

Lecture of Awardee 5

Advocating for High Quality Mathematical Access for Each and Every Child: Our Collective Work, Our Passion, and Our Future

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ABSTRACT It is imperative that we advocate for the highest quality mathematics for each and every student across the world. All students must have access to mathematical learning experiences that will prepare them for success not only in the classroom but also to lead our world in the future. While we have seen much progress in mathematics education over the last 30 years, we continue to face significant challenges related to access. Disparities in learning opportunities based on race, ethnicities, class, language, gender, and perceived mathematics ability are far too prevalent in school mathematics—this has been made more evident during the COVID-19 pandemic. We must address these disparities to ensure equitable mathematical opportunities for each and every student. The National Council of Teachers of Mathematics identifies four key recommendations that serve as a catalyst for change to launch each and every student on a successful journey with mathematics. These are discussed in this paper.

Keywords: Advocacy; Teaching practices; Mathematical understanding

1. Introduction

The National Council of Teachers of Mathematics (NCTM) is honored to receive the International Commission on Mathematical Instruction (ICMI) Emma Castelnuovo Award for Excellence in the Practice of Mathematics Education. It is an honor to receive such a prestigious award that was named after Emma Castelnuovo, an Italian mathematics educator, to honor her pioneering work in mathematics education. Her work aimed at a way of teaching that actively engaged students, marked a key point in history for teaching and learning mathematics that fostered a discovery learning environment for all students from elementary through university. NCTM is honored to continue to build on this legacy so that each and every student has an engaging, high-quality experience in learning mathematics.

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As President of the National Council of Teachers of Mathematics, I would like to thank The United States Commission on Mathematics Instruction, chaired by John W. Staley for submitting the nomination of NCTM for this award. The U.S. Commission includes Solomon Friedberg, James Roznowski, James Barta, Marta Civil, Robert Gould, Maria Hernandez, Ilana S. Horn, Chris Rasmussen, Padmanabban (Padu) Seshiyer and April Strom. In their nomination they highlighted four continuing priorities in NCTM's work:

- NCTM has served the mathematics education community (nationally and internationally) for 100 years by providing leadership, publications and resources, professional development, and networking opportunities.
- NCTM has served its membership by supporting and growing educators and involving them in many of the organization's initiatives and projects, and providing various opportunities to develop members' leadership skills.
- NCTM continues to advocate for high-quality mathematics teaching and learning for each and every student. This advocacy extends to the work that helps educators who choose to advocate with their elected officials and policymakers. And
- NCTM continues to build and value collaborative relationships with educators throughout the world.

The U.S. Commission noted that the National Council of Teachers of Mathematics is the public voice of mathematics education, supporting teachers to ensure equitable mathematics learning of the highest quality for each and every student through vision, leadership, professional development, and research. We also are grateful for the multiple letters of support that were included in the nomination.

Our thanks also goes to the International Commission on Mathematical Instruction for awarding the 2020 Emma Castelnuovo Award to the National Council of Teachers of Mathematics. I would like to thank Dr. Jill Adler, President of the International Commission on Mathematical Instruction. It was an honor for NCTM to receive notification of the 2020 Emma Castelnuovo Award from Dr. Adler in October of 2019. I also thank Professor Konrad Krainer, Chair of the Emma Castelnuovo Awards Committee and the entire committee for their work in reviewing nominations. We are honored.

NCTM's work in mathematics education is consistent with International Commission on Mathematical Instruction's principles:

- The development of mathematical education at all levels; and
- The promotion of reflection, collaboration, exchange, and dissemination of ideas on the teaching and learning of mathematics from the primary to the university level.

NCTM's mission is to advocate for high-quality mathematics teaching and learning for each and every student from early childhood through secondary school and beyond. NCTM includes mathematics educators from preschool, elementary, middle grades, high school, universities and colleges across the United States and

Canada and 171 other countries across the world with over 30,000 members and more than 230 Affiliates. NCTM also established the International Corresponding Societies (currently 19 organizations with representatives from South and Central America, Europe, Asia, Africa and Australia) to build ties with professional associations of mathematics education in other countries. In addition, NCTM has supported several initiatives with educators in Latin, Central, and South America.

