

TODOS 2014

Building Bridges through Creative Practice: Making the Transition to CCSSM

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This session addresses the pressing concern of transitioning to CCSSM with students at elementary grade levels beyond Kindergarten. Because the standards specify greater depth of mathematical practice on a relatively narrow range of topics at each grade level and the new standards are not being phased over time, teachers are responsible for understanding how to meet the needs of students whose experiences have not been guided by CCSSM in previous years. This presentation of work done with a group of fifth-grade students in an urban Midwestern charter school was motivated by the mandate to transition to CCSSM in the 2012-2013 school year. The mandate placed enormous demands on teachers for understanding the new standards, planning for meeting the needs of their students, and following through on implementation of the standards.

I planned with one fifth-grade teacher for creative project work with nine students to be implemented in the last three weeks of the school year. These students had not achieved the level of understanding of fractions specified for 5th grade in CCSSM. The teacher was looking for ways to bridge the gap between the students' current understandings and the expectations as described in CCSSM. One way to think differently about school mathematical practice is to consider authentic creative practices that require mathematical thinking. For example, work in the arts requires meaningful planning and management of activity (Heath, 2010, 2012), which may include problem solving, critiquing work and accepting the critique of others, modifying thinking and processes during problem solving, using tools and materials creatively and appropriately, measuring, attending to detail, and being precise. Session participants will hear about the processes of engaging 5th-grade students in creative project work through quilt design, see images of the students' work, and discuss implications for other classrooms.

Heath, S.B. (2010). Family literacy or community learning? Some critical questions on perspective. In K. Dunsmore & D. Fisher (Eds.), *Bringing literacy home* (pp. 15–41). Newark, DE: International Reading Association.

Heath, S.B. (2012). *Words at work and play*. Cambridge, UK: Cambridge University Press.

CCSSM -- Fractions

Third Grade

- 3.NF.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.3. Explain equivalence of fractions in special cases, and compare fractions by reasoning about their size.
 - Recognize and generate simple equivalent fractions, e.g., $1/2 = 2/4$, $4/6 = 2/3$. Explain why the fractions are equivalent, e.g., by using a visual fraction model.
 - Express whole numbers as fractions, and recognize fractions that are equivalent to whole numbers. *Examples: Express 3 in the form $3 = 3/1$; recognize that $6/1 = 6$; locate $4/4$ and 1 at the same point of a number line diagram.*

¹ Grade 3 expectations in this domain are limited to fractions with denominators 2, 3, 4, 6, 8.

- 3.G.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.*

Fourth Grade

- 4.NF.1. Explain why a fraction a/b is equivalent to a fraction $(n \times a)/(n \times b)$ by using visual fraction models, with attention to how the number and size of the parts differ even though the two fractions themselves are the same size. Use this principle to recognize and generate equivalent fractions.
- 4.NF.3. Understand a fraction a/b with $a > 1$ as a sum of fractions $1/b$.
 - Understand addition and subtraction of fractions as joining and separating parts referring to the same whole.
 - Decompose a fraction into a sum of fractions with the same denominator in more than one way, recording each decomposition by an equation. Justify decompositions, e.g., by using a visual fraction model. *Examples: $3/8 = 1/8 + 1/8 + 1/8$; $3/8 = 1/8 + 2/8$; $2 \frac{1}{8} = 1 + 1 + 1/8 = 8/8 + 8/8 + 1/8$.*
 - Solve word problems involving addition and subtraction of fractions referring to the same whole and having like denominators, e.g., by using visual fraction models and equations to represent the problem.

¹ Grade 4 expectations in this domain are limited to fractions with denominators 2, 3, 4, 5, 6, 8, 10, 12, 100.

² Students who can generate equivalent fractions can develop strategies for adding fractions with unlike denominators in general. But addition and subtraction with unlike denominators in general is not a requirement at this grade.

