Context for the Video Segment
Tuesday August 5, 2014

This video clip is taken from a summer mathematics program class that takes place every summer for approximately 30 rising fifth graders. The children are recruited from a school district whose enrollment predominately consists of students who are members of marginalized groups. Families live in two adjacent communities, both of which have experienced significant economic decline in the last years, including rising unemployment and homelessness. Mathematics achievement is a broad concern in the district, drawing as evidence students' scores on the state assessment.

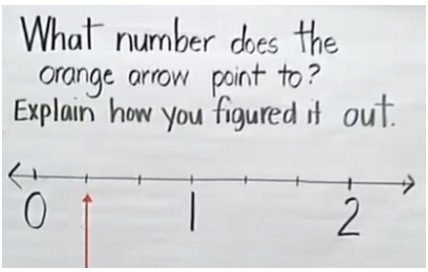
Students are randomly selected from those who apply for participation in the program, but the gender composition is deliberately balanced. The target for participation in the program is students who have not experienced success with mathematics in school, including some who are having significant difficulty. The classes vary slightly from year to year, but typically over 80% identify as Black, about 10 - 12% as Latin@, and the remaining 8% or so as White. Most students enrolled in the program have not enjoyed, felt confident, nor experienced success with mathematics in school. Although a strong effort is made to recruit students who have not been doing well, the program is not designed or advertised to be "remedial." Instead it is designed based on the assumption that, given the opportunity, the children can succeed with challenging and complex mathematical work. The work aims to fill in possible gaps at the same time that it engages the students in novel mathematics.

The teacher is a White woman, with over 30 years of teaching experience, consistently with children and families of color and multilingual children and families. This particular class is composed of 30 children, who identify to the best of our knowledge as:

	Black	Latin@	White
Male	10	2	2
Female	11	3	2

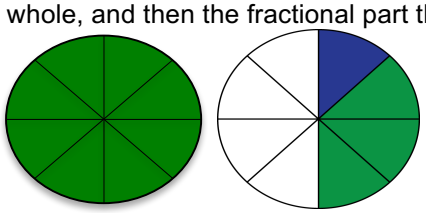
In the program, the children work on mathematics for 2½ hours each day for five days each across two weeks. The mathematical content of the instruction includes work on fractions (definitions, representations, placement on the number line), as well as on reading, interpreting, and solving equations. The students also encounter and are supported to solve complex and unfamiliar mathematics problems. Mathematical practices and techniques include explaining, representing, proving complex claims, presenting in public, and listening to others' mathematical ideas attentively, respectfully, and critically.

On the day of this video clip, the seventh day of the program, or the second day of the second week, the children began the morning with a "warm-up problem":



This problem represents a significant turning point in the mathematical work, from naming fractions as parts of areas to identifying fractions as points on the number line.

One important shift is to understand that on the number line, the whole is defined as the distance from 0 to 1. With area models, the whole can be greater than 1. For example, in the figure below, it is possible to name the green shaded portion as 1 3/8 or 11/8, if one identifies one circle as the whole. But it is also correct to identify two circles as the whole, and then the fractional part that is green is 11/16.



