

Empowerment WITH Access and Equity

Matt Larson
NCTM President
@mlarson_math

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Goals

- Look at how I think NCTM found itself in its current position with respect to Access and Equity.
- Discuss NCTM's re-framing of Access and Equity.
- Make connections between Equitable Instructional Practices and *Principles to Actions*.
- Offer my perspective on why we teach mathematics.

Math Education Reform Has Been Driven by Economic Concerns

The current reform movement in mathematics education has been framed within a discussion of national economic interests.

Tate, W. F. (2013). Race, retrenchment, and the reform of school mathematics. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers, second edition* (pp. 42-51). Milwaukee, WI: Rethinking Schools.

Economic Concerns Have Long Driven Mathematics Education

Mercantile schools in 14th century Europe began teaching commercial arithmetic out of a growing economic need for efficient calculation.

Harouni, H. (2015). Toward a political economy of mathematics education. *Harvard Educational Review*, 85(1), 50-74.

Economic Concerns Have Long Driven Mathematics Education

... as business grew in the colonies, the need for more citizens to be able to perform simple arithmetic increased, and eventually, schools added arithmetic to the required subjects.

Larson, M. R., & Kanold, T.K. (2016). *Balancing the equation: A guide to school mathematics for educators and parents*. Bloomington, IN: Solution Tree Press.

Economic/National Defense Origins of 20th Century Math Education Reforms

- WWII: American recruits did not have sufficient basic computational and problem solving skills.
- Soviet launching of Sputnik in 1957.

Fey, J. T., & Graeber, A. O. (2003). From the new math to the Agenda for Action. In G.M.A. Stanic & J. Kilpatrick (Eds.), *A history of school mathematics* (Vol. 1, pp. 521-558). Reston, VA: National Council of Teachers of Mathematics.

Standards-Based Reform Has Its Origin in National Defense/Economic Concerns

A Nation at Risk (1983):

If an unfriendly foreign power had attempted to impose on America the mediocre educational performance that exists today, we might well have viewed it as an act of war.

National Commission on Excellence in Education. (1983, April). *A nation at risk: The imperative for educational reform*. Washington, DC: US Department of Education.

NCTM Joined the Dominate Narrative

The social injustices of past schooling practices can no longer be tolerated ... Mathematics has become a critical filter for employment and full participation in our society.

We cannot afford to have the majority of our population mathematically illiterate: Equity has become an economic necessity. (p. 4)

NCTM. (1989). *Curriculum and evaluation standards for school mathematics*. Reston, VA: NCTM.

NCTM Attempted to Change the Narrative

The need for mathematics in a changing world:

- *Mathematics for Life* – knowing mathematics can be personally satisfying and empowering.
- *Mathematics as a part of cultural heritage*.
- *Mathematics for the workplace*.
- *Mathematics for the scientific and technical community*.



NCTM. (2000). *Principles and Standards for School Mathematics*. Reston, VA: NCTM. (p. 4)

NCLB Returned to the Traditional Economic National Interest Narrative

No Child Left Behind motives are cast in the national interest rather than aimed at developing a truly democratic society.

Berry, R. Q. III, Ellis, M., & Hughes, S. (2014). Examining a history of failed reforms and recent stories of success: mathematics education and Black learners of mathematics in the United States. *Race Ethnicity and Education*, 17(4), 540-568.

The Common Core Initiative Continued the Same Narrative

The standards are designed to be robust and relevant to the real world, reflecting the knowledge and skills that our young people need ... With American students fully prepared for the future, our communities will be best positioned to compete successfully in the global economy.

National Governors Association Center for Best Practices and Council of Chief State School Officers. 2010a. Common Core State Standards Initiative, Mission Statement. <http://www.corestandards.org/>.

What is Usually Missing From Current Mathematics Education Debates?

There are intense debates focusing on curriculum, teaching, learning, and assessment, but few debates on **understanding the realities of children's lives**.

Berry, R. Q. III, Ellis, M., & Hughes, S. (2014). Examining a history of failed reforms and recent stories of success: mathematics education and Black learners of mathematics in the United States. *Race Ethnicity and Education*, 17(4), 540-568.

