

Raising the Bar: Lifting Students by Learning from Their Views on Mathematical Strengths

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Overview of Presentation

- Our Journey to Mathematical Strengths
- Math Strength Activity: *Say Cheese!!*
- Using Students' Strengths in the Classroom
- Examining Students' Views on Mathematical Strengths



Our PLC was formed



- Mathematical Pedagogical Problem Solvers (MPPS)
- Established in 2010
- Math Teachers & UGA Teacher met monthly
- Purpose:
 - Address our pedagogical problems of practice
 - Improve instruction for our diverse learners
 - Learn to motivate all students
 - Normalize problems of practice (Little & Horn, 2007)



Our Guiding Principles – Year 1

- Teaching is a complex endeavor that requires teachers to tackle many problems of practice.
- Problems are more likely to be resolved when teachers collaborate with colleagues in a professional learning community.



At first it was great!

- Met with teachers from the 4 middle schools
- Shared, listened, and reflected on the myriad of problems that arose in our teaching including:
 - motivating students
 - differentiating instruction for diverse learners
 - navigating new curricular resources
 - district mandates
- Had pizza!





A change in perspective

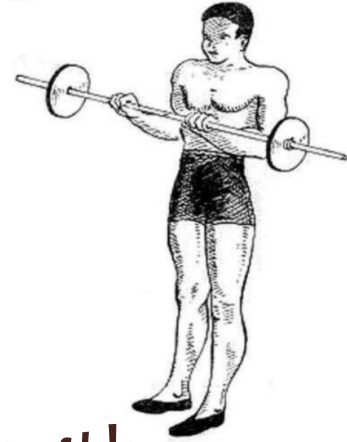
- Unfortunately, we spent much of our meetings discussing our students' weaknesses and unproductive behaviors instead of focusing on solutions to our pedagogical problems.
- We shifted away from *what our students could not do and understand*, towards *what they could do and understand*, which we refer to as their strengths
- It was empowering and challenging at the same time, requiring us to broaden our definition of a mathematical strength.

Our PLC's second guiding principle..

Every student brings strengths into the classroom, and it is up to us, as teachers, to identify and capitalize on those strengths for everyone's benefit.



Take a moment to think about the students in your class



- What are your students' mathematical strengths?
- How do you know a mathematical strength when you see it?
- Can you identify at least one mathematical strength for every student?

Share your responses with your tablemates

Why strengths?

- Allow us to look at our students from a positive lens
- Increase student self efficacy
- Promote our continued growth and reflection
- Development of the taxonomy of students' mathematical strengths
 - brainstormed strengths we wanted to see
 - observed our students
 - found additional strengths and modified our list



These strengths extend beyond rapid computations and when acknowledged, can positively affect the classroom climate and attitudes of both teachers and students.

As educators, however, focusing on students' strengths can be difficult, because we have been taught to look for students' errors and misconceptions in order to correct them (Jilk 2016)

However, identifying every students' strengths can be a challenge.

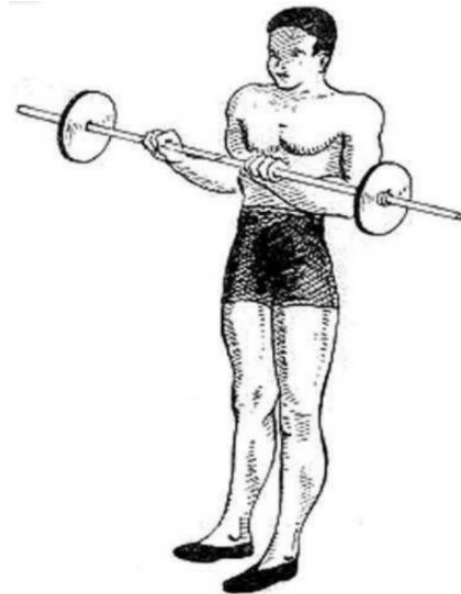


Our Context

- Kent County (a pseudonym) School District enrolls a diverse student body across 21 schools.
- During the 2015–2016 school year, the district enrolled approximately 13,600 students
 - 49 percent African American
 - 24 percent Hispanic
 - 21 percent White,
 - 4 percent Multiracial, and 2 percent Asian, with approximately
 - 78 percent of students eligible for free or reduced lunch.
- The district includes four middle schools with approximately 2,800 students in grades 6–8.



