

## **SC READY Mathematics Grades 5-6 2019 Data Review Report**

In October 2019 the South Carolina Department of Education convened a panel of experts to review item data on the SC READY grades 5-6 tests. The panel looked at items with a high percentage of students answering correctly and items with a low percentage of students answering correctly. The discussions of that panel yielded the recommendations that follow. Teachers on this year's panel felt that last year's suggestions were still extremely relevant and that teachers should be reminded to look at last year's Data Review Report (2018). The panel recognizes the hard work of SC educators and offers these suggestions as an addendum to those from last year.

### **General Suggestions:**

The following are general suggestions that arose for multiple items.

- Academic vocabulary, and its proper use, was again one of the most often discussed topics during Data Review. Both teachers and students must use proper academic vocabulary in class when speaking or writing. Vocabulary can be found both in the standards and in the support documents on the Office of Standards and Learning webpage. Vertically align academic vocabulary from elementary through high school to make sure vocabulary is introduced in the appropriate grade and its use is carried forward. One panel member suggested encouraging students to find “misused math terms” in daily life. Teacher can even bring in items they find and then see if students can spot the misused math term in a video clip, news article, etc.
- The panel felt students need more work on fact fluency. Students need conceptual understanding, fact fluency, and good number sense in order to experience continued success in math. The panel felt that there was a middle ground among these goals that made sense.
- Students should be efficient, flexible, and curious in their thinking. Encourage students to think deeply and ask questions about even simple mathematical concepts. Ask students open ended questions and see how they respond. For instance: How many numbers have absolute value of 5? How many numbers are in the solution set for  $x < 5$ ? Can all fractions be written as a decimal? Can all decimals be written as a fraction? Is it possible for a tall and short right rectangular prism to have the same volume?
- The panel this year discussed that too often teachers are “sanitizing the rigor.” Students benefit from productive struggle. The panel thought teachers need to remember to remove the scaffolding after they have built up their teaching.
- The panel encouraged giving students more time with items during class. Encourage students to slow down and read items. Have students deeply discuss complex issues with each other and then present solutions or questions to you. If students are presenting a solution, push back on them and ask if they think it is reasonable. Students are not asking themselves, “is this answer reasonable given the context?”
- Students need to know the difference between expressions and equations and when each is appropriate. Ensure students understand that “expressions” set up the reasoning while “equations” look for answers.
- Avoid negative math talk and discourage it in the classroom. Don't commiserate with students when they say, “I hate fractions.” Teachers are attempting to build student

confidence with mathematics. Avoid saying that math is hard, instead say math makes logical sense. Math is grounded in the real-world. Be excited by fractions, say things like “fractions are your friends.”

- Mathematical discussions are a great tool to use with your students. Mathematical discussions can be whole class, small group, or even journaling about math. Having students interact daily with math in a novel way increases the likelihood that students will retain or deepen their conceptual understanding. This could be as simple as having students explain why their answer is correct or why another answer is incorrect.
- The panel thought that vertical alignment was needed by both upper and lower grade teachers. The panel felt the lower grades would benefit from understanding how the concepts they introduce mature. Further, the teachers in higher grades could see how concepts are introduced and how deeply certain concepts are taught. Both groups could benefit from a deeper understanding of the types of modeling called for in the standards.
- The panel again this year wanted to highlight two practical aspects of SC READY. First, there is no formula sheet. Students should be prepared to answer items without one. Secondly, that some of our items are structured in the following way:
  - Text that introduces context
  - Image (graph, chart, table, etc)
  - Text that builds context
  - Question
  - Answer options

The panel thought teachers should give items with a similar structure so students are used to reading and interpreting items. The sample release items show this type of structure.

- Practice the Online Tools Training (OTT). The OTT is there to minimize test day stress. The OTT familiarizes students with the mechanics of the test and the tools that are there to help them.

### **Grade 5 Suggestions:**

The following suggestions are specific to grade 5 items. They are organized by key concept.

#### **Number Sense and Base Ten (NSBT):**

- Discuss with students when the value is changing by a multiple of ten and when the value changes by a tenth. The standard, 5.NSBT.2, goes beyond naming the place value and focuses on the value of the digit in that place value. In particular, make sure students are saying that the value is one-tenth what the same digit represents in the place to its left.
- Practice area models in items that have a context as well as bare math items. Practice partially setting up an area model and have students fill in the blanks. Then have students make their own area models. Give students hands on experiences using the area model. The panel suggested using base 10 blocks and using the flat as a ten. Then re-unitize the other blocks so that a rod is one and a unit is one-tenth. Teachers can further re-unitize the flat to a one when working with hundredths.
- The panel stressed students need good number sense and fluency in multiplication and division facts. Teacher should create authentic experiences to reinforce fact families prior to teaching operations with decimals or fractions.
- The panel recommended teachers limit lattice modeling when teaching 5.NSBT.7. They felt there were models and drawings that used skills that are more transferrable to other mathematical concepts.
- When reading numbers be sure to read them in a mathematical way. In particular, when reading the number 2.34, read, “two and thirty-four hundredths” not “two point three four.” The second completely misses the value of the number. We do not say you own me “two five dollars.” We say we are owed “twenty-five dollars.” Pay attention to this during mathematical discussions as well.
- The panel pointed out that 5.NSBT.2 is a student’s first exposure to exponents. The panel cautioned teachers to check for vertical alignment in this area. Students at this grade level and beyond are having a difficult time with exponents. When teaching the connection between the number of zeros and the exponent when multiplying by powers of 10, explicitly tell students that the exponent is the number of times we are multiplying by 10. It helps to express it in expanded form at first and then occasionally to reinforce the connection. For instance, show students that  $3 \times 10^3 = 3 \times (10 \times 10 \times 10)$ .

#### **Number Sense – Fractions (NSF):**

- The panel reminds teachers to pay attention to the number sense part of this key concept. In an item dealing with division of fractions students were told that a person started with a fractional portion of a whole. The person then divided that amount amongst a number of containers. The item asked how much each container held. Approximately a third of students chose an option that was actually more than a whole (thus more than the person actually had to start). Students must be encouraged to slow down and think. It appears that students are pulling numbers from items and simply performing known operations until they find an answer option that matches.

- Teachers must teach reasonableness of answers intentionally. The panel pointed out that estimation is not always rounding at the end of an item. They thought teachers should be using estimation as a tool for considering the reasonableness of answer options. In the above bullet, imagine if a student knew that the answer must be less than one.
- Teachers teaching 5.NSF.5 are setting up concepts that will be further explored in 6<sup>th</sup> and 7<sup>th</sup> grade RP standards. Teaching that multiplying by anything less than one decreases the value of the original number and multiplying by anything greater than one will increase the value of the original number is a concept seventh grade teachers can then tie to percent increase and decrease when covering 7.RP.3.
- The panel felt that certain ideas must be covered deliberately. For instance, students must be comfortable with fractions adding up to be more than a whole number, and that mathematical properties still apply. Students can use the commutative and associative properties to aid their addition.
- The panel suggested using arrays or other visual models to help students when multiplying fractions. Generally, the panel strongly recommended the continuing use of fractional models and moreover physical models to help student understanding of fractions. Specifically, the panel recommended showing students multiplication and division of fractions using a pictorial representation. Additionally, students need practice multiplying two mixed numbers together.
- The panel suggested avoiding the “butterfly method” when teaching anything about fractions. Students tend to use the “butterfly method” to answer any item where two fractions are next to each other regardless of the sign between them. The panel thought some teacher may think they “teach it right,” however student data suggests otherwise. Furthermore, the panel felt that the “butterfly method” attempts to skirt deep mathematical understanding of fractions in favor of a quick trick. While this trick may appear to help students understand the relative value of fractions, students do not see that they are truly just finding a common denominator. In fact, students do not see the fractions at all, but only see their new numerators without the denominator or the context of the fractions. While teachers may understand how the trick works, students are not making those connections.

### **Algebraic Thinking and Operations (ATO):**

- The panel suggested that students should be working yearlong on translating from verbal to numerical expressions and vice versa. Students tend to write the numbers in the order they appear in the item rather than considering the words connecting them as well. For instance, we have many ways to express subtraction of two numbers, “five minus four,” “five take away four,” “four taken away from five,” “the difference of five and four,” “five subtract four,” “four subtracted from five,” etc. While that list is not meant to be comprehensive, it does illustrate some of the many ways we have for expressing a very simple mathematical expression “ $5 - 4$ .” The panel also suggested that once they have been taught, give students the symbolic representation and see how many verbal expressions they can write.