Fifth Grade

- 5.NF.1. Add and subtract fractions with unlike denominators (including mixed numbers) by replacing given fractions with equivalent fractions in such a way as to produce an equivalent sum or difference of fractions with like denominators. *For example, $2/3 + 5/4 = 8/12 + 15/12 = 23/12$. (In general, $a/b + c/d = (ad + bc)/bd$.)*

<p>Day 1: May 28</p> <p><u>Introduction</u></p> <ul style="list-style-type: none"> • Show quilt squares and other small quilts • Read part of <i>Stitchin' and Pullin'</i> <p><u>Table work</u></p> <ul style="list-style-type: none"> • Assess students' prior knowledge through activity and questioning • Students create design • Group work on counting with fractions • Group problem solving on naming pieces smaller than a ninth 	<p>Day 2: May 29</p> <ul style="list-style-type: none"> • Review of previous day's activity • Analyze designs from previous day • Students share findings • Discussion of ninths and eighteenths 	<p>Day 3: May 30</p> <p><u>Introduction</u></p> <ul style="list-style-type: none"> • Show nine-patch with picture at the middle • Read "Sweet Clara and the Freedom Quilt" <p><u>Table work</u></p> <ul style="list-style-type: none"> • Review ninths and eighteenths • Introduce smaller pieces 	<p>Day 4: June 3</p> <p><u>Problem solving</u></p> <ul style="list-style-type: none"> • Divide 9-patch into fourths • Students figure out how to cover $\frac{1}{4}$ of the 9-patch • How to use rulers; mark two points to define a line • Choose fabrics/colors • Start new design 	<p>Day 5: June 4</p> <p><u>Introduction</u></p> <ul style="list-style-type: none"> • Review of $\frac{1}{9}$, $\frac{1}{18}$, $\frac{1}{36}$ • Explanation of how to lay out pieces for cutting <p><u>Table work</u></p> <ul style="list-style-type: none"> • Finish designs on 2-inch grid • Make 3-inch grid on graph paper (PS) • Recreate design on 3-inch grid (dilation) • Students figure out numbers of each shape and color to be put on fusing material
<p>Day 6: June 5</p> <ul style="list-style-type: none"> • Work on individual projects 	<p>Days 7 & 8: June 6 & 7</p> <ul style="list-style-type: none"> • Work on individual projects 	<p>Day 9: June 10</p> <p><u>Introduction</u></p> <ul style="list-style-type: none"> • Demonstration of how Digi-Quilt works • Probing for understanding with guiding questions • Essential understanding: A 2-inch square will not always be a ninth <p><u>Table work</u></p> <ul style="list-style-type: none"> • Analyze and write about individual 9-patch designs 	<p>Day 10: June 11</p> <ul style="list-style-type: none"> • Continue analysis and writing 	<p>Day 11: June 12</p> <p><u>Work in Digi-Quilt</u></p> <ul style="list-style-type: none"> • Analyze design in Digi-Quilt and compare results • Create new design • Create animation of creation of the design <p>or</p> <p><u>Finish project with fabric</u></p>

Interview with **Brandon**

CVB: I really like that design. It is nice and bold, and I think it ended up looking really good. Did you enjoy doing it?
B: Yeah.
CVB: Now you talked about having six yellows, six, blues, and six greens. Could you explain that? And can you use fraction names?
B: OK. So, each of them are one eighteenth, like each one.
CVB: Each of...?
B: Half; triangles.
CVB: Each half triangle, or it's half of what?
B: Each half square. And then there is one, two, three, four, five, six yellow triangles, and that equals six eighteenths. And then there's six one eighteenth green triangles, and there is six blue triangles, six eighteenths, so that's [inaudible].
CVB: ... OK, so when I put two of the eighteenths together, what do I get?
B: Four?
CVB: How many squares are there on here?
B: Six. I mean, there's nine.
CVB: OK. So when I put two <i>triangles</i> together, it makes one small square, doesn't it?
B: Yeah.
CVB: OK. And how much is that?
B: Nine.
CVB: A ninth? Is that what you are saying? I am sorry. I didn't understand you. OK. So when I put two of the blue together, that equals...
B: One ninth.
CVB: And I put another two blue together...