Bottom Line: I Agree

NCTM has traditionally focused on standards, curriculum, instructional practices, and assessment in a de-contextualized way – **emphasizing “technical solutions” that too often have ignored the experiences of children.**

We Must Recognize Students’ Realities

The work to become truly effective educators [of marginalized students] requires a new approach to teaching that embraces the complexity of place, space, and their collective impact on the psyche of urban youth ... Teaching to who students are requires a recognition of their realities.



Emdin, C. (2016). *For white folks who teach in the hood ... and the rest of y'all too: reality pedagogy and urban education*. Boston, MA: Beacon Press.

Moving Forward

NCTM has too often narrowly addressed Access and Equity through “access” issues.

We are re-framing our discussion to focus on Access, Equity, and Empowerment, to capture the critical constructs of identity, agency, and social justice.

NCTM-hosted Equity Initiative

March 24, 2016

- TODOS
- NCSM
- AMTE
- ASSM
- BBA
- WME
- NASGEm
- Journal of Urban Mathematics Education (JUME)



Priority NCTM Actions: Access, Equity and Empowerment

- Stop using deficit language
- Expand beyond Access & Equity, to include concepts of Identity and Agency



Priority NCTM Actions: Access, Equity and Empowerment

- Incorporate discussion/examples of equity issues in the enactment of the eight effective teaching practices in NCTM's *Principles to Actions: Ensuring Mathematical Success for All* (P2A) in our forthcoming grade-band teaching practices elaboration books and other P2A related materials.



Priority NCTM Actions: Access, Equity and Empowerment

- Redefine Culture and Values within and Communicated by NCTM
 - Work to make NCTM's membership and leadership more diverse
 - Work to change the dialogue within and from NCTM



2017 NCTM Annual Conference



Three Multilingual Sessions

- Panel Discussion
- Elementary Workshop
- Secondary Workshop

2017

ACCESS, EQUITY & EMPOWERMENT
November 15 – 17, 2017
Las Vegas, NV

2018

**The Language of Mathematics: Students
Finding Their Voice in Mathematics**
October 4-6, 2018
Hartford, CT
**Kyndall Brown, TODOS Board Member, is
Program Chair**

Some Connections Between *Principles to Actions* and Equitable Instructional Practices

Mathematical Identity

Mathematics identity includes beliefs about one's self as a mathematics learner, one's perceptions of being seen by others as a mathematics learner, beliefs about the nature of mathematics, engagement in mathematics, and perception of oneself as a potential participant in mathematics.

Solomon, Y. (2009). *Mathematical literacy: Developing identities of inclusion*. New York, NY: Routledge.

Building Mathematical Identity

Teachers can cultivate mathematical abilities by providing opportunities for students to make sense of and persevere in challenging mathematics. That is, students should be engaged with mathematics that requires active participation, asking questions, problem posing, and reasoning.

Berry, R. Q. III. (2016). Informing teachers about identities and agency using the stories of Black middle school boys who are successful with school mathematics. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Helping all students understand important mathematics* (pp. 27-54). Reston, VA: NCTM.

Teaching and Learning Principle

Teaching and Learning. An excellent mathematics program requires effective teaching that engages students in meaningful learning through individual and collaborative experiences that promote their ability to make sense of mathematical ideas and reason mathematically.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Beliefs about teaching and learning mathematics

Unproductive beliefs	Productive beliefs
The role of the teacher is to tell students exactly what definitions, formulas, and rules they should know and demonstrate how to use this information to solve mathematics problems.	The role of the teacher is to engage students in tasks that promote reasoning and problem solving and facilitate discourse that moves students toward shared understanding of mathematics.
The role of the student is to memorize information that is presented and then use it to solve routine problems on homework, quizzes, and tests.	The role of the student is to be actively involved in making sense of mathematics tasks by using varied strategies and representations, justifying solutions, making connections to prior knowledge or familiar contexts and experiences, and considering the reasoning of others.
An effective teacher makes the mathematics easy for students by guiding them step by step through problem solving to ensure that they are not frustrated or confused.	An effective teacher provides students with appropriate challenge, encourages perseverance in solving problems, and supports productive struggle in learning mathematics.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Anticipating Student Thinking Builds Identity

Teachers' anticipation of students' thinking and action is a form of helping students develop their identities because it conveys to students that their teachers care enough about them to understand how they think and see the world.