What does it mean to be smart in math?



What does it mean to be smart in math?



- I'm good at asking questions to catch up.
- I'm good with guess and check.
- I'm smart at math because I'm logical.
- I know my times tables.
- I am open to new approaches.
- I can balance my checkbook.
- I am comfortable with graphs and tables.
- I can follow directions.
- I am smart at estimating.
- I can explain my thinking.
- I'm good at math because I'm motivated to solve problems.
- I work well in groups.
- I can use multiple strategies to solve one problem.
- I can think under pressure.
- I can visualize how problem work before I solve them.
- I'm smart at math because I'm good at multiplication.
- I am good at making charts.

Adapted from the book, *Smarter Together! Collaboration and Equity in the Elementary Math Classroom* (2011)

Taxonomy of Students' Mathematical Strengths

Motivation

Excited about what they solved

Perseverance

Desires to learn and understand
– wants to know why

Mathematical Knowledge

Knows basic facts

Mental mathematics

Identity as a Doer-of-Mathematics

Confident in what they know

Thinks deeply

Generates
examples and
counter-examples

Self-awareness of what s/he
knows and can draw upon in given
situations

Communication

Explains ideas to other students
well
Takes risks – willingness to
contribute
Shows work

Problem Solving

Creates a diagram of problem
or thinks simpler problem

Remembers
context of
problem

Ability to think
of alternate
methods

Has reasoning skills
Pays attention to details



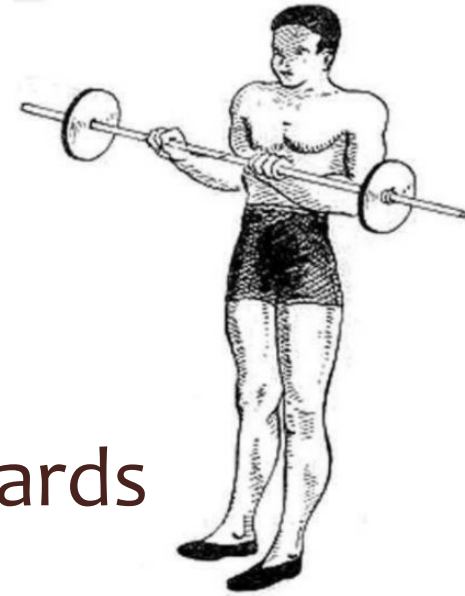
How we use the Taxonomy

- Infuse students' strengths during lesson planning
- Use students' strengths to reword tasks
- Recognize students' strengths that are often overlooked
- Acknowledge students' strengths to encourage participation

A MATHEMATICS STRENGTH ACTIVITY



Let's do an activity!: Say Cheese!



- Each Group of 4 will get a set of cards and materials.
- Read the directions before you begin.
- Work together to complete the table and solve the problem.

Adapted from the book, *Smarter Together! Collaboration and Equity in the Elementary Math Classroom* (2011)

Let's do an activity!

Group Norms

- Everyone must contribute
- Respect the contributions of all members
- No talking outside your group
- Listen carefully to each member of your group
- Call the instructor for group questions only.
- You have the responsibility to ask for help and the responsibility to offer it.
- I can't..... yet!



Adapted from the book, *Smarter Together! Collaboration and Equity in the Elementary Math Classroom* (2011)

How much does a smile cost?

Use the clues to place the faces and sums on the table below. Once complete, figure out how much each face cost.

	1	2	3	Sum
1				\$40
2				\$32
3				\$35
4				\$37
Sum	\$52	\$50	\$42	

Adapted from FigureThis! (www.figurethis.org)

Reflection Questions:

- Was it more difficult to explain your thinking or to listen to another member of the group explaining?
- If your group became “stuck,” how did you get “unstuck”?
- Name one special contribution a person at your table made as you were working on this task.