B: That's two ninths.
CVB: We're up to two ninths,
B: Three ninths.
CVB: ...and then I put another two blues together. Three ninths. So can we say that the six eighteenths is the same as three ninths? OK. How does that work with the yellow and the green?
B: It's about just the same. Wait, like, what is..., explain it to me again.
CVB: Oh. I thought you were explaining it to me.
B: No, ask the question.
CVB: OK. I was just wondering, what we just did with the blue, would that work with the green, and would that work with the yellow?
B: Oh, yeah. Yeah. ... [He still needed a lot of guidance with the reasoning.]
CVB: OK. Is there anything else you can tell me about this experience and working with fractions and the design?
B: Like we're supposed to pick like colors that match with it, like colors that makes it bright. Yellow and green, that makes it brighter and stuff.
CVB: OK. So in order to visually... I call that "making it pop." ... So choosing colors was an important part to you?
B: Yeah.
CVB: OK. Was there something else that was a real important part to you?
B: Learning how to make the straight lines, like with the ruler.
CVB: Ah. OK.

Interview with **Brandon**

B: Because if you didn't know how to do that it would mess up the whole thing.

Interview with Abreyan

CVB: We don't have to have it ¹ in front of us to talk about what you've done and what you've learned. So, I am wondering what you thought were important parts of this project. What parts were important to you?
A: The part that was important to me was trying to get, figure out how many parts of it were like different colors.
CVB: Oh, OK. Uh huh. And what did you find out?
A: That when you put fabrics together you want to have at least one that has a lot of designs on it, and then one with a little bit of designs on it, and then one with no designs on it.
CVB: Oh, OK. So you want one with a complex pattern, and one medium, and one kind of plain fabric?
A: Mm hmm.
CVB: OK. ... What did you learn about fractions? Or about your particular fractions. It doesn't have to be about fractions in general.
A: Well, I had "six eighteenths of my pattern was red, and six eighteenths of my pattern was yellow, and six eighteenths of my color is" ² blue. Pink, pink, pink.
CVB: Pink, yeah. You had a really awesome design that you made there. And, so what did you find out about that, as we worked more with the DigiQuilt? What did you find out about those six eighteenths?
A: That it's the same, cuz when you do a nine patch, it still takes six of those to fit in each square on that first row of the nine patch.
CVB: Oh. You mean it takes six to fill a whole <i>row</i> ? And so how much would a row be?
A: Three ninths.
CVB: Three ninths. And then here you have something else written that I thought was really pretty cool.
A: Oh. When I made a <i>new</i> DigiQuilt, this time I had one third red, one third yellow, and one third pink.
CVB: Yeah! And it was actually the same pattern.
A: Mm hmm.

¹ Her design page was not in the envelope.

² Read from her analysis page.

CVB: ...but when you put it into DigiQuilt it said that it was a third red, a third yellow, and a third pink. Is that the same thing as three ninths and six eighteenths?
A: Yes. One third is the same as six eighteenths. Because when you fill up the rows, it was like I was already saying, if you fill up the rows, then it will still be one third because you just filled in one row and it is like you shaded in one thirds.
CVB: OK. That's good. So what else can you tell me? What were your favorite parts? What part of it was motivating, or what part was demotivating?
A: The part that was motivating to me was when we got to put our pieces on fabric, and then you got to sew them together.
CVB: OK. So working with the fabric was very important to you?
A: Mm hmm.
CVB: You've also done some really cool things in DigiQuilt and PowerPoint. What are you thinking about that?
A: It was kind of hard, because you had to keep on going back in and saving the image once, and then go back and saving it twice, and saving like how many times you did it, in order.
CVB: Because you were doing an animation of <i>creating</i> the DigiQuilt project. Yeah. You've done two of those already. That's pretty cool.
A: Uh huh.
CVB: So they are calling people already ³ . Is there anything you want to add before we are done talking?
A: Yes. One more thing. One thing you should never do when you are making a quilt is put two light colors together, two light fabrics together, because it will be too light.
CVB: Oh. OK. So it is important to go...
A: ...with even light and dark, both together, yeah.

³ End of school day, for buses...