Berry, R. Q. III. (2016). Informing teachers about identities and agency using the stories of Black middle school boys who are successful with school mathematics. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Helping all students understand important mathematics* (pp. 27-54). Reston, VA: NCTM.

Five Practices to Promote Productive Math Discussions

1. Anticipating likely student responses to challenging mathematical tasks.
2. Monitoring students' actual responses to the tasks (while students work on the tasks in pairs or small groups).
3. Selecting particular students to present their mathematical work during whole-class discussion.
4. Sequencing the student responses that will be displayed in a specific order.
5. Connecting different students' responses and connecting the responses to key mathematical ideas.



Smith, M. S., & Stein, M. K. (2011). *5 practices for orchestrating productive mathematics discussions*. Reston, VA: NCTM.

Agency: Identity in Action

Mathematical agency is about participating in mathematics in personally and socially meaningful ways ... With a high sense of agency students can resist negative identities imposed on them by having a sense of control over their academic success.

Berry, R. Q. III. (2016). Informing teachers about identities and agency using the stories of Black middle school boys who are successful with school mathematics. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Helping all students understand important mathematics* (pp. 27-54). Reston, VA: NCTM.

Agency

Teachers can affirm students mathematics identity and help them develop a sense of agency by promoting persistence and reasoning during problem solving ... Teachers can encourage students to see themselves as confident problem solvers and as active participants in mathematics.

Berry, R. Q. III. (2016). Informing teachers about identities and agency using the stories of Black middle school boys who are successful with school mathematics. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Helping all students understand important mathematics* (pp. 27-54). Reston, VA: NCTM.

Eight Research-Informed Instructional Practices

Support productive struggle in learning mathematics.

Effective teaching of mathematics consistently provides students, individually and collectively, with opportunities and supports to engage in productive struggle as they grapple with mathematical ideas and relationships.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Some of Berry's Reflective Questions on Identity and Agency

- In what ways, if any, do I affirm the identities of my students?
- What teaching practices do I use to support and affirm students' mathematics identity development?
- How do students demonstrate high and low sense of agency in my mathematics classroom?
- How do I model a high sense of agency and how do I provide opportunities for students to demonstrate a high sense of agency?

Berry, R. Q. III. (2016). Informing teachers about identities and agency using the stories of Black middle school boys who are successful with school mathematics. In E. A. Silver & P. A. Kenney (Eds.), *More lessons learned from research: Helping all students understand important mathematics* (pp. 27-54). Reston, VA: NCTM.

Equity-based Mathematics Teaching Practices that Strengthen Mathematical Learning and Cultivate Positive Student Mathematical Identities

Going deep with mathematics. Lessons include high cognitive demand tasks that support and strengthen student development of the strands of mathematical proficiency.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

Contextualized Cognitively Demanding Tasks

[We must] engage students, socially marginalized in their societies, in cognitively demanding mathematics ... Doing serious mathematics allows students to challenge dominant ideological messages they have internalized about their own ability ... to do academic mathematics.

Powell, A. B. (2012). The historical development of critical mathematics education. In A. A. Wager & D. W. Stinson (Eds.), *Teaching mathematics for social justice: Conversations with educators* (pp. 21-34). Reston, VA: NCTM.

Supporting Emerging Bilinguals

Practices for effective mathematics instruction with EB:

- ELLs should work on challenging tasks that reflect their mathematical potential. The level of the mathematical tasks should not be lowered based on language considerations while making the context accessible.

Civil, M., & Turner, E. E. (2014). Introduction. In M. Civil & E. Turner (Eds.), *The common core state standards in mathematics: For English language learners, grades K-8* (pp. 1-5). Alexandria, VA: TESOL Press.

Eight Research-Informed Instructional Practices

Implement tasks that promote reasoning and problem solving.

Effective teaching of mathematics engages students in solving and discussing tasks that promote mathematical reasoning and problem solving and that allow for multiple entry points and varied solution strategies.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Implement tasks that promote reasoning and problem solving Teacher and student actions

What are teachers doing?	What are students doing?
Motivating students' learning of mathematics through opportunities for exploring and solving problems that build on and extend their current mathematical understanding.	Persevering in exploring and reasoning through tasks.
Selecting tasks that provide multiple entry points through the use of varied tools and representations.	Taking responsibility for making sense of tasks by drawing on and making connections with their prior understanding and ideas.
Posing tasks on a regular basis that require a high level of cognitive demand.	Using tools and representations as needed to support their thinking and problem solving.
Supporting students in exploring tasks without taking over student thinking.	Accepting and expecting that their classmates will use a variety of solution approaches and that they will discuss and justify their strategies to one another.
Encouraging students to use varied approaches and strategies to make sense of and solve tasks.	