Adapted from Teachers Development Group 2005

Our journey...

All students can learn mathematics

All students can do mathematics

All students have mathematical strengths

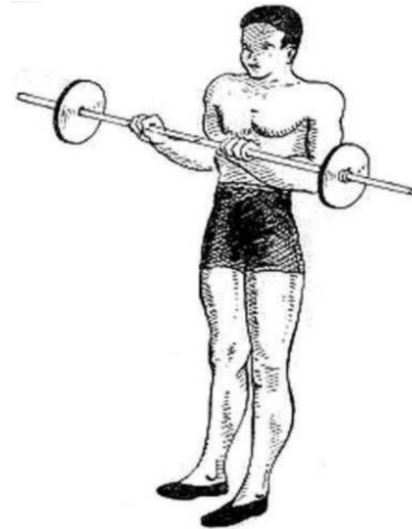
All teachers can identify and support
students' mathematics strengths



A stylized, dark brown illustration of a plant with several leaves and small, round berries or buds, positioned on the left side of the slide.

USING STRENGTHS IN THE CLASSROOM

EXPLORING STUDENTS' VIEWS ON STRENGTHS



We wanted to know what middle school students thought about strengths...

Each teacher designed an action research project to share the taxonomy with their students.

Teacher	Number of Students	Grade	Number of Classes	Collection Methods
Kristina	26	8th	2	Class discussions
Nick	37	7th	2	Survey and class bulletin board
Rob	50	6th	2	Surveys and class discussion
Fred	110	7th	4	Surveys and class discussions



Kristina's Project

- Two classes of 8th grade students who struggle in mathematics and did not see themselves as “good in math”
- Class conversations answering the question: What does it mean to have a math strength?
- Initial List focused on computations
 - Shows work
 - Explains thinking
 - Works hard
- Asked students to pick a strength from list and document when they used it.
- Students quick to identify strengths when making list, but more hesitant to identify his or her own strengths.



Kristina's Project

Student	Identified strength	Story of strength
S11	Draw upon what you know	When solving systems of equations algebraically, student made explicit connections to solving linear equations and using inverse operations.
S16	Mental math	Finding solution to a linear equation, student was able to generate examples quickly by manipulating the equation mentally.
S23	Thinks deeply Takes risks and willingness to contribute	When creating a system to compare pizza companies, this student thought through the problem (given price per pizza and delivery fees) to decide which was cheaper. Shared thinking in conversation.



Nick's Project

Wanted the students to recognize their strengths and work on them.

Administered survey to two classes: Adv. and Inclusion (n=37).

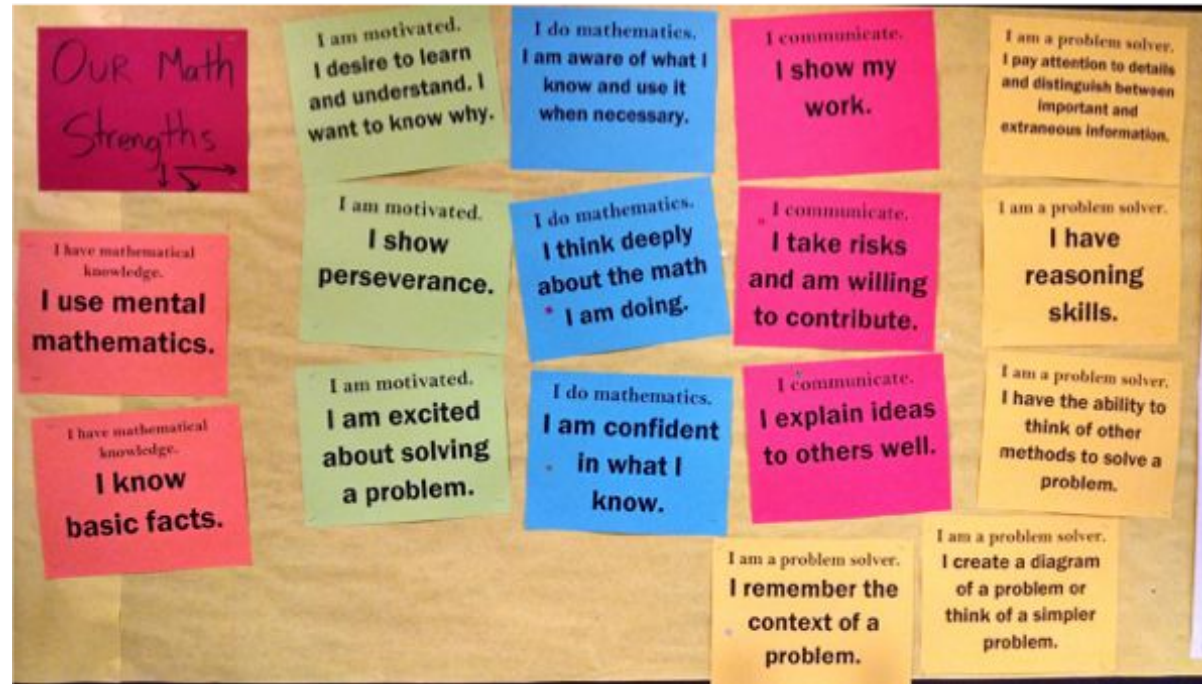
Asked student to read and select greatest strength and strength to improve from Taxonomy

