Winchester Math Curriculum Grade 3

Subject	Mathematics
Grade/Course	Grade Three
Unit of Study	Unit 8: Bridge Design and Data Collection & Analysis
Pacing	May / June
Unit Summary	In the final unit of the year, students learn about different kinds of bridges by reading nonfiction, looking at pictures, doing research, and building their own model bridges. This unit integrates mathematics and science with a primary focus on designing and building model bridges, which are then tested in systematic ways to collect data. Students graph and analyze the data, finding the range and mean, to make conjectures and draw conclusions about effective bridge design and construction.

Overarching Mathematical Practices

3.MP.1 Make sense and persevere in solving problems.
3.MP.2 Reason abstractly and quantitatively.
3.MP.3 Construct viable arguments and critique the reasoning of others.
3.MP.4 Model with mathematics.
3.MP.5 Use appropriate tools strategically.
3.MP.6 Attend to precision.
3.MP.7 Look for and make use of structure.
3.MP.8 Look for and express regularity in repeated reasoning.

Unit CT Core Content Standards

3.NF.A.1
Understand a fraction 1/*b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts; understand a fraction *a*/*b* as the quantity formed by *a* parts of size 1/*b*.

3.NF.A.3.d
Compare two fractions with the same numerator or the same denominator by reasoning about their size. Recognize that comparisons are valid only when the two fractions refer to the same whole. Record the results of comparisons with the symbols >, =, or <, and justify the conclusions, e.g., by using a visual fraction model.

3.MD.A.1

Tell and write time to the nearest minute and measure time intervals in minutes. Solve word problems involving addition and subtraction of time intervals in minutes, e.g., by representing the problem on a number line diagram.

3.MD.A.2

Measure and estimate liquid volumes and masses of objects using standard units of grams (g), kilograms (kg), and liters (l). Add, subtract, multiply, or divide to solve one-step word problems involving masses or volumes that are given in the same units, e.g., by using drawings (such as a beaker with a measurement

scale) to represent the problem.

3.MD.B.3

Draw a scaled picture graph and a scaled bar graph to represent a data set with several categories. Solve one- and two-step "how many more" and "how many less" problems using information presented in scaled bar graphs. *For example, draw a bar graph in which each square in the bar graph might represent 5 pets*.

3.MD.B.4

Generate measurement data by measuring lengths using rulers marked with halves and fourths of an inch. Show the data by making a line plot, where the horizontal scale is marked off in appropriate units— whole numbers, halves, or quarters.

3.MD.C.7.B
Multiply side lengths to find areas of rectangles with whole-number side lengths in the context of solving real world and mathematical problems, and represent whole-number products as rectangular areas in mathematical reasoning.

3.G.A.1

Understand that shapes in different categories (e.g., rhombuses, rectangles, and others) may share attributes (e.g., having four sides), and that the shared attributes can define a larger category (e.g., quadrilaterals). Recognize rhombuses, rectangles, and squares as examples of quadrilaterals, and draw examples of quadrilaterals that do not belong to any of these subcategories.

3.G.A.2

Partition shapes into parts with equal areas. Express the area of each part as a unit fraction of the whole. *For example, partition a shape into 4 parts with equal area, and describe the area of each part as 1/4 of the area of the shape*.

"Unwrapped" Standards

Skills	Content
Understand	● a fraction *1/b* as the quantity formed by 1 part when a whole is partitioned into *b* equal parts ● a fraction *a/b* as the quantity formed by *a* parts of size *1/b* ● shapes in different categories may share attributes ● shared attributes can define a larger category
Compare	two fractions with the same numerator or the same denominator by reasoning about size
Recognize	● comparisons are valid only when two fractions refer to the same whole

	● rhombuses, rectangles, and squares are examples of quadrilaterals.
Record	the results of comparisons with symbols <, >, +
Justify	conclusions
Tell and write	time to the nearest minute
Measure	● time intervals in minute ● liquid volumes and masses of objects with standard metric units ● lengths using rulers with halves and fourths
Estimate	● liquid volumes and masses of objects with standard metric units
Solve	● word problems involving addition and subtraction of time intervals ● one- and two- step problems using information in scaled bar graphs
Represent	● word problems involving addition and subtraction of time intervals on a number line ● whole number products as rectangular areas
Add, subtract, multiply and divide	to solve one-step word problems involving masses or volumes given in the same units
Use	drawing with measurement scale to represent problems
Draw	● a scaled picture graph ● a scaled bar graph ○ to represent a data set with several categories ● quadrilaterals that are not squares, rectangles, or rhombuses
Generate	measurement data of lengths
Show	data by making line plots (horizontal scale marked off in appropriate units whole, halves, quarters)
Multiply	whole number side-lengths to find area of rectangles in context of real world and math problems
Partition	shapes into parts with equal area

Express	area of an equal part as a unit fraction

Essential Questions	Corresponding Big Ideas
1. What is the purpose of measurement? 2. What do fractions represent? 3. How can we use measurements to solve real world problems?	1. Measurement is used to describe, compare, precisely explain, and solve problems in the world. 2. Fractions represent equal parts of a whole unit. 3. Objects have attributes that can be measured in many ways. The measurements can be combined and broken down into parts to solve problems.