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Supporting Emerging Bilinguals

Practices for effective mathematics instruction with EB:

- ELLs need to have opportunities to communicate mathematically in the classroom (beyond vocabulary) ... teachers should engage ELLs in mathematical discourse by encouraging them to make conjectures and explain their thinking.

Civil, M., & Turner, E. E. (2014). Introduction. In M. Civil & E. Turner (Eds.), *The common core state standards in mathematics: For English language learners, grades K-8* (pp. 1-5). Alexandria, VA: TESOL Press.

Eight Research-Informed Instructional Practices

Facilitate meaningful mathematical discourse.

Effective teaching of mathematics facilitates discourse among students in order to build shared understanding of mathematical ideas by analyzing and comparing student approaches and arguments.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Supporting Emerging Bilinguals

Practices for effective mathematics instruction with EB:

- Teachers should use (and encourage students to use) multiple resources to support sense making and communication – go beyond traditional forms of communication, e.g. drawings, gestures, & concrete materials.

Civil, M., & Turner, E. E. (2014). Introduction. In M. Civil & E. Turner (Eds.), *The common core state standards in mathematics: For English language learners, grades K-8* (pp. 1-5). Alexandria, VA: TESOL Press.

Supporting Emerging Bilinguals

Students' use of everyday language should not be treated as a failure to be mathematically precise, but as a resource for communicating mathematical reasoning, making sense of mathematical meanings, and learning with understanding ... focus on the mathematical content of students' contributions.

Moschkovich, J. (2014). Building on student language resources during classroom discussions. In M. Civil & E. Turner (Eds.), *The common core state standards in mathematics: For English language learners, grades K-8* (pp. 7-19). Alexandria, VA: TESOL Press.

Equitable Instructional Practices & Connections to Supporting Principles

Access and Equity

Curriculum

Tools and Technology

Assessment

Professionalism



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Guiding Principles for School Mathematics: Access and Equity

Access and Equity. An excellent mathematics program requires that *all* [each and every] students have access to high-quality mathematics curriculum, effective teaching and learning, high expectations, and the support and resources needed to maximize their learning potential.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Concerns with “For All”

... the language suggests a myopic focus on modifying curricula, classrooms, and school cultures assuming there are aggregate mathematical experiences that are beneficial for all children regardless of their background.

Berry, R. Q. III, Ellis, M., & Hughes, S. (2014). Examining a history of failed reforms and recent stories of success: mathematics education and Black learners of mathematics in the United States. *Race Ethnicity and Education*, 17(4), 540-568.

We Have to Confront Structural Obstacles

Even with the best-made plans, Herculean efforts, and supportive families, research shows how, more often than not, Latinas are often forced off their paths by structural and systemic barriers such as tracking, race and gender discrimination, and negligence and low expectations among school staff.

Jilk, L. M. (2014). Everybody can be somebody: Expanding and valorizing secondary school mathematics practices to support engagement and success. In N. S. Nasir, C. Cabana, B. Shreve, E. Woodbury, & N. Louie (Eds.), *Mathematics for equity: A framework for successful practice* (pp. 107-128). New York: Teachers College Press.

Some Structural Obstacles

- Tracking
- Teacher assignments
- Definition of Mathematics Proficiency
- Assessment

Beliefs about access and equity in mathematics, *continued*

Unproductive beliefs	Productive beliefs
Mathematics learning is independent of students' culture, conditions, and language, and teachers do not need to consider any of these factors to be effective.	Effective mathematics instruction leverages students' culture, conditions, and language to support and enhance mathematics learning.
Tracking promotes students' achievement by allowing students to be placed in "homogeneous" classes and groups where they can make the greatest learning gains	The practice of isolating low-achieving students in low-level or slower-paced mathematics groups should be eliminated.
Only high-achieving or gifted students can reason about, make sense of, and persevere in solving challenging mathematics problems.	All students are capable of making sense of and persevering in solving challenging mathematics problems and should be expected to do so. Many more students, regardless of gender, ethnicity, and socioeconomic status, need to be given the support, confidence, and opportunities to reach much higher levels of mathematical success and interest.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Tracking and Identity

The power and status of school mathematics often manifest themselves in decisions about what content gets taught, to which students, and by which teachers ... what gets taught in the mathematics classroom shapes the mathematics identities of both students and teachers.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

High-Rigor Course Access is Not a Reality in the United States

- Nationwide 48% of high schools offer calculus.
- Nationwide 78% of high schools offer Algebra II.

U.S. Department of Education, Office for Civil Rights. (June 7, 2016). *2013-14 Civil Rights Data Collection: A First Look*. Accessed at <http://www2.ed.gov/about/offices/list/ocr/docs/crdc-2013-14.html>

High-Rigor Course Access is Not a Reality in the United States

- 33% of high schools with high black and Latino student enrollment (greater than 75%) offer calculus, compared to 56% of high schools with low black and Latino student enrollment (less than 25%).

U.S. Department of Education, Office for Civil Rights. (June 7, 2016). *2013-14 Civil Rights Data Collection: A First Look*. Accessed at <http://www2.ed.gov/about/offices/list/ocr/docs/crdc-2013-14.html>

High-Rigor Course Access is Not a Reality in the United States

- 71% of high schools with high black and Latino student enrollment offer Algebra II, compared to 84% of high schools with low black and Latino enrollment.

U.S. Department of Education, Office for Civil Rights. (June 7, 2016). *2013-14 Civil Rights Data Collection: A First Look*. Accessed at <http://www2.ed.gov/about/offices/list/ocr/docs/crdc-2013-14.html>

Educide by the “Low-Slow” Group

Low expectations often result in self-fulfilling prophecies. Once placed in the low tracks, it is very difficult for students to move to a higher track.

Flores, A. (2008). The opportunity gap. *TODOS Research Monograph: Promoting High Participation and Success in Mathematics by Hispanic Students: Examining Opportunities and Probing Promising Practices*, 1(1), 1-18.

Different Opportunities for Different Students

Research indicates that students in “low grouped” classrooms are exposed to more slowly paced instruction, less advanced mathematics topics, and less emphasis on problem solving.

Stein, M.K., Kaufman, J. H., Sherman, M., & Hillen, A. F. (2011). Algebra: A challenge at the crossroads of policy and practice. *Review of Educational Research*, 81(4), 453-492.

Tracking Persists in New Forms

Although many schools have done away with traditional three-track sorting, hidden forms of tracking persist ... For example, an algebra course might sort students into fast and slow speeds of learning, so that by the end of the year students in the same class have not had the same opportunity to learn.

AERA. (2006). Do the math: Cognitive demand makes a difference. *Research Points: Essential Information for Education Policy*, 4(2).

Educide via Tracking

Too often, schools serving large populations of minority students emphasize "slowing down" or providing less mathematics content, rather than providing more challenging content.

Walker, E. N. (2007). Why aren't more minorities taking advanced math? *Educational Leadership*, 65(3), 48-53.

On Paper We've "De-Tracker" High School

Even with universal algebra policies, there is the real possibility that 'tracking' will create different 'algebras' for different populations of students.

Stein, M. K., Kaufman, J. H., Sherman, M., & Hillen, A. F. (2011). Algebra: A challenge at the crossroads of policy and practice. *Review of Educational Research*, 81, 453-492.

Is it Even Really Algebra?

Nearly all of the class of 2005 graduated having taken "Algebra 1."

However, based on the course materials, fewer than one in four studied the kind of challenging topics needed to prepare for college-level mathematics.

Nord, C., Roey, S., Perkins, R., Lyons, M., Lemanski, N., Brown, J., and Schuknect, J. (2011). *The Nation's Report Card: America's High School Graduates* (NCES 2011-462). U.S. Department of Education, National Center for Education Statistics. Washington, DC: U.S. Government Printing Office.

Are the Teachers Tracked?

Teachers themselves are tracked, with those judged to be the most competent, experienced, or high status assigned to the top tracks and those with the least experience and training assigned to the lower tracks.

Darling-Hammond, L. (2007). The flat earth and education: How America's commitment to equity will determine our future. *Educational Researcher*, 36(6), 318-334.