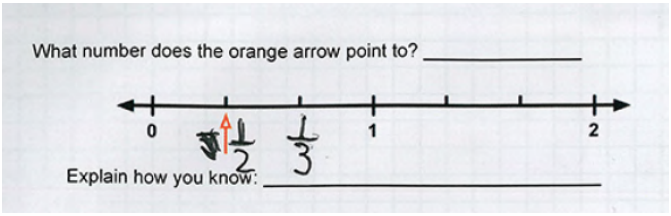
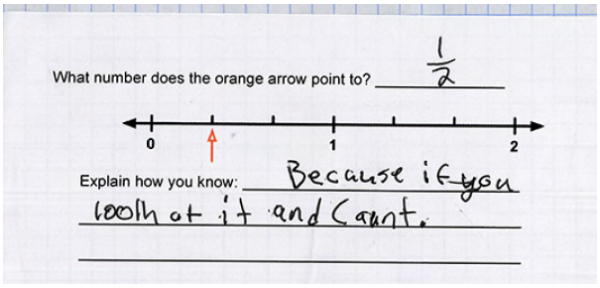
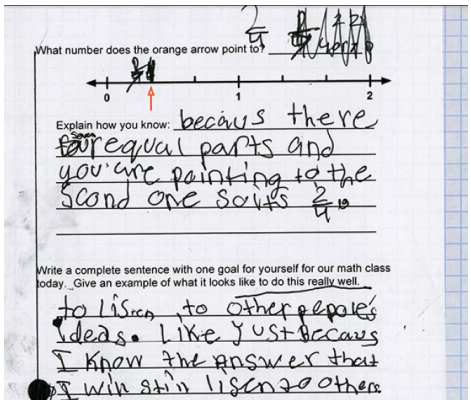
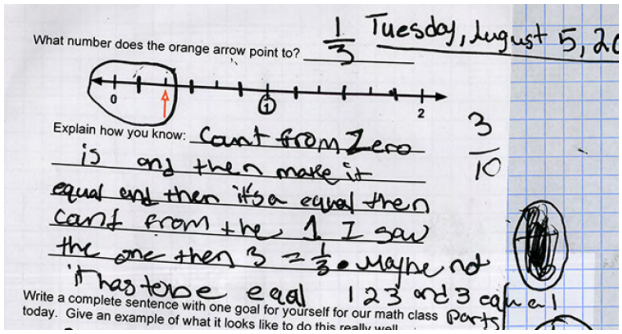
For the children, it is an important new understanding to learn that, on the number line, the whole is always defined as the interval from 0 to 1.

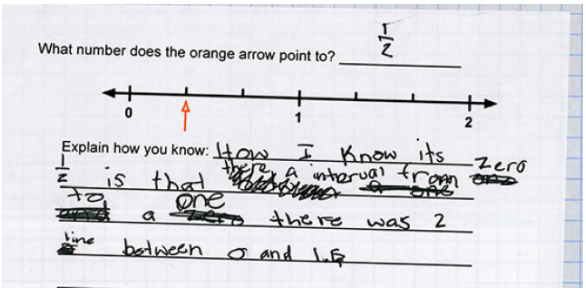
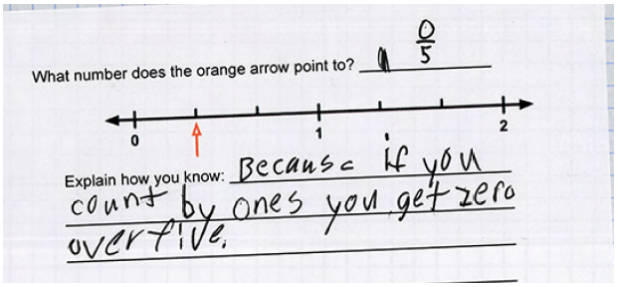
During the warm-up period (about five minutes), they pasted the warm-up problem in their individual notebooks and wrote their answers and explanations individually. The correct answer is 1/3.

This table shows what each child had written before the beginning of the class discussion represented on the video:

Gender	Race/ ethnicity	Child's name	Before class discussion
M	L	Abraham	1/2 no mention of equal parts or unit
F	B	Amaree	1
F	B	Anayjah	1/4
F	B	Aniyah	1/7
M	B	Aoud (Kennedy)	1/4
M	B	Ashton	1/2 (1/3)
M	B	Ben	--
F	L	Brenda	1/4
F	B	Brionne	~~1/3, 2/5~~, 1/3
M	B	Dante	1/2
M	W	Dylan	1/3
F	B	Dyniesha	1/2 ("I don't know! That's what I am saying!")
M	L	Efrain	1/3
F	W	Emeline	1/3 (incorrect explanation)
F	B	Ife	1/3 (incorrect explanation)
M	B	Jai'wan	1/3 ("because I know")
M	B	Jamari	1/3 (many cross-outs)
F	W	Jenna	1/7 (lots of cross-outs)
F	L	Katherine	2/4
F	B	Lakeya	2/4
M	B	Larry	2/4
F	B	Makayla	3/10 or 1/3
M	B	Marcus	--
F	L	Mariana	1/2
F	B	Ny'ree	-2
M	W	Parker	0/5
M	B	Randy	1
M	B	Robert	6/3
F	B	Starr	Lots of cross-outs
F	B	Toni	1/3