Evidence of Learning - Assessment

Pre/Post Assessment	Interim Assessment	Additional Evidence of Learning
● May - Number Corner Checkup 4 ● June - Comprehensive Growth Assessment	●	Options ● Exit tickets Observational Assessments ● Weight Lifting - M1, S2 ● Wacky Discussion - M1, S2 ● Speed Skating - M2, S1 ● Curling - M2, S1 ● Graphing Our Bridge Collection - Student Book - M2, S4 ● Plotting Bridge Lengths - Student Book - M2, S3 ● Finding Shapes in Bridges - Student Book - M2, S5 ● Long Bridges - Journal Entry- M3, S4 ● Longest, Strongest Bridges Journal Entry - M4, S3 ●

Smarter Balanced Interim Assessment

Smarter Balanced General Scoring Rubrics - 4 Rubrics included - Score Pt 4 to Score Pt 1

· **Smarter Balanced Interim Blocks**

· Interim assessment blocks may be used for a variety of assessment purposes, including: pre/post, interim and formative (additional evidence of learning).

· The Style Guide, which aligns with the expectations of Smarter Balanced Assessments, will support the creation of unit- and standard-aligned items for instructional use.

· The items on the interim assessments are developed under the same conditions, protocols, and review procedures as those used in the summative assessments. Therefore, they assess the same Common Core State Standards, adhere to the same principles of Universal Design in order to be accessible to all students, and provide evidence to support Smarter Balanced claims in mathematics and ELA/literacy. The interim assessment items are non-secure but non-public. This means that educators may view the items, however, they should not be made public outside of classroom, school or district.

Interim Assessment Block - access through CSDE Assessment Portal

- IAB - N/A

· *Some interim blocks show clear, strong alignment to priority standards within the unit. Other blocks have been placed in one specific unit but could be aligned to the priority standards of several units. Blocks have been spread out over the course of all units for a more balanced approach to assessment throughout the school year. These interim blocks, used in partnership with the Style Guide, will support the creation of unit- and standard-aligned items for instructional use.*

Learning Plan

Researched-based Instructional Resources and Methods

Sequence of Instruction:
Number Talk/Number Corner → Problem + Investigations →Work Places → Math Forum→Daily Practice or Home Connection

Bridges Number Corner for Unit 8:

Fractions

- Fractions and area of rectilinear figures
- Equivalent Fractions
- Comparing Fractions
- Fractions and mixed numbers on number lines
- Benchmark Fractions
- Estimating the sum of fractions

Computational Fluency

- Quick Facts routines - Facts to 100

Problem Solving

- Solving problems with multiplication facts and properties and division

Bridges - Whole Group, Small Group, and Independent Problem Centered Activities			
Module 1	Module 2	Module 3	Module 4

Problem + Investigation ● Sessions 1-5 Problem String ● None Work Place ● Session 2 Math Forum ● None Daily Practice ● Sessions 1-5 Home Connection ● Sessions 2,4	Problem + Investigation ● Sessions 2-5 Problem String ● None Work Place ● Session 1 Math Forum ● None Daily Practice ● Sessions 1-5 Home Connection ● Sessions 1,3,5	Problem + Investigation ● Sessions 1-6 Problem String ● None Work Place ● Sessions 5-6 Math Forum ● None Daily Practice ● Sessions 1-6 Home Connection ● Sessions 2,4,6	Problem + Investigation ● Sessions 1-4 Problem String ● None Work Place ● Session 1 Math Forum ● None Daily Practice ● Sessions 1-4 Home Connection ● Session 2