Strength	What is one of YOUR math strengths?		Choose a math strength that you want to get BETTER at this year in math.	
	Number	Percent	Number	Percent
Knows basic facts	5	14%	4	11%
Good at mental math	8	22%	4	11%
Excited about what you solved	2	5%	2	5%
Perseverance (keeps trying even when it's hard)	6	16%	6	16%
Desires to learn and understand — wants to know WHY	4	11%	0	0%
Explains ideas to other students well	1	3%	2	5%
Takes risks—willing to contribute	3	8%	3	8%
Shows your work	4	11%	7	19%
Creates a diagram of a problem or thinks of a simpler solution	2	5%	0	0%
Remembers the context of a problem	0	0%	1	3%
Ability to think of alternate methods	0	0%	4	11%
Has reasoning skills	2	5%	0	0%
Pays attention to details—distinguishes between important/ extraneous data	0	0%	4	11%



Nick's Project

After conversation with MPPS, attempted to incorporate mathematical strengths explicitly into his lessons to increase awareness of strengths.



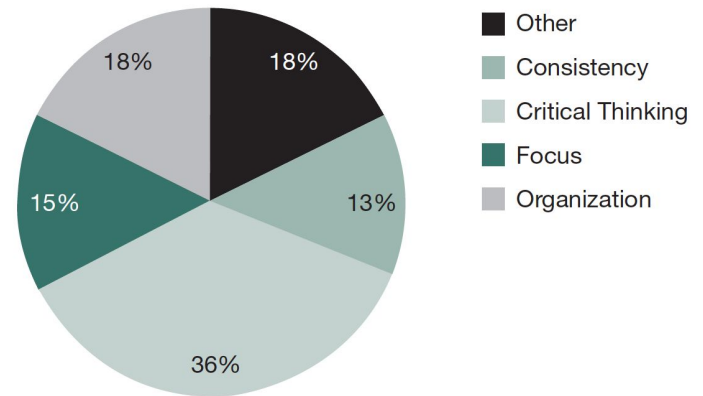
Rob's Project

Two rounds of surveys to two classes
(n=50).

1st survey focused on question: “What is your greatest strength?” along with a collection of question to get to better know the students (e.g. How many hours of sleep do you get a night?)

Students given four strengths to choose from and an “other” option.

What is your greatest strength as a student?