Some examples of what students have in their notebooks before the discussion:

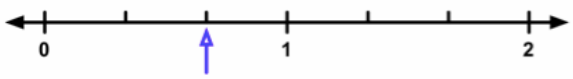
Ashton	
Dante	
Lakeya	
Makayla	

Mariana	
Parker	

During this short video segment, four children participate in the whole group discussion: Aniyah, Toni, Lakeya, and Dante. The class discussion continues for another 48 minutes. During this time, the discussion emphasizes the importance of partitioning the unit interval in equal parts and being sure to count spaces (i.e., intervals, not hash marks) to determine the distance from 0 for a given point on the line. Students practice naming points on the line and also explaining carefully with reference to the "whole" and to "equal parts" and to counting spaces to determine the number.

At the end of the class work, the teacher poses a question as an "end of class check," or "exit ticket":

1. What number does the blue arrow point to?



Explain how you figured this out:_____

_____

_____

_____

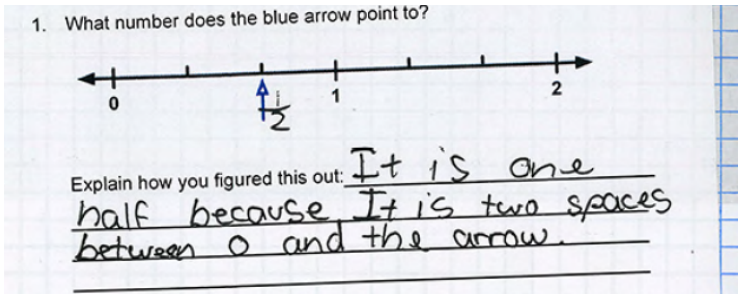
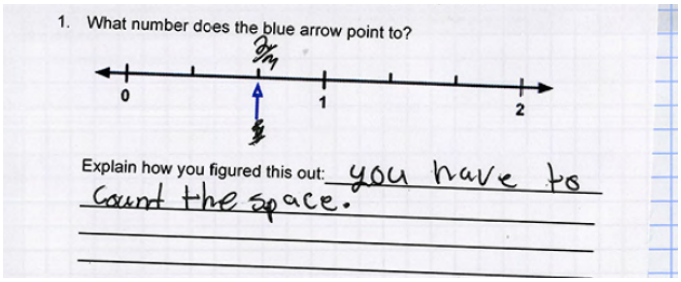
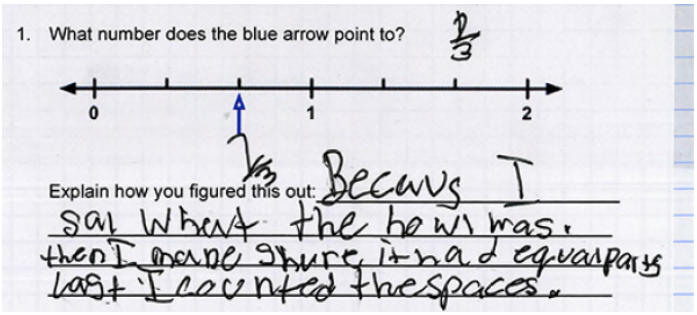
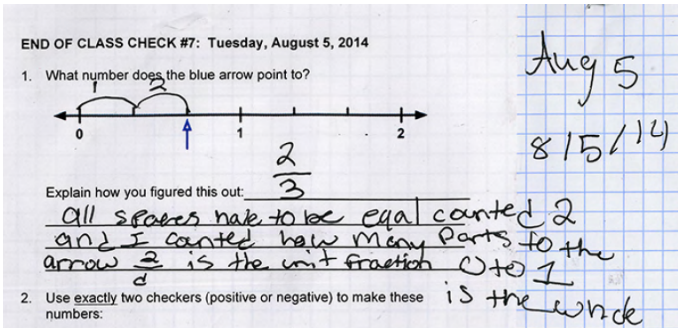
The correct answer is 2/3, and the target explanation would draw on the notions of the whole (the interval from 0 to 1), equal partitions of that whole, naming one part, and naming the number of equal parts.