Possible Misconceptions	Teacher Moves
1. Some students may think only about one of the dimensions needed to find volume. Some students may believe that because an object is tall, it will have lots of volume, ignoring the other two dimensions.	1. Provide additional experiences for students to measure and compare a variety of objects by using all three dimensions to address this misconception.
2. Fractions are foundational in grade 3 and it is important to take the time necessary to develop student understanding.	2. This is best accomplished through extensive use of concrete representations, including fraction strips, area models, fraction bars, geoboards, number lines, and other similar items. Do not work with too many representations at the same time. Begin with activities that use area models and reinforce those ideas with fraction strips and then number lines. For most students one experience with a concept will not be adequate to develop deep understanding.
3. Students might demonstrate the misconception that given the same size whole, the smaller the denominator the smaller the piece or fraction pieces must be the same shape and size.	3. These students need additional experiences connecting concrete representation with fraction concepts.
4. Some students might exhibit the following misconceptions; the numerator cannot be greater than the denominator, the larger the denominator, the larger the piece, fractions are a part of a whole, therefore you cannot have a fraction that is greater than 1 whole, and in building sets of equivalent fractions, students use addition and subtraction to find equivalent	4. These students need more work with concrete and then pictorial representations.

fractions. 5. Although it is not critical for students to differentiate between the intervals between points and actual points on the number line, you want to be careful not to cause any misconceptions.	5. The fraction that names a point on the number line describes the distance of that point from zero and not the point itself.

Vocabulary and Representations

Tier 2 (Academic Vocabulary)	Tier 3 (Domain Specific Vocabulary
anchorage arcade area* average + balance cable cluster column compression deck dimension environment force load outlier + partition pier saddles span stable structure suspenders tension tier towers	abutment arch bridge bar graph* beam bridge girder hexagon* keystone line plot* mean + median + mode + parallelogram* perimeter* picture graph* quadrilateral* range + scatter plot + suspension bridge truss weight

Mathematics Teaching Practice Resources

1. **Bridges** - Reference Math Practices in Action Notes - The notes identify how particular mathematical practice is employed in a specific activity.
2. **Math Practices Teacher Question Starters**
3. **Implementing the Standards of Mathematics Practice**
4. Illustrating the Standards of Mathematical Practice
5. Grade 3 - Standards + Practice Explanations and Examples
6. Math Practice Standards Posters Gr. 2-3
7. Accountable Talk Moves
8. Contribution Checklist
9. Building a Mathematical Mindset Community
10. **Supporting Productive Struggle**

11. **Use and Connect Mathematical Representations**
12. Implement Tasks that Promote Reasoning and Problem Solving
13. Number Talks Matter - Number Talks at a Glance and Fluency without Fear
14. National Library of Virtual Manipulatives
15. Three Act Math Tasks
16. Beginning to Problem Solve with I Notice and I Wonder
17. Journal Prompts for Math
18. Bridges Interactive Math Manipulatives
19. Illustrative Math – Grade 3 - Resources and activities for the grade aligned by standard.
20. Teacher/Student Actions
21. Developing Conceptual Understanding of Area - A collection of lesson to develop and/or reinforce conceptual understanding.
22. Understanding unit fractions - lessons to support the development of students' understanding of unit fractions.
23. Understanding Equivalent Fractions - lessons/activities to develop a conceptual understanding of the equivalence of fractions as equal areas of area models and locations on number lines.

Suggestions for Differentiation, Scaffolding and Intervention

Differentiation or Intervention

Any teacher moves/strategies that address misconceptions can be used in differentiation or as interventions.

Math Teaching Practice Resources contain resources that provide opportunities for differentiation, intervention, or extension aligned to the strategies below.

- How to Select Math Intervention Content
- Coherence Map in Math – The coherence map shows how standards within and across grades build upon each other. You can use the map to assist you in to build student understanding by linking together concepts within and across grades and identify gaps in a student's knowledge by tracing a standard back through its logical prerequisites.
- CT Dept. of Education Evidence-based Practice Guides – These guides provide links to "evidence-based activities, strategies and interventions (collectively referred to as 'interventions')."
- Evidenced-based strategies for supporting struggling students (U.S. Dept. of Education – What Works Clearinghouse)
- Ensure instructional materials are systematic and explicit. In particular, they should include numerous clear models of easy and difficult problems, with accompanying teacher think alouds.
- Provide students with opportunities to solve problems in a group and communicate problem-solving strategies.
- Teach students about the structures of various problem types, how to categorize problems based on structure, and how to determine appropriate solutions for each problem type.
- Students should work with visual representations of mathematical ideas.
- If visual representations are not sufficient for developing accurate abstract thought and answers, use concrete manipulative first. (Include the next line for middle school and older students only) Although this can also be done with students in upper elementary and middle school grades, use of manipulatives with older students should be expeditious because the goal is to move toward understanding of and facility with visual representations and finally to the abstract.

- Provide carefully constructed questions to help direct students in determining what to do to solve problems, but they shouldn't be told how to reach the solution.
- Instruction during the intervention should be explicit and systematic. This includes providing models of proficient problem solving, verbalization of thought processes, guided practice, corrective feedback, and frequent cumulative review.