Rob's Project

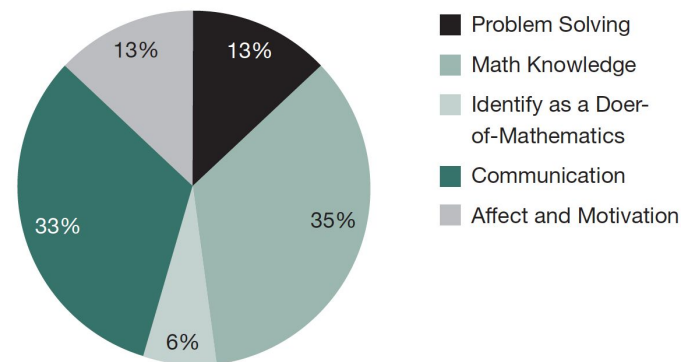
Refined the direction of project after meeting with MPPS group.

Introduced Taxonomy and had students at the end of class refer to it and select the strengths they had demonstrated.

After 10 days, gave students a 2nd survey asking 3 questions:

- 1) Which of the 5 characteristics outlined above did you most identify with as a math student?
 - a) Problem solving
 - b) Mathy knowledge
 - c) Identity as a doer-of-mathematics
 - d) Communication
 - e) Affect and Motivation
- 2) Why did you choose that?
- 3) What motivates you to do well in school?

Which of the 5 characteristics outlined above do you most identify with as a math student?



Fred's Project

Surveyed all classes (n = 110).

Two surveys given at the end of weekly content assessments: "What is/are your mathematical strength(s)?"

Initial survey asked students to select as many strengths as they believed they possessed from a list of 10.

The results were difficult to interpret because students' responses ranged from selecting one strength to all ten strengths.

	Number of students
Knows basic facts	100
Knows mental mathematics	99
Excited about what I solved	63
Desires to learn and understand	110
Confident in what I know	50
Thinks deeply	19
Self-aware of what I know and can use it in situations	43
Explains ideas to other students	22
Shows work	110
Ability to think of alternate methods	45



Fred's Project

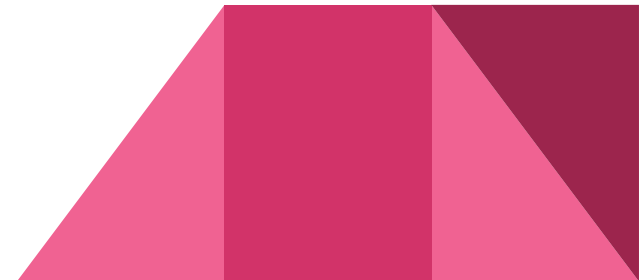
Between assessment surveys, shared Taxonomy and modeled what the 10 strengths listed would look like.

At the end of the lessons, he had students give examples of the strengths Fred had demonstrated through the lesson.

This lead to students discussing what it means to demonstrate a strength.

To ease data analysis, the second survey only allowed students to select two strength they most displayed.

All students choose two of the ten: "Knew basic facts" & "Confident in what I know"



Summary of Projects

- All students consider speed and accuracy as mathematical strengths and we were surprised to learn they rarely thought about many of the strengths we identified on the TMS.
- Some students were resistant to these new strengths when we first presented them and made comments like, “*I don’t think I have one*” or “*This is easy for you [the teacher] because you know this stuff.*”
- Students welcomed the opportunity to broaden their views on strengths, and as one student noted, “*it was freeing to know that there were many ways to be successful beyond being textbook smart.*”



(White, et. al., 2017, p. 43)



Summary of Projects

- We began to see a shift in the way students talked about strengths and interacted with each other.
- Students paid attention to the way their peers solved problems and provided justifications.
- We saw students' willingness to try, to reach outside of their comfort zone, to take chances, and to seem vulnerable in front of their peers.
- The conversations during our MPPS meetings helped us clarify our thinking, interpret what students thought, and support our efforts.
- We could not have learned as much if we did the projects on our own.