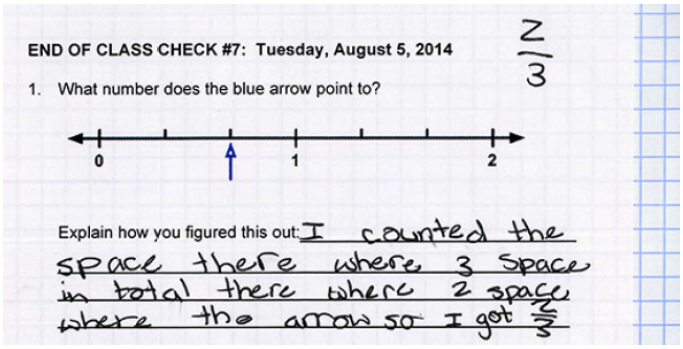
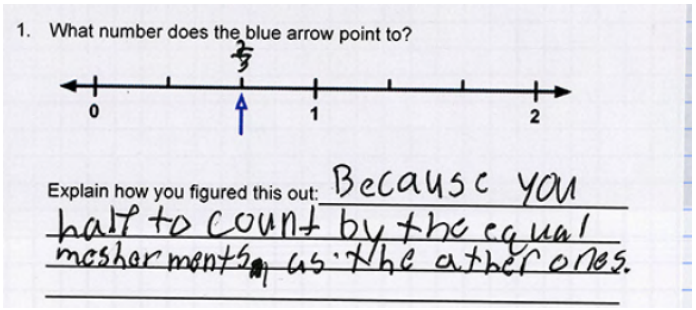
Here are what is in the children's notebooks at the end of this class:

Gender	Race/ ethnicity		After class discussion	Notes
M	L	Abraham	2/3	Explanation focuses on parts
F	B	Amaree	2/3	Explanation focuses on counting "spaces"
F	B	Anayjah	2/3	Explanation focuses on counting toward 1
F	B	Aniyah	2/3	Meta-comments about fractions
M	B	Aoud (Kennedy)	2/3	Strong explanation
M	B	Ashton	1/2	Reference to whole and spaces
M	B	Ben	2/3	Reference to counting spaces
F	L	Brenda	2/3	Explanation shifted from counting lines to spaces
F	B	Brionne	2/3	Clear explanation
M	B	Dante	2/3	Shifts from "look and count" to counting spaces
M	W	Dylan	2/3	Good explanation
F	B	Dyniesha	2/3	With elaborately labeled number line with all the numbers
M	L	Efrain	2/3	Good explanation
F	W	Emeline	2/3	Good explanation
F	B	Ife	2/3	Very good explanation
M	B	Jai'wan	2/3	More explanation
M	B	Jamari	2/3	More explanation
F	W	Jenna	2/3	Good explanation
F	L	Katherine	2/3	Good explanation
F	B	Lakeya	2/3	Good explanation
M	B	Larry	3/4	Emphasis on equal parts
F	B	Makayla	2/3	Very complete explanation
M	B	Marcus	2/3	Good explanation
F	L	Mariana	2/3	Good explanation
F	B	Ny'ree	1/3	Emphasis on spaces
M	W	Parker	2/3	Explanation
M	B	Randy	--	Marks correctly and pays attention to equal spaces but does not name specific number
M	B	Robert	2/3	Uses definition
F	B	Starr	2/3	Offers explanation
F	B	Toni	2/3	Improved explanation

So before the class discussion, about 7 children (23%) can correctly name the point on the number line with a correct number name. After the discussion, 26 (87%) can do so, and of the four students who did not name the point correctly, they referred to important aspects of the definition, including "equal parts" and "spaces."

Here again are the same six students whose warm-up problems are shown above, this time showing their work on the end-of-class check. It is interesting to compare their answers before and after the 51-minute in-class discussion of how to name fractions as points on the line.

Ashton	
Dante	
Lakeya	
Makayla	

Mariana	
Parker	

Mathematical learning goal as represented in the Common Core State Standards:

3.NFA.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.NFA.1 and 2: Understand a fraction as a number.

The translation of this standard into a usable definition of fractions, developed by the teacher and the students over a few days: