine the measure of an angle or the sum of the angles in a polygon
		Determine a length using parallel lines and proportional parts
		Determine a length using the properties of a 45-45-90 degree triangle or a 30-60-90 degree triangle
		Solve a problem involving the length of an arc
		Determine the length of a line segment, the measure of an angle, or the measure of an arc using a tangent to a circle
		Determine a length using a line segment tangent to a circle and the radius that intersects the tangent
		Determine the measure of an arc or an angle using the relationship between an inscribed angle and its intercepted arc
		Solve a problem involving the distance formula
		Solve a problem using inequalities in a triangle
		Determine a length in a complex figure using the Pythagorean theorem
		Solve for the length of a side of a triangle using the Pythagorean theorem
		WP: Determine a length or an angle measure using triangle relationships
		Determine the length of a side or the measure of an angle in congruent triangles
		WP: Solve a problem using the properties of angles and/or sides of polygons
		Determine the length of a side in one of two similar polygons
		Determine the length of a side or the measure of an angle in similar triangles
		Determine a length given the perimeters of similar triangles or the lengths of corresponding interior line segments
		Determine a length in a triangle using a midsegment

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement (continued)	Determine a missing measure or dimension of a shape (continued)	WP: Determine a length using similarity
		Determine the measure of an arc or a central angle using the relationship between the arc and the central angle
		Solve a problem involving the midpoint formula
		Determine a length or an angle measure using the segment addition postulate or the angle addition postulate
		Solve a problem involving a bisected angle or a bisected segment
		Determine the measure of an angle in a figure involving parallel and/or perpendicular lines
		Determine the measure of an angle using angle relationships and the sum of the interior angles in a triangle
		Determine a length in a triangle using a median
		Solve a problem involving a point on the bisector of an angle
		Determine a length or an angle measure using general properties of parallelograms
		Determine a length or an angle measure using properties of squares, rectangles, or rhombi
		Determine a length or an angle measure using properties of kites
		Determine a length or an angle measure using properties of trapezoids
		Determine a length or an angle measure in a complex figure using properties of polygons
		Determine the effect of a change in dimensions on the perimeter or area of a shape
		Determine the distance between two points on a coordinate plane
		Determine the measure of an angle formed by parallel lines and one or more transversals given algebraic expressions
		Use triangle inequalities to determine a possible side length given the length of two sides
		Determine the measure of an angle or an arc using a tangent to a circle
		WP: Solve a problem involving similar shapes
		WP: Use the Pythagorean theorem to find a length or a distance
		Identify figures that are the same size and shape
		Compare common objects to basic shapes
		Determine lines of symmetry

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement (continued)	Identify congruence and similarity of geometric shapes	Determine the result of a reflection, rotation, or translation
		Identify a triangle congruence postulate that justifies a congruence statement
		Identify a triangle similarity postulate that justifies a similarity statement
		Identify similar triangles using triangle similarity postulates or theorems
		Identify congruent triangles using triangle congruence postulates or theorems
		Determine the coordinates of a preimage or an image given a reflection across a horizontal line, a vertical line, the line y = x, or the line y = –x
		Determine the coordinates of the image of a figure after two transformations of the same type
		Identify congruent shapes
		Identify mirror images
	Solve a problem involving the area of a shape	Determine the area of a square
		Determine the area of a rectangle given the length and width
		Determine the area of a right triangle
		Determine the area of a circle
		Use a formula to determine the area of a triangle
		Determine the area of a complex shape
		Solve a problem given the area of a circle
		Determine the area of a polygon on a grid
		Determine the missing side length of a rectangle given a side length and the area
		Determine the area of a right triangle or a rectangle given the coordinates of the vertices of the figure
		Determine the area of a quadrilateral
		Determine a length given the area of a parallelogram
		Determine the area of a sector of a circle
		Determine the length of the radius or the diameter of a circle given the area of a sector
		WP: Determine a length or an area involving a sector of a circle
		Determine the measure of an arc or an angle given the area of a sector of a circle

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement (continued)	Solve a problem involving the area of a shape (continued)	Determine the area or circumference of a circle given an equation of the circle
		Determine the area of a shape composed of rectangles given a picture on a grid
		Determine a length given the area of a kite or rhombus
		Determine a length given the area of a trapezoid
		WP: Determine the area of a rectangle
		WP: Determine the area of a triangle
		WP: Determine a missing dimension given the area and another dimension
		WP: Determine the area of a square or rectangle
	Solve a problem involving the perimeter of a shape	Determine the perimeter of a square
		WP: Determine the perimeter of a rectangle
		Determine the perimeter of a triangle
		Solve a problem involving the circumference of a circle
		Determine the perimeter of a rectangle given a picture showing length and width
		Determine the missing side length of a rectangle given a side length and the perimeter
		WP: Determine the perimeter or the area of a complex shape
	Solve a problem involving the surface area or volume of a solid	Determine the volume of a rectangular prism
		Determine the surface area of a rectangular prism
		WP: Find the surface area of a rectangular prism
		Determine the volume of a rectangular or a triangular prism
		Determine a length given the surface area of a right cylinder or a right prism that has a rectangle or a right triangle as a base
		Solve a problem involving the volume of a right pyramid or a right cone
		Determine the surface area of a sphere
		Determine the volume of a sphere or hemisphere
		Solve a problem involving the surface areas of similar solid figures
		WP: Solve a problem involving the volume of a geometric solid
		WP: Determine the surface area of a geometric solid
		WP: Determine the volume of a rectangular prism
		Identify rays

