

Empowerment WITH Access and Equity

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Disclaimers



- I am on my own journey to better understand issues of race, access, and equity.
- I am working to understand NCTM's current and historical role in these issues.

Disclaimers



- I will likely make unintentional errors in interpretation and misuse language. I welcome feedback from critical friends.

Goals

- **Discuss NCTM's re-framing of Access and Equity**
- **Make connections between equitable instructional practices and *Principles to Actions***
- **Offer a perspective on why we teach mathematics**

Our Challenge

We have a long standing, thoroughly documented, and seemingly intractable problem in mathematics education: inequity. Children of certain racial, ethnic, language, gender, ability, and socio-economic backgrounds experience mathematics education in school differently and many are disadvantaged by their mathematics education experience.

Aguirre, J., Herbel-Eisenmann, B., Celedon-Pattichis, S., Civil, M., Wilkerson, T., Stephan, M., Pape, S., & Clements, D. H. (2017). Equity within mathematics education research as a political act: Moving from choice to intentional collective professional responsibility. *Journal for Research in Mathematics Education*, 48(2), 124-147.

Issues of Race/Culture are Challenging

There is a long history in mathematics education of seeing race and culture as outside the purview of the discipline of mathematics, and the myth that race and culture do not matter for mathematics teaching and learning continues to perpetuate.

Nasir, N. S. (2016). Why should mathematics educators care about race and culture? *Journal of Urban Mathematics Education*, 9(1), 7-18.

Issues of Race/Culture are Challenging

Not only is learning inherently cultural in nature, but schools, themselves, are cultural institutions. Schools are culturally lived and experienced; in fact, they are culturally organized, guided by norms, conventions, artifacts, and involve social interaction. They are also potential spaces of empowerment, marginalization, and identity building.

Nasir, N. S. (2016). Why should mathematics educators care about race and culture? *Journal of Urban Mathematics Education*, 9(1), 7-18.

Three Reasons We as Mathematics Educators Should Care About Race and Culture

1. Our society is racially stratified and students experience access to high-quality mathematics instruction by virtue of race.
2. Racial stereotyping influences access to mathematical identities for students, and thus disrupts mathematics learning.
3. High-quality mathematics instruction (potentially) disrupts unequal access to mathematics learning for students from marginalized groups.

Nasir, N. S. (2016). Why should mathematics educators care about race and culture? *Journal of Urban Mathematics Education*, 9(1), 7-18.

Student Population

The majority of public school children today are students of color – and their percentage is growing – whereas a majority of their teachers are White.

National Center for Education Statistics, U.S. Department of Education. (2015). *Digest of education statistics 2013* (NCES 2015-011). Washington, DC: Government Printing Office.

The Need for Grace and Space

We have a duty, all of us, to understand race issues, especially with all that's going on in our nation today. We have a duty to approach it with a culture of inquiry ... in the mathematical community, let's provide each other the grace and space to talk about these difficult things

Francis Su, MAA Past President.

"Freedom through Inquiry." Address at the Inquiry-Based Learning Forum & 19th Annual Legacy of R. L. Moore Conference. August 4, 2016.

The Need for Grace and Space

And if we provide each other with the grace and space to talk about race without shame, we won't have to fear saying ridiculous things. We'll be able to forgive each other for ways in which we might inadvertently offend.

Francis Su, MAA Past President.

"Freedom through Inquiry." Address at the Inquiry-Based Learning Forum & 19th Annual Legacy of R. L. Moore Conference. August 4, 2016.

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

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.

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

- Student Tracking
- Teacher Tracking

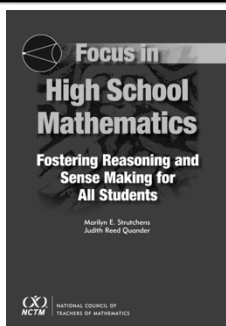
Beliefs about access and equity in mathematics, *continued*

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.

NCTM Has Previously Addressed this Issue



- Examined the impact of students' lack of opportunity to reason and make sense of mathematics (access)
- English learners in the mathematics classroom
- Students with disabilities
- Policy issues standing as obstacles to access & equitable outcomes
- Effective mathematics learning communities

Strutchens, M. E., & Quander, J. R. (2011). NCTM.

Mathematics Education is a Powerful Force (Positive and Negative)

Mathematics education often reinforces, rather than moderates, inequalities in education.