(White, et al., 2017)

Annual Perspectives in Mathematics Education

Reflective and Collaborative Processes to Improve Mathematics Teaching

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NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS

Educators Learning from Middle School Students' Views of Mathematical Strengths

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Creating equitable classroom environments where every student is valued and respected requires teachers to work collaboratively as they plan instruction, resolve problems of practice, and support each other to take responsibility for their students' mathematics learning (National Council of Teachers of Mathematics [NCTM] 2014). Research on professional learning communities (PLCs) suggests that these communities can provide teachers with opportunities to work collaboratively, communicate with colleagues, and continuously learn together (Vescio, Ross, and Adams 2008). Paramount to these communities is teacher engagement in professional conversations, defined as "discussions among those who share a complex task or profession in order to improve their understanding of and efficacy in what they do" (Britt, Irwin, and Ritchie 2001, p. 31). These conversations can promote professional learning and instructional improvement when teachers reflect on problems of practice (Little and Horn 2007). Problems such as motivating students, differentiating instruction for diverse learners, and navigating new curricular resources and district mandates are more likely to be resolved when teachers collaborate with colleagues. In our PLC, we have found that focusing our conversations on students' mathematical strengths has fostered new perspectives of our students' potential and success in mathematics classrooms.

Featherstone and colleagues (2011) have suggested that every student has mathematical strengths and that it is the teacher's responsibility to set norms in the classroom that highlight these strengths. Students' strengths extend beyond rapid computation and other attributes traditionally seen as displays of intelligence and understanding in mathematics.

A professional learning community, or PLC, identifies students' mathematical strengths and shows how the PLC uses the information to support students as mathematical thinkers and doers.

ASSEMBLING THE **PUZZLE** OF MATHEMATICAL STRENGTHS

Dorothy Y. White, Carlos Nicolas Gomez,
Fredric Rushing, Nicholas Hussain,
Kristina Patel, and Jason Pratt

Take a moment to think about the students in your class. What are your students' mathematical strengths? How do you know a mathematical strength when you see it?

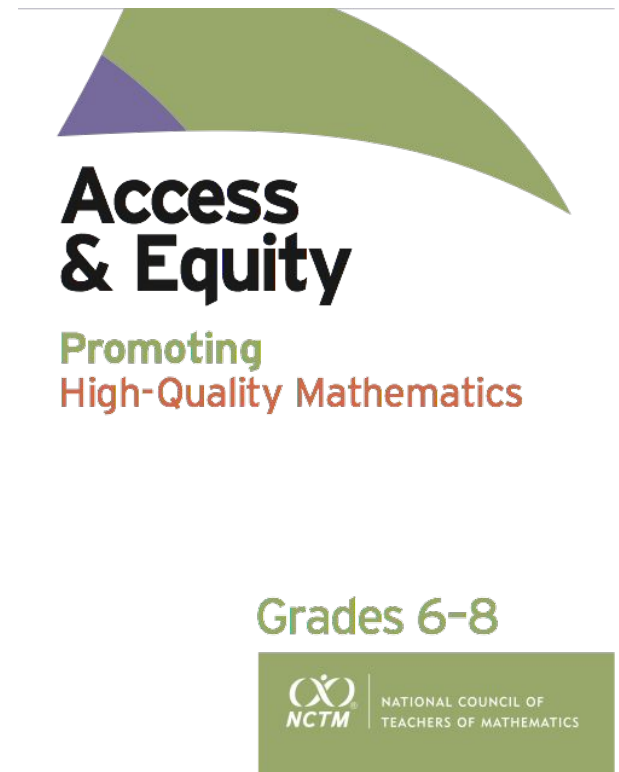
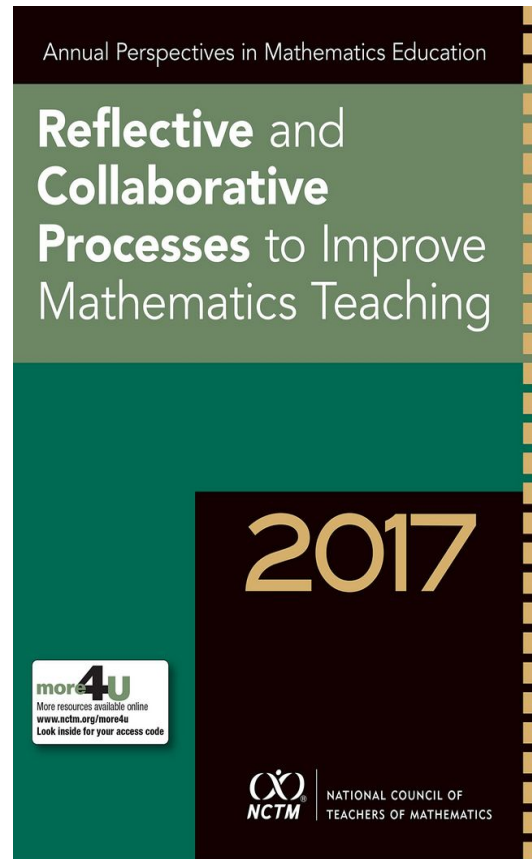
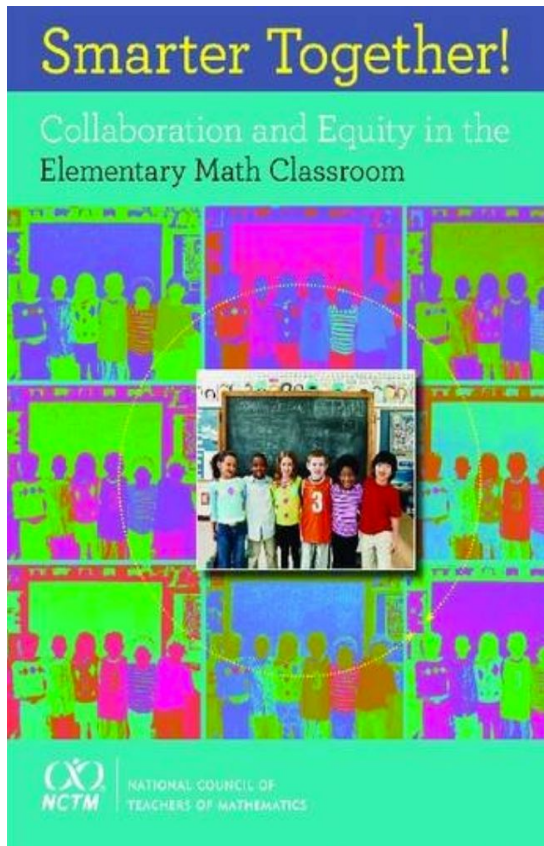
Can you identify at least one mathematical strength for every student? More important, how are you using students' strengths in your mathematics classrooms?