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement (continued)	Use the vocabulary of geometry and measurement	Identify line segments
		Identify parallel lines
		Identify intersecting line segments
		Identify perpendicular lines
		Identify perpendicular or parallel lines when given a transversal
		Classify an obtuse angle or an acute angle given a picture
		Classify an angle given its measure
		Determine the common attributes in a set of geometric shapes
		Use basic terms to describe position
		Identify a circle, a triangle, a square, or a rectangle
		Identify a line of symmetry
		Identify a shape with given attributes
		Identify a common solid shape
		Classify a right angle or a straight angle given a picture
		Relate the coordinates of a preimage or an image to a translation described using mapping notation
		Relate the coordinates of a preimage or an image to a dilation centered at the origin
		Identify a relationship between points, lines, and/or planes
		Identify angle relationships formed by multiple lines and transversals
		Identify parallel lines using angle relationships
		Determine the angle of rotational symmetry of a figure
		Use deductive reasoning to draw a valid conclusion from conditional statements
		Identify a statement or an example that disproves a conjecture
		Identify a valid biconditional statement
		Determine the number of faces, edges, or vertices in a 3-dimensional figure
		Identify a cross section of a 3-dimensional shape
		Relate a net to a 3-dimensional shape
		Identify the converse, inverse, or contrapositive of a statement
		Determine attributes of a triangle or a quadrilateral from a model
		Relate a model of a triangle or a quadrilateral to a list of attributes

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement (continued)	Use the vocabulary of geometry and measurement (continued)	Identify a picture of a 3-dimensional shape
		Name a 3-dimensional shape from a picture
		Identify a geometric construction given an illustration
		Compare objects using the vocabulary of measurement
	Calculate elapsed time	Calculate elapsed time exceeding an hour with regrouping
		Calculate elapsed time within an hour, given two clocks, with regrouping
		WP: Calculate elapsed time exceeding an hour with regrouping hours
	Determine a measurement	Convert between degree measure and radian measure
		Determine the value of an inverse sine, cosine, or tangent expression
		Identify angle relationships formed by parallel lines cut by a transversal
		Identify angle relationships formed by intersecting lines
		Determine the measure of a vertical angle or a supplementary angle
		Determine a sine, cosine, or tangent ratio in a right triangle
		Convert between inches, feet, and yards
		Estimate the height or length of a common object in customary units
		Convert between customary units of capacity
		Convert within metric units of mass, length, and capacity
		Determine the approximate value of a unit converted between customary and metric measures
		Identify an angle given its measure
		Estimate the height of a common object in metric units
		Measure length in centimeters
		Convert a rate from one unit to another with a change in one unit
		Convert a rate from one unit to another with a change in both units
		WP: Determine a measure of length, weight or mass, or capacity or volume using proportional relationships
		Measure length in inches
		Read a thermometer in degrees Fahrenheit or Celsius

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Geometry & Measurement (continued)	Relate money to symbols, words, and amounts	Determine cent amounts that total a dollar
		Identify a coin or the value of a coin
		Determine the value of groups of coins to $1.00
		Translate between a dollar sign and a cent sign
		Convert money amounts in words to amounts in symbols
	Tell time	Tell time to the minute
		Tell time to the quarter hour
		Tell time to 5-minute intervals
		Tell time to the hour and half hour
		Convert hours to minutes or minutes to seconds
Data Analysis, Statistics, and Probability	Determine a measure of central tendency	Determine the mean of a set of whole number data
		Determine the median of a set of data given a frequency table
		Determine the median of an odd number of data values
		Determine the median of an even number of data values
	Determine the probability of one or more events	Determine the probability of a single event
		Determine the probability of independent events
	Read or answer a question about charts, tables, or graphs	Determine if a scatter plot shows a positive relationship, a negative relationship, or no relationship between the variables
		Make a prediction based on a scatter plot
		Read a simple pictograph
		Read a table
		Read a bar graph
		Read a circle graph
		Answer a question using information from a table
		Answer a question using information from a bar graph
		Answer a question using information from a circle graph
		Answer a question using information from a line graph
		Answer a question using information from a pictograph (1 symbol = more than 1 object)
		Answer a question using information from a bar graph with a y-axis scale by 2s

Table 22: Star Math Spanish Blueprint Skills

Blueprint Domain	Blueprint Skill Set	Star Math Spanish Blueprint Skill
Data Analysis, Statistics, and Probability (continued)	Read or answer a question about charts, tables, or graphs (continued)	Read a double-bar graph
		Answer a question using information from a double-bar graph
		Answer a question using information from a circle graph using percentage calculations
		Answer a question using information from a histogram
		Read a tally chart
		Read a line graph
		Read a 2-category tally chart
		Answer a question using information from a 2-category tally chart
		Read a line plot
		Answer a question using information from a line plot
		Answer a question using information from a scatter plot
	Use a chart, table, or graph to represent data	Use a circle graph to represent percentage data
		Use a histogram to represent data
		Use a pictograph to represent data (1 symbol = more than 1 object)
		Use a line graph to represent data
		Use a bar graph with a y-axis scale by 2s to represent data
		Use a double-bar graph to represent data
		Use a line plot to represent data
		Use a scatter plot to organize data
		Use a 2-category tally chart to represent groups of objects (1 symbol = 1 object)
	Use a proportion to make an estimate	Use a proportion to make an estimate, related to a population, based on a sample

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About Renaissance

Renaissance® transforms data about how students learn into instruments of empowerment for classroom teachers, enabling them to guide all students to achieve their full potentials. Through smart, data-driven educational technology solutions that amplify teachers' effectiveness, Renaissance helps teachers teach better, students learn better, and school administrators lead better. By supporting teachers in the classroom but not supplanting them, Renaissance solutions deliver tight learning feedback loops: between teachers and students, between assessment of skills mastery and the resources to spur progress, and between each student's current skills and future academic growth.

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