- The panel also suggested using error analysis type items for students to critique incorrect translations. Give students a handful of items and tell them some of the translations are correct and some are incorrect. Have them work individually to figure out which are correct and then put them into groups to have a mathematical discussion. Additionally, the panel thought that writing down what students say instead of what they mean to say will help them to slow down and consider how they are translating between representations.
- Students may need a strategy for story items. The most important feature is considering the question the item is asking. Too often students answer questions that are not asked. There are many strategies for solving story items that help students navigate story items initially. Ultimately, flexible thinking and creativity should be preferred over strict adherence to an arbitrary strategy.

### **Geometry (G):**

- The panel pointed out that there is translation in geometry items as well. An item may ask which ordered pair contains an 'x' that with a value twice the 'y' or something similar.
- Students should know all the types of triangles and their properties. Students should be able to compare and contrast the different triangle types.
- The panel thought students would benefit from more time classifying shapes based on their attributes and categorizing appropriately. They felt that students need some extra time working towards clarity on what it means to be a quadrilateral and a parallelogram. They further wanted to stress that "rhombus" is used rather than "diamond."

### **Measurement and Data Analysis (MDA):**

- Students had a difficulty working with line plots. The panel highly recommended exposing students to line plots throughout the year. When teaching 5.NSF.1 if those fractions come from a line plot then the students have also worked with 5.MDA.2.
- Students are not accounting for all of the points plotted on a line plot. For instance, if there were two "x's" over  $\frac{1}{4}$  the students only counted  $\frac{1}{4}$  once. Various strategies were shared from writing the values next to each 'x' on the number line, to counting the number of "x's" and using that to check the addends.
- The panel felt teachers should tell students that answer options may be bare numbers. For teachers, this is because of how we ask the question. So, a question may ask, "How many total gallons of soup were there?" This way the units are put into the question and the answer options are able to be bare numbers.
- Students in this grade are asked to convert from larger to smaller and smaller to larger units within a system of measurement. The panel thought giving students a hands-on demonstration would help here. For instance, give students two objects, one that weighs one gram and another that weighs one kilogram. Then ask simple questions like how many of the grams do they think it would take to make up a kilogram? Teacher can press this point by asking what fraction of the kilogram is the gram? The point is to give students a hook they can come back to later when converting centimeters to meters.

### **Grade 6 Suggestions:**

The following suggestions are specific to grade 6 items. They are organized by key concept.

#### **Number System (NS):**

- The panel thought students need more work with greatest common factor (GCF) and least common multiple (LCM). One recommendation was to separate the teaching of GCF and LCM since they are often confused. In addition to giving students two numbers and asking for the GCF or LCM, the panel recommended giving students many pairs of numbers and asking which pair has a GCF or LCM within a given range of numbers.
- The panel felt that understanding GCF and LCM is much easier if students have good number sense and fluency in multiplication and division facts. Teachers should create authentic experiences to reinforce fact families prior to teaching GCF and LCM.
- The panel thought that placing a coordinate grid on the floor and giving students various points that all have the same x-coordinate could help students understand signs in ordered pairs. Teachers should be intentional when showing students that one of those coordinates could be on the axis. Students also must know the quadrant names and locations.
- When teaching 6.NS.6c include the language used when teaching transformations. A reflection is a geometric transformation and should be accompanied by the vocabulary, image, pre-image, mapping, etc. This language allow us to distinguish between the given point and the transformed point. Give students items where they must reflect a given point and where they must indicate where a given point originated given the image.
- Students should plot positive and negative rational numbers on a number line. Give students items with mixed forms as well. Can students plot decimals, proper fractions, improper fractions, and integers with mixed signs all in the same item on the same number line? Can students determine relative values (“greater than,” “less than”) given a number line with mixed representations of rational numbers?

#### **Ratios and Proportional Relationships (RP):**

- The panel thought teachers should make sure students are working through more story items. Teachers should avoid too many items with bare numbers and no context.
- Students may need a strategy for story items. The most important feature is considering the question the item is asking. Too often students answer questions that are not asked. There are many strategies for solving story items that help students navigate story items initially. Ultimately, flexible thinking and creativity should be preferred over strict adherence to an arbitrary strategy.
- Work with students on setting up rates from a context. Students should be challenged to think when working on story items. Give students a few different types of fruit and a few different types of cereal in the story item. Then ask students for the ratio of cereal to fruit. Students then need to work on organizing their information, getting the order of the ratio correct, and then setting up the correct ratio.
- Further encourage students to explore rates. Extend the thinking beyond what is given. This thinking is setting up the constant rate of change for linear functions later on. Teachers encouraging curious thinking here will pay off in later grades.