Intervention for facts

- Provide about 10 minutes per session of instruction to build quick retrieval of basic arithmetic facts. Consider using technology, flashcards, and other materials for extensive practice to facilitate automatic retrieval.
- For students in K -2 explicitly teach strategies for efficient counting to improve the retrieval of mathematics facts.
- Teach students in grade 2-8 how to use their knowledge of properties, such as commutative, associative, and distributive to derive facts in their heads.
- How to Promote Acquisition of Math Facts – Intervention for struggling students
- National Center on Intensive Intervention - Basic Facts
- Once a strategy has been taught, it is important to reinforce it. The reinforcement or practice exercises should be varied in type and focus as much on the discussion of how students obtained their answers as on the answers themselves.
- Having students work in groups (as opposed to handing your bright students a workbook to work on when the classroom material isn't challenging enough) with other children ready for advanced material shows them that mathematics is not a solitary discipline -- mathematics is exciting and vibrant and creative and fun.
- Struggles with basic facts - need more experience with concrete and pictorial representations, including describing what their models represent to make connection to basic facts. Time and experience with developing strategies that are based on patterns and properties will help support learning the facts. It is important to give students time to learn and understand these concepts before procedural skill practice takes place.
- Concrete, Representational, Abstract Progression

EL Strategies

- Colorin Colorado – A Bilingual site for educators and families of English learners
- Stanford University - Principles for Mathematics Instruction of ELs
- CT State Dept. Of Education English Learner Standards and Resources
- Nonverbal responses, such as thumbs up, will help you check for understanding without requiring students to produce language. ELLs can participate and show that they understand a concept, or agree or disagree with an idea, without having to talk. This is especially important for students whose comprehension of English is more advanced than their ability to speak the language.
- Pre-teach vocabulary in ways that connect to students' prior knowledge.
- Display posters of graphic representations of vocabulary words.
- http://www.cal.org/siop/lesson-plans/
- Provide support to assist in explaining thinking with sentence starters and work banks.
- Use Work Place Sentence Frames or other sentence frames to assist students in math discourse.
- Speak slowly and use clear articulation. Reduce the amount of teacher talk and use a variety of words for the same idea. Exaggerate intonation and place more stress on important new concepts or questions. After asking a question, wait for a few moments before calling on a volunteer. Writing the question on the board will also help.

- English language learners are not always able to answer the questions posed to them, especially when the questions are open-ended. Provide support for and improve the participation of students with lower levels of English proficiency by using a prompt that requires a physical response, like "Show me a half, a third, etc.." or "Touch the larger number."
- Increase academic language knowledge for English learner success.

Extension:

- If your class built different types of bridges, you might invite students to calculate the average number of grams held by each type of bridge and compare the average performances.
- Have students use calculator and add up the data from experiments to find the mean of the data.
- Ask students what they think would happen if you graphed the data from the bridge experiments and you changed the scale of the graph from half inch to whole inch.

Interdisciplinary Connections

Children's Literature * Bridges recommended titles - # Titles embedded in Bridges Units

#Kids Discover Magazine - Bridges
13 Bridges Children Should Know by Brad Finger
Twenty-one Elephants and Still Standing by April Jones Prince
Building Bridges by Tammy Enz
Bridges by Katie Marsico

ELA

CCSS.ELA-LITERACY.SL.3.1
Engage effectively in a range of collaborative discussions (one-on-one, in groups, and teacher-led) with diverse partners on *grade 3 topics and texts*, building on others' ideas and expressing their own clearly.
CCSS.ELA-LITERACY.SL.3.1.A
Come to discussions prepared, having read or studied required material; explicitly draw on that preparation and other information known about the topic to explore ideas under discussion.
CCSS.ELA-LITERACY.SL.3.1.B
Follow agreed-upon rules for discussions (e.g., gaining the floor in respectful ways, listening to others with care, speaking one at a time about the topics and texts under discussion).
CCSS.ELA-LITERACY.SL.3.1.C
Ask questions to check understanding of information presented, stay on topic, and link their comments to the remarks of others.
CCSS.ELA-LITERACY.SL.3.1.D
Explain their own ideas and understanding in light of the discussion.

Science

- Define a simple design problem reflecting a need or a want that includes specified criteria for success and constraints on materials, time, or cost.
- Generate and compare multiple possible solutions to a problem based on how well each is likely to meet the criteria and constraints of the problem.
- Plan and carry out fair tests in which variables are controlled and failure points are considered to identify aspects of a model or prototype that can be improved.

Social Studies

- Research famous bridges
- Study the impact of the development/use of bridges on trade and transportation