I would like to take this opportunity to recognize Ken Krehbiel as Executive Director of NCTM. He has provided professional leadership for the organization for over 20 years. He has guided NCTM in multiple efforts to further the mission and vision of the organization. I also want to acknowledge the work and leadership of Dr. Robert Q. Berry, III who was NCTM President at the time of the nomination and continues as Past President. Dr. Berry is an accomplished writer, researcher, presenter, and leader in mathematics education. It was in his role as president-elect that NCTM's Catalyzing Change initiative for high school was launched under the leadership of then NCTM President Matt Larson. Dr. Berry has expanded the initiative to address early childhood, elementary and middle school levels. I was fortunate to be in the position of president-elect at that time to work with him and the other outstanding writers on the Catalyzing Change position and series of publications. It is this initiative, *Catalyzing Change in Mathematics* to which I would like to devote the remainder of this paper.

2. Advocating for High-Quality Mathematics Teaching and Learning

Let us consider our role and responsibility in advocacy for high quality mathematics teaching and learning. It is imperative for our profession that we advocate for the highest quality mathematics for each and every student across the world. All students must have access to mathematical learning experiences that will prepare them for success not only in the classroom but also prepares them to lead our world in the future. While we have seen much progress in mathematics education over the last 30 years, we continue to face significant challenges related to access. Disparities in learning opportunities based on race, ethnicities, class, language, gender, and perceived mathematics ability are far too prevalent in school mathematics — this has been made more evident during the COVID-19 pandemic. We must address these disparities to ensure equitable mathematical opportunities for each and every student. How can we do that? To that end, NCTM gathered writing groups to examine how we can address the issues we face today and move forward in the teaching and learning of mathematics for all. *Catalyzing Change* moves this conversation forward by focusing on structural policies, engaging in conversations on the purposes of school mathematics, and sustaining a focus on sense-making and reasoning.

2.1. Catalyzing change in early childhood and elementary mathematics

Why do we need *Catalyzing Change* in early childhood (NCTM, 2020a)? We know that children's growth in mathematical knowledge in kindergarten and first grade is a

strong predictor of later mathematics success. Mathematics instruction in early childhood and elementary school often places too much emphasis on memorizing basic number facts and following procedures at the expense of developing deep conceptual understanding. And mathematically powerful instruction in early childhood and elementary school is reaching too few children, particularly those most marginalized in our society. This leads to differential and unjust mathematics learning environments and outcomes (Adair 2015).

2.2. *Catalyzing change in middle school mathematics*

Why do we need *Catalyzing Change* at the middle grades level? At the middle grades level structures and traditions in mathematics education are deeply rooted. We must reconsider legacy practices and structures impacting students' mathematical identities and sense of mathematical agency (NCTM, 2020b). Instructional practices must be examined in order to systemically support, enhance, and adopt practices that are equitable and provide high-quality learning opportunities to motivate and engage students in learning. The evidence is compelling that students who are identified as marginalized learners based on certain ethnicities, Indigenous populations, language learners, poor, or those with disabilities do not have the same access to a high-quality mathematics program as their peers.

2.3. *Catalyzing change in high school mathematics*

Why do we need *Catalyzing Change* at the high school level? We are finding that in the United States the percentage of high school students enrolling in upper-level mathematics courses over the last three decades has increased (Dossey, McCrone, and Halvorsen, 2016). This is good, but there are major gaps on who has access to those courses and who does not. There is a concern over opportunity gaps and actions that are needed to support each and every high school student. It is an issue of access. There are times that the sheer amount of content expected to be addressed in high school is seen as a deterrent to addressing the desired level of rigor that is needed. Further, it is imperative that we have a high school mathematics experience for our students that prepares them for future college and career opportunities, particularly related to STEM fields, that is the fields of Science, Technology Engineering, and Mathematics. Thus, it was important to consider what changes were needed and how these might be addressed (NCTM, 2018).

3. Recommendations Serving as a Catalyst for Change in Mathematics

It is important to initiate these critical conversations and consider next steps and actions that are needed. As noted previously, NCTM began in 2018 with *Catalyzing Change in High School Mathematics: Initiating Critical Conversations* and followed in 2020 with the publication of *Catalyzing Change for Early Childhood and Elementary Mathematics* and then *Catalyzing Change for Middle School Mathematics*. Together

these outline four key recommendations that serve as a catalyst for change to launch each and every student on a successful journey with mathematics. They are

- (1) Broaden the Purposes of Learning Mathematics;
- (2) Create Equitable Structures in Mathematics;
- (3) Implement Equitable Mathematics instruction; and
- (4) Develop Deep Mathematical Understanding.

While the four recommendations span the grade bands, they vary slightly in focus depending on the grade band. Let's unpack these four recommendations and consider what critical conversations we need to have that will lead to actions to address these recommendations. Consider who we should engage in those conversations. Who are our partners and stakeholders in mathematics education?

3.1. Recommendation #1: broaden the purposes of learning mathematics

For all grade levels there are three major areas of focus: develop a deep understanding of mathematics, understand and critique the world through mathematics, and experience the wonder, joy and beauty of mathematics with developing as confident and capable learners and contributing to a positive mathematics identity as central.

The early childhood and elementary authors note that “The power of the multiple purposes occurs when the purposes converge in ways that foster positive relationships between children and mathematics. The goal is for children to see themselves in the world of mathematics, not looking in from the perimeter or looking for the nearest exit door” (NCTM, 2020a, p. 23). We should also note that the mathematics students learn during middle school includes many of the most useful mathematics concepts that students will use as adults. “Middle school mathematics programs must challenge students to reason, and, most important, they must be respectful of students’ distinctive cultural and developmental needs and interests” (Gutstein, 2003; Liptstiz, & West, 2006; Lounsbury, 2015 as cited in NCTM, 2020b, p. 7). The purposes have to do with empowerment. Preparing learners for their future education and employment-opening and expanding opportunities. As students transition to high school, we need to remember that “A multipurpose high school mathematics curriculum plays a critical role in the cultivation of students who become fully engaged members of society, who contribute to society in positive ways and who become human beings capable of achieving their full potential, personally and professional, through the intellectual experiences of their mathematics education” (NCTM, 2018, p. 12–13).

Each and every learner should develop deep mathematical understanding, be able to use mathematics to understand and critique the world, and experience the wonder, joy, and beauty of mathematics. I challenge us to consider what short- and long-term work needs to be done toward achieving this vision of broadening the purposes of learning mathematics. That is, what can we do now and what can be done over time? This is an important, critical conversation to have.

3.2. Recommendation # 2: create equitable structures in mathematics

Across grade levels we need to dismantle and attend to inequitable structures such as ability grouping and tracking of students and teachers, and challenge spaces of marginality and privilege that exclude many students from high-quality learning opportunities in mathematics. These may vary or look different across our countries, but we all need to carefully examine our structures that support or may be deterring the teaching and learning of mathematics. We need to position students as competent, confident, and capable learners and doers of mathematics affirming their strengths every day in ways that cultivate positive mathematical identities and a sense of agency.

As students move from early grades to middle school, they continue to build their mathematics identity. We need to continue to support their positive mathematics identity as they develop in their mathematical thinking and explore their world through mathematics. One's mathematical identity continues to develop from adolescence to adulthood. Our continual affirmation of students' positive mathematical identities through their learning experiences, building on their strengths will support them in developing strong and resilient positive identities (NCTM, 2018, 2020a, & 2020b).

We need to examine our own deficit-based beliefs about students or their families and communities and ensure that we truly believe that all students can and should do mathematics. Are there ways that we are grouping students that limit their access to high quality mathematics instruction and opportunities for deep understanding of mathematics? Are there historical, cultural or social beliefs about our students' mathematical abilities contributing to inequitable practices and opportunities in mathematics. Are structures in place that inhibit student learning in mathematics?

I encourage us to ask ourselves: What supports are needed in schools, districts, states/provinces, or our countries to discontinue inequitable practices such as ability grouping, tracking, and dead-end course pathways where students' opportunities for learning mathematics are limited and not always of high quality and inclusive? Have we considered our curriculum, instructional resources, assessment practices and professional development and support for our teachers? What work is needed to make sure all students — and specifically those often traditionally marginalized — have equitable structures in place to support their mathematics learning? Actions might include identifying, analyzing, and evaluating policies and practices to assess the impact of tracking; providing each and every student access to grade-appropriate intellectually challenging curriculum; providing ongoing professional development and support for our teachers; and providing time and space for educators to collaborate (Berry, 2018).

3.3. Recommendation #3: implement equitable mathematics instruction

“Teachers and their instructional practices have strong influences, often far greater than one realizes, on children as they learn mathematics” (NCTM, 2020a, p. 45). Equitable mathematics instruction requires that teachers take direct action stemming from

intentional planning and reflection informed by data from their students (NCTM, 202b). We should approach through asset, strengths-based perspectives and not deficit views of students and their learning. Our instructional practices should be dedicated to implementing equitable instruction that engages all students in learning mathematics. Students bring multiple strengths to the mathematics learning experience. They begin formal school eager and ready to learn, and with multiple strengths from their daily learning experiences. These strengths continue to grow if nurtured in both formal and informal learning environments. We need to identify, foster and value these strengths, support students as thinkers and doers of mathematics, and leverage students' experiences, cultural perspectives, backgrounds, languages, and interests. This strengths-based approach will facilitate deepening mathematical understanding, helping students make sense of their world through mathematics.

In 2014 NCTM published *Principles to Actions: Ensuring Mathematical Success for All*, which identified eight effective mathematics teaching practices.

- (1) Establish mathematical goals to focus learning
- (2) Implement tasks that promote reasoning and problem solving
- (3) Use and connect mathematical representations
- (4) Facilitate meaningful mathematical discourse
- (5) Pose purposeful questions
- (6) Support productive struggle
- (7) Build procedural fluency from conceptual understanding
- (8) Elicit and use evidence of student thinking

These eight, taken together, provide research-informed mathematics teaching practices to create a classroom learning environment that supports ambitious, effective, and equitable mathematics instruction and nurtures children's positive mathematical identities and strong sense of agency with shared authority in learning mathematics.

Focusing on implementing equitable, effective mathematics instruction helps us to consider the quality of mathematics learning experiences rather than quantity of problems and provides a space for student voice, student interest, and student concerns. This focus supports mathematics as a collaborative endeavor and one in which problems may be solved in multiple ways, and it encourages students to share their mathematical thinking and not just solutions. All learners are viewed as thinkers and doers of mathematics across all grade levels (NCTM 2014, 2018, 2020a, and 202b). I challenge us to consider the question: Do our student see themselves as mathematically capable? Do all teachers see all students as *doers* of mathematics? Do we see ourselves as a *doer of mathematics*? Implementing equitable instructional practices positions all students for success. "effective teaching is the nonnegotiable core that ensures that all students learn mathematics at high levels and that such teaching requires a range of actions ...[at all]....levels" (NCTM , 2014, p. 4).

Let's consider this question: In what ways can and should we engage in discussions with multiple stakeholders to create shared experiences and a collective understanding

of equitable mathematics instruction? Who are our partners and stakeholders? Are we inclusive of voices and supportive?

3.4. Recommendation # 4: develop deep mathematical understanding

Considering broadening the purposes of mathematics, implementing equitable structures and equitable, effective mathematics teaching practices leads us to the last recommendation — develop deep mathematical understanding. “When mathematics instruction goes deep, children are empowered to explore the richness of the mathematical landscape” (NCTM, 2020a, p. 77). *Catalyzing Change* underscores the importance of engaging children — beginning in early childhood and elementary grades—as active doers of mathematics who author and generate strategies and share their mathematical insights. Doing mathematics involves engaging in the norms, routines, and habits that are central to the work of mathematicians (NCTM, 2018, 2020a, 2020b). These include representing and connecting mathematical ideas and concepts, explaining and justifying mathematical thinking, and noticing, using and understanding mathematical structures.

Moving to middle grades mathematics students need to engage “as active participants in their and their peers’ mathematics learning” (NCTM, 2020b, p. 67). They need to engage in mathematics that is relevant — often about sensitive or controversial topics — and requires careful attention and thoughtful implementation, but it needs to be a part of students’ middle school mathematical learning experiences. Across all grade levels to support students in developing a deep mathematical understanding there are multiple mathematical proficiencies to address as noted by the National Research Council (2001). They include conceptual understanding, procedural fluency, strategic competence, adaptive reasoning, and productive disposition. Further, we need to include mathematical experiences and course or curricular pathways that support students’ development of key mathematical practices such as those identified in the Common Core State Standards in the United States (National Governors Association Center for Best Practices [NGA Center]) and Council of Chief State School Officers [CCSSO], 2010). These include making sense of problems, persevering in solving problems, reasoning both abstractly and qualitatively, being able to construct viable arguments, model with mathematics, use appropriate tools strategically, attend to precision, along with recognize and use mathematical structures. We need to consider mathematical and statistical modeling and thinking threaded throughout all grades. *Catalyzing Change* calls for disrupting the cycle of rote learning of mathematics. Each and every learner deserves mathematically powerful learning spaces that emphasize reasoning and sense making on a daily basis (NCTM 202a).

Often in the United States in the high school grades we see a segmented approach to the curriculum that includes a course sequence of an Algebra I, Geometry, and Algebra II pathway with a rush to calculus. This is often to the detriment of deep understanding of major key mathematical concepts and connections, and it avoids addressing other essential mathematical topics such as statistics, quantitative literacy,

and modeling which are essential in today's world and to our future. This is not necessarily the case in other parts of the world but there may be other challenges that exist when thinking about mathematical experiences across all grade levels in developing a deep understanding of mathematics. Important questions for us to consider are: What is the essential mathematics needed? What are varied possible pathways for students to pursue rich mathematical experiences? And do all students have access to those essential robust pathways?

4. Conclusion

In considering these four recommendations it is essential that we engage in critical conversations to move to actions that will provide and support powerful mathematical learning spaces to support access and equity for all. Currently there are many marginalized students who are not receiving equitable learning experiences and thus their education is limiting their future opportunities. We have an opportunity to change this by working together in mathematics education. To be effective and impactful we must advocate both individually and collectively across local, national, and international levels. The gathering at the 14th International Congress of Mathematical Education was a unique opportunity to engage in reflection, discussions and collaboration to address advocacy efforts in mathematics education.

In my April 2021 NCTM President's message, *Advocacy as a Mathematics Education Community-The Time is Now*, I shared that we have much we can engage in as an advocate in mathematics education. We need to be called to action to advocate for high-quality mathematics teaching and learning for all students (Wilkerson, 2021).

Advocating for high-quality mathematics teaching and learning for each and every student must be more than words. To be effective advocacy must include thoughtful actions both individually and collectively across local, national, and international levels. Advocacy should raise awareness and influence decision makers and the public on issues to expand high-quality mathematics teaching and learning and provide access to every student, school, and community. Why should we advocate? What are effective ways to advocate in mathematics education? These are just some of the questions to consider as we examine our role in advocacy in mathematics education.

Every voice matters in mathematics education. Just think what we can do working together on this journey advocating for high-quality mathematics teaching and learning for each and every student and supporting each and every teacher! We must challenge existing inequities in structures and practices related to teaching and learning mathematics. Together we can do this.

On behalf of the National Council of Teachers of Mathematics, I want to again thank the International Commission on Mathematical Instruction for honoring NCTM with the Emma Castelnuovo Award for Excellence in the Practice of Mathematics Education. It's been an honor to accept the award and to have this opportunity to offer this address. I look forward to our continued dialogue.

References

- J. K., Adair (2015). *The Impact of Discrimination on the Early Schooling Experiences of Children from Immigrant Families*. Washington, DC: Migration Policy Institute.
- R. Q. Berry III (2018). "Initiating Critical Conversations on the Discontinuation of Tracking". Blog post, 2018. <https://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/Robert-Q-Berry-III/Initiating-Critical-Conversations-on-the-Discontinuation-of-Tracking/>
- J. A. Dossey, John, S. S. McCrone, and K. T. Halvorsen. *Mathematics Education in the United States, 2016: A Capsule Summary Fact Book*. Reston, Va.: National Council of Teachers of Mathematics, 2016.
- E. Gutstein 2003. "Teaching and Learning Mathematics for Social Justice in an Urban Latino School." *Journal for Research in Mathematics Education* 34 (1): 37–73.
- J. Lipstitz, and T. West (2006). "What Makes a Good School: Identifying Excellent Middle Schools." *Phi Delta Kappan* 88 (10): 57–66.
- J. H. Lounsbury (2015). "Lest We Forget-The Open Window." *Middle School Journal* 46 (5): 14–16.
- National Council of Teachers of Mathematics (NCTM). 2014. *Principles to Actions: Ensuring Mathematical Success for All*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics (NCTM). 2018. *Catalyzing Change in High School Mathematics: Initiating Critical Conversations*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics (NCTM). 2020a. *Catalyzing Change in Early Childhood and Elementary Mathematics: Initiating Critical Conversations*. Reston, VA: NCTM.
- National Council of Teachers of Mathematics (NCTM). 2020b. *Catalyzing Change in Middle School Mathematics: Initiating Critical Conversations*. Reston, VA: NCTM.
- National Governors Association Center for Best Practice and Council for Chief State School Officers (NGA Center and CCSSO). 2010. *Common Core State Standards in Mathematics*. Washington, DC: NGA Center and CCSSO. <http://www.corestandards.org>.
- National Research Council. 2001. *Adding It Up: Helping Children Learn Mathematics*. Washington, DC: National Academies Press.
- T. Wilkerson (April 2021). *Advocacy as a Mathematics Education Community-The Time Is Now*. National Council of Teachers of Mathematics President's Message. <https://www.nctm.org/News-and-Calendar/Messages-from-the-President/Archive/Trena-Wilkerson/Advocacy-as-a-Mathematics-Education-Community%E2%80%94The-Time-Is-Now/>