Teacher Assignments Often Exacerbate Opportunities to Learn

The assignment of less experienced teachers to lower achieving students is likely to exacerbate within school achievement gaps ...

Kalogrides, D., Loeb, S., Betteille, T. (2013). Systematic sorting: Teacher characteristics and class assignments. *Sociology of Education*, 86, 103-123.

Who is Teaching Whom?

In a study of 29 districts in 16 states, marginalized students in grades 4 through 8 had access to less effective instruction than non-marginalized students, and that lack of access persisted over time.

Isenberg, E., Max, J., Gleason, P., Potamites, L., Santillano, R., Hock, H., & Hansen, M. (2013). *Access to effective teaching for disadvantaged students* (NCEE 2014-4001). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department of Education.

We Need to Challenge Course and Teacher Assignment Practices

Schools should carefully study whether their teacher assignments and tracking practices are helping or hindering equity ...

Lubienski, S. T. (2007). What can we do about achievement disparities? *Educational Leadership*, 65(3), 54-59.

We expect that the very best doctors will treat the most grievously ill patients.

It should be no different in education. Great teachers have the skills to help the students who struggle the most.

Education Trust. (2005). *Gaining traction, gaining ground: How some high schools accelerate learning for struggling students*. Washington, DC: Education Trust.

How is Mathematics Defined?

Traditional school mathematics is often constructed very narrowly:

- privileges few ways to 'do math'
- valorizes speed and accuracy above other important mathematical skills and understanding

A narrow construction of mathematics may in fact alienate the same students we are trying to better serve.

Jilk, L. M. (2014). Everybody can be somebody: Expanding and valorizing secondary school mathematics practices to support engagement and success. In N. S. Nasir, C. Cabana, B. Shreve, E. Woodbury, & N. Louie (Eds.), *Mathematics for equity: A framework for successful practice* (pp. 107-128). New York: Teachers College Press.

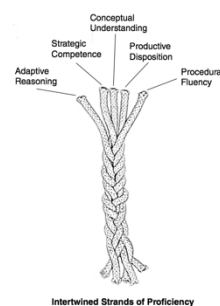
We Need to Challenge the Definition of Mathematical Proficiency

... how students experience mathematics in their classrooms shapes their views of mathematics and themselves as mathematics learners and doers. Thus, how mathematical proficiency is defined and communicated to students has a powerful impact on their mathematics identities and their exercise of various forms of agency.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

Mathematical Proficiency is Multifaceted



NRC, 2001

The Benefits of a Broader Definition of Mathematical Proficiency

For students, these broader conceptions of mathematical proficiency provide multiple ways to demonstrate their competence. That is, these expanded possibilities for developing and demonstrating mathematics competence can represent substantial opportunities to learn and engage in mathematics.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

We Need to Leverage Assessment as an Equity-based Mathematics Teaching Practice

Assessment. An excellent mathematics program ensures that assessment is an integral part of instruction ... and informs feedback to students, instructional decisions, and program improvement.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

We Need to Leverage Assessment as an Equity-based Mathematics Teaching Practice

The types of feedback that students receive can have a tremendous impact on the progress of their mathematical learning and their conceptions of themselves as mathematics learners ... feedback tends to accentuate what students do not know and cannot do, thus leading them to believe that they are 'not smart,' lack ability, or cannot learn.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

We Need to Leverage Assessment as an Equity-based Mathematics Teaching Practice

[We must focus] students' attention on making sense of mathematics, affirming evidence of mathematical progress (such as innovative strategies and correct answers and procedures), and providing students with opportunities to grow mathematically without sacrificing their mathematical confidence.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

We Need to Leverage Assessment as an Equity-based Mathematics Teaching Practice

Incorporating opportunities to revise work on the basis of meaningful feedback enables students to move forward in their mathematics understanding in productive ways that can keep their positive mathematics learner identities intact.



Aguirre, J. M., Mayfield-Ingram, K., & Martin, D. B. (2013). *The impact of identity in K-8 mathematics learning and teaching: Rethinking equity-based practices*. Reston, VA: NCTM.