- Teacher must intentionally teach percent as “per 100.” A large portion of students are treating the percent as an integer rather than a rate. The panel felt that using proportions here would help make that distinction. Further, they recommended not “slipping and sliding the decimal point.” Rather, cultivate a deep conceptual understanding of percent. Teachers here are laying the groundwork for seventh grade, where students will encounter percent increase/decrease items, and moreover in Algebra 1 through Calculus where students will study exponential functions.

### **Expressions, Equations, and Inequalities (EEI)**

- Students should be ready to handle academic vocabulary in this particular key concept. Students should be able to handle picking out an expression that is the “product of two factors.” Items will include operational vocabulary, mathematical properties, and terms such as “equivalent expressions.”
- Students in sixth grade are expanding on their understanding of exponents. Teachers should build on the conceptual understanding in fifth grade (5.NSBT.2) to include any positive rational number as a base. Students seem to have particular trouble when asked to raise a fraction to an exponent. Avoid tricks and instead focus on the meaning of exponents. Again this is laying the groundwork for all of their subsequent mathematics classes.
- Students were asked to translate a verbal phrase into an expression. They were given a story item and essentially asked to express something similar to “ $\frac{4}{5}$  of a number is 24.” Students had a great deal of trouble with this translation. The panel thought it was due to the fraction. Some suggestions to help students were to replace the fraction with a more well-known one, such as  $\frac{1}{2}$ , or with an integer. Students would also benefit from more fractions in classroom items.

### **Geometry and Measurement (GM):**

- The panel thought teachers should give students hands on experience when working with area of triangle, quadrilaterals, and other polygons. For instance, having students experience that the area of a triangle really is half a quadrilateral is helpful for students trying to understand why we multiply by  $\frac{1}{2}$ . Presenting formulas to students with little to no context makes math feel mystical. Math is grounded in the real-world; give students opportunities to make and see those connections.
- When teaching students volume remember to find, with equal regularity, the area of the base and then multiply by the height. Volume is not just “length times width times height.” Students will not always be able to just find three numbers from an item, multiply and get the correct answer. Students should be comfortable working with the area of the base when finding volume.
- Teachers should give students tasks that do not come out and ask students to find the “volume,” “surface area,” etc. by name. Instead try asking, “when completely full how much water could the container hold?” or, “how many square inches did a student paint if s/he painted the entire outside?” This forces students to decide which tool to use when solving an item.

- Students may need a review of polygon names and properties when practicing drawing polygons in the coordinate plane. Students may be asked which ordered pairs create a specific type of quadrilateral. When graphing polygons in the coordinate plane, the panel recommended using page protectors over graph paper and dry erase markers so students can work in class and have a different experience with graphing.
- The panel recommended further giving students hands-on experience folding nets in class to make geometric solids. Allow students to cut out and fold nets in class. Give them some nets that do not make solids and have them discover and discuss why that is.

### **Data Analysis and Statistics (DS):**

- The panel felt that when students were asked to find the sample size they picked the largest bar because that is the focus of the questioning at lower grades. While it may be appropriate there, teachers now must change the students' focus to the sample size and what that means.
- Students should be well prepared to answer questions about a data set. The panel recommended using real world data and then asking questions about it.
- There is an abundance of new vocabulary in this key concept. Expose students to “lower quartile,” “first quartile” and “Q1.” Similarly, expose students to the third quartile vocabulary. For context, the median is the second quartile.
- Students cannot assimilate all of Data Analysis and Statistics (DS) if it is left for just before the test. Data Analysis and Statistics (DS) concepts should be woven throughout the curriculum and reinforced regularly. A few suggestions were to use dot plots in the Number Sense key concept when comparing and operating with rational numbers. Also, use box plots to discuss percentiles while learning about ratios and proportions.
- Students should be exposed to comparative language in DS standards as well. For instance, “the range is no more than 10.”