OECD. (2016). *Equations and inequalities: Making mathematics accessible to all*. Paris: PISA OECD Publishing. Downloaded at <http://dx.doi.org/10.1787/9789264258495-en>.

Access Remains a Critical Issue

Students from marginalized groups not only attend schools with fewer qualified teachers but also have less access to college preparatory pathways, and are more likely to be enrolled in a district that employs instructional practices that center on preparation for standardized tests.

Nasir, N. S. (2016). Why should mathematics educators care about race and culture? *Journal of Urban Mathematics Education*, 9(1), 7-18.

Who Teaches Whom What?

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.

Access Remains a Critical Issue

Across OECD countries, more than 70% of students attend schools whose principal reported that students are grouped by ability for math ... reducing ability-grouping can reduce the influence of socio-economic status on students' opportunities to learn.

OECD. (2016). *Equations and inequalities: Making mathematics accessible to all*. Paris: PISA OECD Publishing. Downloaded at <http://dx.doi.org/10.1787/9789264258495-en>.

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 Latina/o student enrollment (greater than 75%) offer calculus, compared to 56% of high schools with low black and Latina/o 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 Latina/o 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>

Type and Quality of Instruction Matters

While education systems have generally done well in providing equitable access to the *quantity* of mathematics education – in the sense that marginalized students spend about the same time in mathematics classes in school as their non-marginalized peers – the data show large differences in the *quality* of learning experiences.

OECD. (2016). *Equations and inequalities: Making mathematics accessible to all*. Paris: PISA OECD Publishing. Downloaded at <http://dx.doi.org/10.1787/9789264258495-en>.

Type and Quality of Instruction Matters

While marginalized students tend to learn simple facts and figures and are exposed to simple applied problems, their privileged counterparts experience mathematics instruction that help them think like a mathematician, develop deep conceptual understanding and advanced mathematical reasoning skills.

OECD. (2016). *Equations and inequalities: Making mathematics accessible to all*. Paris: PISA OECD Publishing. Downloaded at <http://dx.doi.org/10.1787/9789264258495-en>.

Quality of Instruction Matters Beyond School

Learning environments where students are actively engaged in mathematics, i.e. involved in problem solving, the discussion of ideas, and the application of methods, not only enhance individual understanding but may also be related to positive outcomes later in life including the adaptive expertise and the propensity to engage successfully with and use mathematics in their lives as adults.

Boaler, J., Selling, S. K. (2017). Psychological imprisonment or intellectual freedom? A longitudinal study of contrasting school mathematics approaches and their impact on adults' lives. *Journal for Research in Mathematics Education*, 48(1), 78-105.

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).

All Too Often the Teachers are 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.

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.

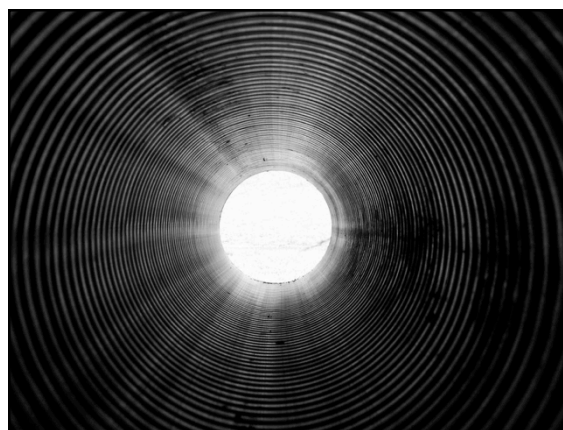
Isenberg, E., Max, J., Gleason, P., Potamites, L., Santillano, R., Hock, H., & Hansen, M. (2013). *Access to effective teaching for disadvantaged students* (NCEE 2014-4001). Washington, DC: National Center for Education Evaluation and Regional Assistance, Institute of Education Sciences, U.S. Department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

We 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.

Access and Equity is Necessary, but Not Sufficient



We All Must Recognize Students' Realities in Our Work

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.


NCTM Action Steps

- NCTM has re-framed its work to focus on Access, Equity, and Empowerment, to capture the critical constructs of identity, agency, and social justice.
- The Board modified its strategic priorities to reflect this reframing of NCTM's scope to include more than just access and equity.


Principles to Actions Professional Resources Toolkit

Leverages Identity and Agency to Frame Access and Equity

- Vignettes and the voices of students, teachers, and other school personnel are used to develop identity (beliefs about oneself, mathematics, etc.) and agency (the presentation of one's identity) as a framework for defining and addressing obstacles.
- Effective Teaching Practices support the cultivation of a positive identity and agency.




2017



Breaking Barriers: Actionable Approaches to Reach Each and Every Learner in Mathematics

November 15-17, 2017

Las Vegas, NV


NATIONAL COUNCIL OF
TEACHERS OF MATHEMATICS

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.

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.

Caution About Productive Struggle

It is critical to recognize that a focus on 'grit' or 'growth mindset' is highly cognitive, places the burden of change on the individual, and fails to interrogate institutional structures/practices that disadvantage students who have been marginalized.

Gutiérrez, R. (2016). Strategies for creative insubordination in mathematics teaching. In J. M. Aguirre & M. Civil (Eds.) *Teaching for Excellence and Equity in Mathematics: Mathematics Through the Lens of Social Justice*, 7(1), 52-60.

Identity and Micromessaging

Micromessages are small, subtle, and unconscious messages we send and receive when we interact with others. Negative micromessages (micro-inequities) cause people to feel devalued, slighted, discouraged, or excluded. Positive micromessages (micro-affirmations) cause people to feel valued, included, or encouraged.

Source: National Alliance for Partnerships in Equity.

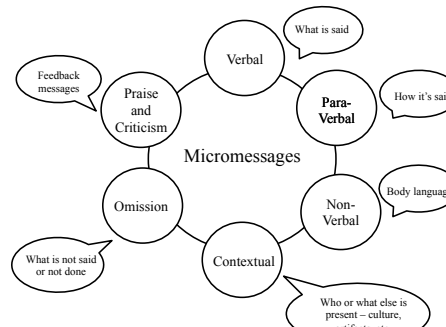
Micromessaging Is Always Present

Individuals send anywhere from 40 to 150 micromessages to each other in an average 10-minute conversation.

We receive (send) between 2,000 and 4,000 micromessages a day.

Young, S. (2007). *Micro-messaging: Why great leadership is beyond words*. New York: McGraw-Hill.

Micromessaging – Six Key Elements



Source: National Alliance for Partnerships in Equity.

Micromessages

Micromessages have a greater impact on the performance of marginalized populations, particularly in schools.

Source: National Alliance for Partnerships in Equity.

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Micromessaging – What it Looks Like in Schools

Micro-affirmation Examples

- Meet and greet your students at the door
- Listen whenever students are talking
- Celebrating the backgrounds and cultures of all students
- Affirm students for their effort, not perceived attributes
- Implement a system for calling on/questioning all students (distributed)
- Ensure classroom and curriculum are culturally responsive
- Limit interruptions
- Connect on a personal level

Source: National Alliance for Partnerships in Equity.

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Micromessaging – What it Looks Like in Schools

Micro-inequities Examples

- Chronically mispronounce select student names
- Tolerate calling out answers from some students but not others
- Discipline some students (groups) more severely than others for similar behaviors
- Avoid eye contact with select students
- Sigh when certain students get the wrong answer
- Acting surprised when a certain student is successful
- What examples have you experienced?
- “These kids”

Source: National Alliance for Partnerships in Equity.

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Micromessaging

Think of a time when you received a micro-affirmation or a micro-inequity. With a partner, describe how it made you feel at that moment. Explain any long term effects.



Source: National Alliance for Partnerships in Equity.

Equity Action Steps

Stop deficit-oriented language in mathematics education work and help educate others about how these perpetuate negative framings of children and communities. As we write and talk about children, their families, and communities, we need to pay attention to whether we are using language that makes people or communities sound more superior or inferior than others.

Aguirre, J., Herbel-Eisenmann, B., Celedon-Pattichis, S., Civil, M., Wilkerson, T., Stephan, M., Pape, S., & Clements, D. H. (2017). Equity within mathematics education research as a political act: Moving from choice to intentional collective professional responsibility. *Journal for Research in Mathematics Education*, 48(2), 124-147.

NCTM Action Steps

NCTM made a commitment to stop using deficit language (eliminate negative micro/macromessaging).

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.

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.

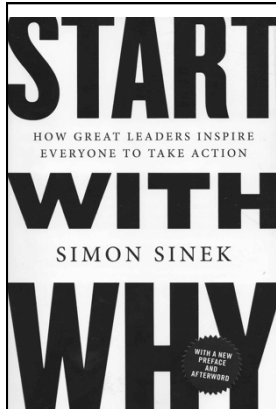


NCTM. (2014). *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.

Equity-Based Practices

The goal in the classroom should be to emphasize students' strengths, while creating a classroom space where students (and the teacher) can be vulnerable. The vulnerability can be made possible by redefining what it means to be smart, as well as what it means to do mathematics – both involve working through difficult problems collaboratively and putting forth effort when things seem difficult.

Nasir, N. S. (2016). Why should mathematics educators care about race and culture? *Journal of Urban Mathematics Education*, 9(1), 7-18.



Why do we teach mathematics?

Why should students learn mathematics?

Traditionally Math Education Reform Has Been Driven by Economic Concerns

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.

Traditionally 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 [American] colonies, the need for more citizens to be able to perform simple arithmetic increased, and eventually, schools added arithmetic to the required subjects.

Jones, P. S., & Coxford, A. F. Jr. (Eds.). (1970). *A history of mathematics education in the United States and Canada* (32nd Yearbook). Reston, VA: National Council of Teachers of Mathematics.

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.

The Common Core Initiative Continued the Same Narrative

The standards are designed to be robust and relevant ... 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/>.

An Agenda for Action Pointed to Mathematics Learning for More Than Economic Reasons

All reasonable means should be employed to assure that everyone will have the foundation of mathematical learning essential to fulfilling his or her potential as a productive citizen.



NCTM. (1980). *An agenda for action*. Reston, VA.

Professional Teaching Standards for Mathematics (NCTM, 1991)



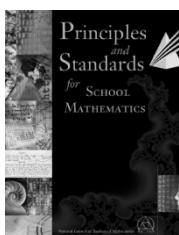
Called for teachers to (among other things):

- Build on strengths from students' **linguistic, ethnic, racial, gender, and socioeconomic backgrounds**;
- Help students to become aware of the **role of mathematics in society and culture**;
- Expose students to the **contributions of various cultures to the advancement of 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.

Principles for School Mathematics



Decisions made by teachers, school administrators, and other education professionals about the content and character of school mathematics have important consequences both for students and for society. These decisions should be based on sound professional guidance. *Principles and Standards for School Mathematics* is intended to provide such guidance. The Principles describe the particular features of high-quality mathematics education. The Standards describe the mathematical content and processes that students should learn. Together, the Principles and Standards constitute a vision to guide educators as they strive for the continual improvement of mathematics education.

- **Equity.** Excellence in mathematics education requires equity—high expectations and strong support for all students. It must be coherent, focused on important mathematics, and well articulated across the grades.
- **Teaching.** Effective mathematics teaching requires understanding what students know and need to learn and then challenging and supporting them to learn it well.
- **Learning.** Students must learn mathematics with understanding, actively building new knowledge from experience and prior knowledge.
- **Assessment.** Assessment should support the learning of important mathematics and furnish useful information to both teachers and students.
- **Technology.** Technology is essential in teaching and learning mathematics; it influences the mathematics that is taught and enhances students' learning.

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In PSSM NCTM Argued There Are Multiple Reasons to Learn Mathematics

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)

What Does it Mean to be Empowered by Mathematics?

- It is more than college and career preparedness (important)
- It is more than enhancing our country's economic competitiveness & national defense (important)
- It means students are prepared through their mathematics education to investigate and critique injustice, and to challenge, in words and actions, oppressive structures and acts (Gutstein, 2016) – teaching mathematics for social justice.

NCTM Action Steps

At its July 2016 meeting, the NCTM Board of Directors unanimously voted to endorse the NCSM/TODOS joint position statement, *Mathematics Education Through the Lens of Social Justice*

Benefits of Teaching 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 rote 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 Teaching 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.


mathalicious

Unit Organization Lessons About FAQ

Distributive Properties

Have income distributions in the U.S. improved over time?

Plan Teach Reflect



The American Dream promises that with hard work and determination, anyone has an opportunity for upward mobility. Does everyone truly have an equal chance of climbing the ladder to success, or are some people stuck at the bottom?

In this lesson, students will analyze income distributions of the three most populous racial/ethnic groups in America to evaluate whether or not these distributions have become more equitable over time. Using data from the 2013 US Census, students compare percentages of total income earned by different subgroups of the working population and decide whether or not the "American Dream" is equally achievable by all Americans.

Students will

- Use histogram of income data to calculate median annual income values by racial/ethnic group

Common Core Standards

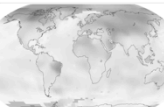
Content Standards

S.ID.2 S.ID.3 S.ID.5

Icy Hot (HS)

How have temperatures changed around the world?

Plan Teach Reflect



How have temperatures changed around the world? Students use trigonometric functions to model temperature changes during the year at different locations around the globe. They also compare their models based on past years' data to current temperature trends. In the end, they discuss the advantages and disadvantages of modeling temperature with sinusoids and explore how the climate has changed in various cities over time.

Students will

- Model annual temperature change in different world capitals using sine waves
- Make weather predictions using sine waves and calculate mean average deviation between predicted and actual temperature data
- Compare temperature models obtained using different data sets
- Discuss implications of global climate change

Common Core Standards

Content Standards

F.IF.4 F.IF.7 F.MF.2 F.TES F.TE2

Mathematical Practices

MP.1 MP.6

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.

We Should Learn Math for Multiple Reasons

Students need full opportunities to learn mathematics for many reasons – economic survival for themselves, their families, and their communities; future education and meaningful vocational or career plans; reading and writing the world (use mathematics to comprehend and change the world); and full actualization of their human potential.

Gutstein, E. (2016). "Our issues, our people – math as our weapon: Critical mathematics in a Chicago neighborhood high school. *Journal for Research in Mathematics Education*, 47(5), 454-504.

Never Has Broadening the Goals of Mathematics Learning Been More Important

Today, more than ever, it is insufficient to just teach and learn mathematics in mathematics class ... we live in a time of deep, sustained, global crises – sociopolitical, economic, and ecological ... If young people are to be prepared for the challenges of the future, involving them in reading and writing the world today is essential for tomorrow.

Gutstein, E. (2016). "Our issues, our people – math as our weapon: Critical mathematics in a Chicago neighborhood high school. *Journal for Research in Mathematics Education*, 47(5), 454-504.

Never Has Broadening the Goals of Mathematics Learning Been More Important

Mathematics literacy is essential to informed and active engagement as a member of our society. We live in a world where mathematics is increasingly used to characterize societal problems and formulate solutions.

The 2016 Word of the Year

Post-truth: relating to or denoting circumstances in which facts are less influential than appeal to emotion or belief

Oxford English Dictionary

University Press.



NCTM Action Steps: Why?

High School Mathematics Task Force:

Pathways through High School Mathematics: Building Focus and Coherence (working title).

- Address the purpose of high school mathematics and include guiding principles (non-negotiables) such as access, equity, and empowerment;
- Define math curricular pathways leading to college pathways and career readiness, as well as active participation in our democratic society; and

The goal of high school mathematics education must always be to expand options for students in ways that appropriately accommodate the post-secondary goals of different students.

Why I Believe We Teach Mathematics

So students are empowered by mathematics to improve their own lives and critically understand the uses (and abuses) of mathematics in society, thereby leading to societal improvement.

Adapted from: Ernest, P. (2010). Why teach mathematics? *Professional Educator*, 9(2). 45-47.

Why I Believe We Teach Mathematics

Students must be able to identify, interpret, evaluate and critique the mathematics embedded in social, commercial and political systems, as well as the claims made in the private and public sector and in public interest-group pronouncements.

Adapted from: Ernest, P. (2010). Why teach mathematics? *Professional Educator*, 9(2). 45-47.

Call to Action

- Confront structural obstacles to equity, including student and teacher tracking.
- Support each and every student in building a positive mathematics identity and sense of agency.
- Emphasize to students (and parents), through the tasks we use in class, the multiple reasons for learning mathematics.

Our Challenge

We have a long standing, thoroughly documented, and seemingly intractable problem in mathematics education: inequity. Children of certain racial, ethnic, language, gender, ability, and socio-economic backgrounds experience mathematics education in school differently and many are disaffected by their mathematics education experience.

Aguirre, J., Herbel-Eisenmann, B., Celedon-Pattichis, S., Civil, M., Wilkerson, T., Stephan, M., Pape, S., & Clements, D. H. (2017). Equity within mathematics education research as a political act: Moving from choice to intentional collective professional responsibility. *Journal for Research in Mathematics Education*, 48(2), 124-147.

The progress we have made is almost solely because of the work you, the people sitting next to you, and thousands of other classroom teachers working each and every day do to engage each and every student in learning and doing math, improving how students think about themselves, and their abilities.

Thank you for what you do!