Revising Work

- **"Homework" should count for very little of a student's grade**
- **Nearly every assessment should be "formative"**

Guiding Principles for School Mathematics: Professionalism

Professionalism. Educators hold themselves and their colleagues accountable for the mathematical success of every student and for their personal and collective professional growth toward effective teaching and learning of mathematics.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

We Need to Challenge the Professionalism Obstacle

In too many schools, professional isolation severely undermines attempts to significantly increase professional collaboration ... A danger in isolation is that it can lead to teachers developing inconsistencies in their practice.



NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

We Need to Collaborate to Promote Equitable Outcomes

There is growing consensus that equitable educational outcomes are not the consequence of a single teacher but rather the product of teams of teachers ... something about collaboration – a certain kind of collaboration – supports ongoing improvement and provides teachers a sense of collective responsibility for students that can make a big difference in student learning.

Horn, I. S. (2014). Teachers' learning on the job. In N. S. Nasir, C. Cabana, B. Shreve, E. Woodbury, & N. Louie (Eds.), *Mathematics for equity: A framework for successful practice* (pp. 145-162). New York: Teachers College Press.

**Why do we
teach
mathematics?**

The NCTM Vision Statement

We envision a world where everyone is enthused about mathematics, sees the value and beauty of mathematics, and is empowered by the opportunities mathematics affords.

What Does it Mean to be Empowered by Mathematics?

- It is more than college and career preparedness
- It is more than enhancing our country's economic competitiveness & national defense
- Mathematical learning experiences impact how one sees oneself
- Mathematics is an essential analytical tool to understand and potentially change the world -- social justice

We Need to Also Focus on Mathematics For Democratic Citizenship

Traditionally, mathematics education has been connected to issues of national economic survival, rather than to the development of democratic citizenship through critical thinking in mathematics.

Tate, W. F. (2013). Race, retrenchment, and the reform of school mathematics. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers, second edition* (pp. 42-51). Milwaukee, WI: Rethinking Schools.

Traditional Goals Remain Important

It is equally important to recognize that improving opportunities for employment is a real expectation that students and parents have of school. But preparation for the job market is indeed preparation for the capability of dealing with new challenges.

D'Ambrosio, U. (2012). A broad concept of social justice. In A. A. Wager & D. W. Stinson (Eds.), *Teaching mathematics for social justice: Conversations with educators* (pp. 201-213). Reston, VA: NCTM.

Benefits of Mathematics for Social Justice

- Students recognize the power of mathematics as an essential analytical tool to understand and potentially change the world, rather than merely regarding math as a collection of disconnected rules to be rotely memorized and regurgitated.
- Students can deepen their understanding of important social issues.

Gutstein, E., & Peterson, B. (2013). Introduction. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers, second edition* (pp. xi-xiii). Milwaukee, WI: Rethinking Schools.

Benefits of Mathematics for Social Justice

- Students can connect math with their own cultural and community histories.
- Students can understand their own power as active citizens in building a democratic society and become equipped to play a more active role in that society.
- Students can become more motivated to learn important mathematics.

Gutstein, E., & Peterson, B. (2013). Introduction. In E. Gutstein & B. Peterson (Eds.), *Rethinking mathematics: Teaching social justice by the numbers, second edition* (pp. xi-xiii). Milwaukee, WI: Rethinking Schools.

Never Has this Been More Important

Mathematics literacy is essential to informed and active citizenship. We live in a world where mathematics is increasingly used to characterize societal problems and formulate solutions.

Never Has this Been More Important

Without mathematics literacy and a positive sense of mathematics identity and agency, ordinary citizens are unlikely to comprehend, let alone challenge, many of the decisions and actions of those in power in political, social, scientific, and economic institutions.

Why I Believe We Teach Mathematics

We want to live in a society where citizens not only have the agency to improve their own lives, but the lives of others and society at large.

Each and everyone of us is engaged in an enterprise much bigger than the specific tasks of our daily job.

We Must

- Build bridges, not walls.
- Challenge teacher assignments.
- Challenge student placements.
- Redefine mathematical proficiency.
- Build collaborative/professional teams.
- Implement equitable instructional practices.
- Emphasize the multiple reasons for learning mathematics.

To remain indifferent to the challenges we face is indefensible. If the goal is noble, whether or not it is realized within our lifetime is largely irrelevant. What we must do therefore is to strive and persevere and never give up.

Dalai Lama XIV