A PROFESSIONAL LEARNING COMMUNITY IN ACTION

Teaching is a complex endeavor that requires teachers to tackle many problems of practice. In *Principles to*



Resources

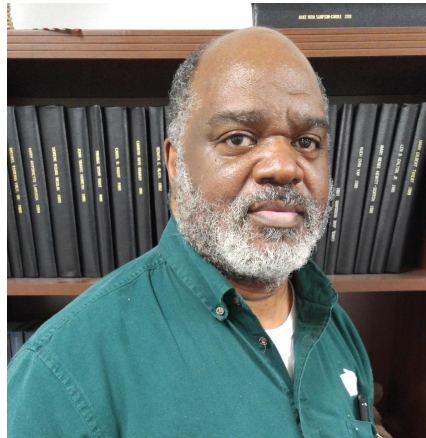
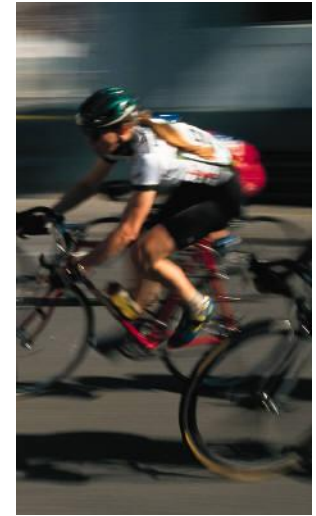




“Opening up more ways to do math creates more opportunities for more children to see themselves, and for others to see them, as smart in math.”

Featherstone, Crespo, Jilk, Oslund, Parks, & Wood (2011, p. 16)

The MPPS invites you to share your ideas



THANK YOU!!!

Thank you!

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